ENVISAT–1

GROUND SEGMENT

MERIS

MEdium Resolution Imaging Spectrometer

Specification of the Scientific Contents of the MERIS

Level-1b & 2 Auxiliary Data Products

Document Number: PO-RS-PAR-GS-0002

Issue: 3 **Revision:** C

Issue Date: 27-Feb-11 **Filename:** PO-RS-PAR-GS-0002 3C - PROD SPEC.DOC

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DOCUMENT CHANGE RECORD

Issue	*Rev.*	*Date*	*Chapter/Paragraph Number, Change Description (and Reasons)*
Draft	-	Nov. 14, 1997	- Draft release of the document.
1	-	Feb. 20, 1998	- Release of the first issue of the document.
1	A	Apr. 29, 1998	- Updated revision following the discussions and comments from the FUB and LISE institutes. Most of modifications were made inside the sections keeping the same structure.
1	B	Feb. 10, 2000	- Updated revision for MERISAT v1.0 draft.
2	-	Feb. 02, 2001	- Changes are related to the requests in the documents: TOS-EMS/00-45/jcd (23/05/2000), 1st list of comments in Issue 1b, . TOS-EMS/00-49/jcd (25/05/2000), 2nd list of comments in Issue 1b.
2	A	June 08, 2001	- Implemented changes from: . Ludovic Bourg's mail (12/03/01) . Ludovic Bourg's mail (22/05/01) . Fax EMS/01-36/jcd (08/06/01) - Sections have been changed to match as much as possible with IODD
2	B	Dec. 15, 2002	- Implemented changes from: . Ludovic Bourg's mail (24/08/01) . Error in LUT Polynomial coefficients for O2 correction (Section 6.11.6, field#1) . Comments from Jean-Claude Debruyn's mail (26/11/02) ⇨ Version in-line with MERISAT v1.2
2	C	July 18, 2003	- Some change implemented with IODD v6.1.
2	D	Oct. 31, 2003	- Complete revision of the document - All changes implemented with IODD v6.1 ⇨ Version in-line with MERISAT v1.3
2	E	May 14, 2004	- Changes implemented with IODD v7.2 ⇨ Version in-line with MERISAT v1.4
2	F	Nov 30, 2005	- Version in-line with IODD v7.2 and MERISAT v1.5 - LUT-122 is now provided by ACRI.

Issue	*Rev.*	*Date*	*Chapter/Paragraph Number, Change Description (and Reasons)*
3	-	July 16, 2009	- Upgrade MERISAT v1.5 into v2.0 by including updated and optimized RTCs. New tool is in line with IODD v7.3a. - Main changes in the LUT recipes: • LUT303: Use of MAR90 assemblage ($iaer\#3$) and a wind-speed of 5 m/s to generate the TOA normalized radiances over a wind-roughened reflective sea surface. • LUTs for Ocean-Aerosol parameters: New definition of aerosol assemblages over ocean and set of aerosol optical thickness at 550 nm in the 3 aerosol layers (*i.e.*, boundary, tropospheric, strato-spheric layers). • LUTs for Cloud parameters (LUT220 & 223): Polynomial fits for retrieving the cloud albedo and the cloud optical thickness are estimated on TOA normalized radiances computed for a spectral extraterrestrial solar irradiance (E_o) of 1 $W.m^{-2}.\mu m^{-1}$. • LUTs for Water-Vapor parameters (LUT121, 122, 123, 124, 125): All these LUTs, which are for now generated by the FUB (Freie Universität of Berlin, Germany) institute, are provided by ACRI.
3	A	July 21, 2009	- Additional wind-speed in atmospheric LUTs over ocean: Use of a newe set of 3 wind-speeds (1.5, 5.0 & 10 m/s): • LUT110: *Rayleigh* reflectance over ocean. • LUT143: Polynomial coefficients for (rhoT/rhoR) to AOT relation. - New complementary recipes for generating atmospheric LUTs over ocean with RTC/UPRAD (SO), by including polarization processes: • LUT110: *Rayleigh* reflectance over ocean. • LUT138: Spectral dependence of the AOT. • LUT139: Aerosol optical thickness at 865 nm. • LUT140: Aerosol single scattering albedo. • LUT141: Aerosol forward scattering proportion. • LUT143: Polynomial coefficients for (rhoT/rhoR) to AOT relation. - MERISAT tool in line with IODD v8.0.

Issue	*Rev.*	*Date*	*Chapter/Paragraph Number, Change Description (and Reasons)*
3	B	Jan. 19, 2011	- Main changes in the LUT recipes: • LUTs for Atmosphere parameters: - remove previous LUT103 & LUT104 (Thresholds on absolute difference in pressure for Cloud/Bright surfaces discrimination over land & over ocean). - replace previous LUT099 and (21 sets of polynomial coefficients for O2 transmittance retrieval at 778.75 nm) and previous LUT105 (21 set of polynomial coefficients for surface pressure retrieval) by 5 new LUTs generated at FUB, and provided by ACRI : LUT099: O2 transmittances around 778.75 nm (21 shifted filters) LUT103: O2 Rayleigh transmittances around 778.75 nm LUT104: O2 aerosol transmittances around 778.75 nm, with H_a=2 km LUT105: O2 aero. *Fresnel* transmittances around 778.75 nm, with H_a=2 km LUT107: O2 atmospheric transmittances around 778.75 nm, with H_a=2 km • LUTs for Water-Vapour parameters: Introduction of a surface albedo map at 865 nm (LUT126) in the ADF. • LUTs for Ocean-Aerosol parameters: Introduction of the atmospheric transmittances (up/down). LUT485: Total downward transmittance (direct+diffuse) LUT486: Total upward transmittance (direct+diffuse) • LUTs for Ocean-Case2 parameters: - replace previous LUT371 (reflectance versus IOPs) by a new LUT generated at BioOptika (Plymouth, UK), and provided by ACRI : LUT371: Coefficients of F' to IOPs relation - introduction of case2 waters neural network parameters (LUT372) • LUTs for Cloud parameters: - introduction of cloud top pressure neural network for not null surface albedo and for null surface albedo (LUT384 & LUT385), generated at FUB, and provided by ACRI - introduction of surface pressure neural network (LUT503), generated at FUB, and provided by ACRI MERISAT tool in line with IODD v8.0a (delivered by ACRI on Sept., 15th - 2009)
3	C	Feb. 27, 2011	MERISAT tool in line with IODD v8.0a (delivered by ACRI on Feb., 15th - 2011)

1. INTRODUCTION

1.1 PURPOSE OF DOCUMENT

The ground processing of the MERIS instrument data requires the use of a vast amount of geophysical models. For processing speed, configuration control, evolution capacity, these models are used primarily in the form of tabulated parameters, limiting on-line computations to interpolation and/or model fitting. The management of these parameter tables implies the availability of adequate production, quality control methods, and sufficient storage.

This document defines the scientific content of all MERIS level-1b and 2 auxiliary data products, which allows their generation. For each data product field, the latters comprise:

- a description of the procedure used for generation
- a description of the tool module used for generation
- the accuracy required and the level of scientific content needed for generation
- an evaluation of computer resources required for generation
- a description of the procedure used for the acceptance of data generation

1.2 SCOPE

This work concerns the Level 2 processing at the ENVISAT-1 Ground Segment of the MERIS instrument data.

1.3 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

ADF	Auxiliary Data File (or Product)
ADS	Annotation Data Set
ADSR	ADS Record
AOT	Aerosol Optical Thickness
BDS	Boundary Dust-Soot-like particles
BDW	Boundary Dust-Water soluble particles
BPAC	Bright Pixel Atmospheric Correction
BRDF	Bidirectional Reflectance Distribution Function
CESBIO	Centre d'Etudes Spatiales de la Biosphère, (Toulouse - France)
C.P.	MERISAT internal Configuration Parameters section
DDV	Dark Dense Vegetation
ECMWF	European Centre for Medium-term Weather Forecast
ESFT	Exponential Sum Fitting Technique (for computing gaseous transmittivity)
FR	Full Resolution
FUB	Freie Universität Berlin, Institute for Space Science, (Berlin - Germany)

GADS Global/General ADS
GAME Global Absorbtion ModEl
IOP Inherent Optical Properties
IPF Instrument Processor Facilities (MERIS processor)
LBL Line-By-Line computation
LISE/UdL Laboratoire Interdisciplinaire en Sciences de l'Environnement, Université du Littoral, (Wimereux - France)
LOV Laboratoire d'Océanographie de Villefranche/Mer (Villefranche/Mer - France)
LUT Look-Up Table
MERIS MEdium Resolution Imaging Spectrometer
MERISAT MERIS Auxiliary data Tool software
MOMO Matrix-Operator MethOd (*see* [RD-1] ***Fell, F., and J. Fischer, 2001.*** "Numerical simulation of the light field in the atmosphere-ocean system using the matrix-operator method", *Journal of Quantitative Spectroscopy & Radiative Transfer: 69* (3), 351-388.
[RD-2] for more details)
MPH Main Product Header
MTCI MERIS Terrestrial Chlorophyll Index
N/A Not Applicable
NIR Near InfraRed (spectral region)
NN Neural Network (tool)
ODOC Optical Dissolved Organic Carbon
OTC Optical Thickness Code
RH Relative Humidity
RR Reduced Resolution
RTC Radiative Transfer Code
SAM Standard Aerosol Model (standard assemblage)
SO Successive Orders method for the *atmosphere* (*see* [RD-3] & [RD-4] for more details)
SPH Specific Product Header
SPM Suspended Particulate Matter
TBD To Be Defined
TOA Top of Atmosphere
WV Water Vapor
WCRP World Climate Research Program

1.3.1 Scientific identificators and units

cot cloud optical thickness
ctp cloud top pressure
deg degree (angle unit)
dl dimensionless
DU Dobson Unit [10^{-3} *atm-cm*]
hPa hecto Pascal [10^{2} *Pa*] (*pressure unit*)
(*Nb*: $1\,atm = 760.31\,torr = 1013.25\,hPa$; $1\,torr = 1\,mmHg = 1.333\,mbar$)
kB Kilo-bytes (1024 *bytes*)

MB	Mega-bytes (1024 *kB*)
μm	micrometer (*wavelength unit*)
n.u.	non unit (*unitless*)
sr	steradian (*solid angle unit*)
W	watt (*power unit*)

1.3.2 Documents identificators

ATBD	Algorithm Theoretical Basis Document
DDD	Detailed Design Document
DPM	Detailed Processing Model document
IODD	Input/Output Data Definition
SRD	Software Requirement Document

1.4 LIST OF SYMBOLS

a, b	parameters of the particle size distribution $(n.u.)$
a_v	weights associated with monochromatic absorption coefficients used in ESFT $(n.u.)$
$dN(r)$	number of particle per volume unit with a radius between r and $r+dr$ (cm^{-3})
E	spectral irradiance $(W\ m^{-2}\mu m^{-1})$
E_o	spectral solar irradiance at TOA $(W\ m^{-2}\mu m^{-1})$
F_o	spectral solar radiance $(W\ m^{-2}sr^{-1}\mu m^{-1})$
g	assymmetry factor of phase function (2nd *Hapke*'s parameter) $(n.u.)$
h	width of the hot-spot (4th *Hapke*'s parameter) $(n.u.)$
ind	index for selecting the type of particle size distribution $(n.u.)$
I_s	maximum order of the *Legendre* polynomial decomposition of the phase function and the radiance $(n.u.)$
k	either imaginary part of the refractive index $(n.u.)$ or wavenumber (cm^{-1})
k_a	absorption efficiency $(n.u.)$
k_e	extinction efficiency $(n.u.)$
k_s	scattering efficiency $(n.u.)$
k_v	monochromatic absorption coefficients $(cm^2 g^{-1})$
L	spectral radiance $(W\ m^{-2}sr^{-1}\mu m^{-1})$
m	real part of the refractive index $(n.u.)$

M	either the number of *Fourier* terms $(n.u.)$ or the airmass (defined as $[1/\cos\vartheta_s + 1/\cos\vartheta_v]$ or $[1/\mu_s + 1/\mu_v]$) $(n.u.)$
n	index for selecting a MERIS spectral band $(n.u.)$ or complex refractive index $(n.u.)$
n_a	refractive index of air $(n.u.)$
n_w	refractive index of pure water $(n.u.)$
$n(r)$	particle size distribution $(cm^{-3}\,\mu m^{-1})$
N	either number of size distributions used in the *Mie*'s computation $(n.u.)$ or number of discrete atmospheric zenithal angles $(n.u.)$
N^*	number of discrete oceanic zenithal angles $(n.u.)$
n_2	number of scattering angles in the *Mie*'s computation $(n.u.)$
n_i / n	component mixing ratio (*i.e.*, volume percentage of particles characterized by the i^{th} size distribution) $(n.u.)$
p	normalized scattering phase function (sr^{-1})
P_s	surface pressure $(mbar\ or\ hPa)$
Q_a	absorption cross section (m^{-2})
Q_e	extinction cross section (m^{-2})
Q_s	scattering cross section (m^{-2})
r	geometrical radius of a scatterer (μm)
$r_{//}, r_{\perp}$	*Fresnel* reflection coefficients in the $//$ and $\perp$ direction to the incidence plane $(n.u.)$
$t_{//}, t_{\perp}$	*Fresnel* transmission coefficients in the $//$ and $\perp$ direction to the incidence plane $(n.u.)$
$r_{\min}, r_{\max}, dr$	minimum and maximum radius (μm), and radius increment (μm) of the particles in a given size distribution
S	amplitude of the hot-spot (3rd *Hapke*'s parameter) $(n.u.)$
$T(u)$	spectrally integrated transmission function for an absorber amount u $(n.u.)$
U_{H_2O}	total water vapor content $(g\ cm^{-2})$
U_{O_2}	total oxygen vapor content $(g\ cm^{-2})$
U_{O_3}	total ozone content $(cm-atm)$
w_i	*Gaussian* weigths $(n.u.)$
w_s	wind-speed above sea level $(m\ s^{-1})$
$\delta_{i,j}$	*Dirac*'s delta function $(n.u.)$

$\Delta\phi$	relative azimuthal angle (deg)
Δv	spectral interval $(s^{-1}\ or\ hertz)$
φ_o	illumination azimuthal angle (deg)
φ_s	solar azimuthal angle (deg)
φ_v	viewing azimuthal angle (deg)
λ	wavelength $(\mu m$ or $nm)$
μ	cosine of zenithal angle $(n.u.)$
μ_i	*Gaussian* angles $(n.u.)$
σ_a	absorption coefficient (aerosols / molecules) (m^{-1})
σ_a^p	absorption coefficient for phytoplankton (m^{-1})
σ_a^{spm}	absorption coefficient for SPM (m^{-1})
σ_a^{ys}	absorption coefficient for yellow substance (m^{-1})
σ_a^w	absorption coefficient for pure sea water (m^{-1})
σ_e	extinction coefficient (aerosols / molecules) (m^{-1})
σ_e^p	extinction coefficient for phytoplankton (m^{-1})
σ_e^{spm}	extinction coefficient for SPM (m^{-1})
σ_e^{ys}	extinction coefficient for yellow substance ($\sigma_e^{ys}=\sigma_a^{ys}$) (m^{-1})
σ_e^w	extinction coefficient for pure sea water (m^{-1})
σ_s	scattering coefficient (aerosols / molecules) (m^{-1})
σ_s^p	scattering coefficient for phytoplankton (m^{-1})
σ_s^{spm}	scattering coefficient for SPM (m^{-1})
σ_s^w	scattering coefficient for pure sea water (m^{-1})
θ	scattering angle (deg)
θ_p	phase function truncation angle (deg)
ϑ_c	critical zenithal angle for total internal reflection (deg)
ϑ_o	illumination zenithal angle (deg)
ϑ_s	solar zenithal angle (deg)
ϑ_v	viewing zenithal angle (deg)
ρ_s	reflectance of ground surface or ocean bottom assumed to be *Lambertian* $(n.u.)$

ρ_G	specular reflection of sunlight over ocean waves $(n.u.)$
ρ_F	*Fresnel* reflectance at the *air-sea* interface $(n.u.)$
ρ_{DDV}	Ground DDV albedo $(n.u.)$
$\overline{\rho}_{aG}$	Aerosol-ground DDV coupling bidirectionality term $(n.u.)$
$\overline{\rho}_{aR}$	Aerosol-molecule coupling bidirectionality term $(n.u.)$
$\overline{\rho}_{RG}$	*Rayleigh*-ground DDV coupling bidirectionality term $(n.u.)$
τ	optical thickness $(n.u.)$
τ^a	aerosol optical thickness $(n.u.)$
τ^c	cloud optical thickness $(n.u.)$
τ^R	*Rayleigh* (molecular) optical thickness $(n.u.)$
τ^{O_3}	ozone optical thickness $(n.u.)$
ω	single scattering albedo (1st *Hapke*'s parameter) $(n.u.)$
ω_o	single scattering albedo $(n.u.)$
ω_o^p	single scattering albedo for phytoplankton $(n.u.)$
ω_o^{spm}	single scattering albedo for SPM $(n.u.)$
ω_o^w	single scattering albedo for pure sea water $(n.u.)$
Ω	solid angle (sr)

1.5 REFERENCES

This section contains a list of applicable and reference documents for the Product Specifications document. The reader must refer to the STD document [AD-1] *PO-MA-BOM-GS-0003* "Software Transfer Document for MERIS Level-2 Auxiliary Data Tool S/W"
] to obtain the issue number of each document pertaining to the current MERISAT software release [AD-2].

1.5.1 Applicable documents

No	*Document*	*Title*
[AD-1]	*PO-MA-BOM-GS-0003*	"Software Transfer Document for MERIS Level-2 Auxiliary Data Tool S/W"
[AD-2]	*PO-MA-BOM-GS-0008*	"Software User's Manual for MERIS level-2 Auxiliary data Tool software"
[AD-3]	*PO-TN-MEL-GS-0002-i7r2*	"MERIS Level-2 Detailed Processing Model & Parameter Data List"
[AD-4]	*PO-TN-MEL-GS-0002-i7r0*	"MERIS Level-1b Detailed Processing Model & Parameter Data List"

[AD-5]	*PO-TN-MEL-GS-0005*	"MERIS Level-2 ATBD: Algorithm Theoretical Basis Document"
[AD-6]	*PO-TN-MEL-GS-0026*	"Reference Model for MERIS Level-2 Processing – 3rd MERIS Reprocessing"
[AD-7]	*PO-RS-PAR-GS-0003*	"Specification of the Contents of the MERIS Radiative Transfer Tools used to Generate the Level-2 Auxiliary Data Products"
[AD-8]	*PO-TN-MEL-GS-0003*	"MERIS Input/Output Data Definition"
[AD-9]	*Presentation slides*	"MERIS Water Vapor retrieval"

1.5.2 Reference documents

No	*Reference (authors, title, journal)*
[RD-1]	***Fell, F., and J. Fischer, 2001.*** "Numerical simulation of the light field in the atmosphere-ocean system using the matrix-operator method", *Journal of Quantitative Spectroscopy & Radiative Transfer*: 69 (3), 351-388.
[RD-2]	***Fell, F., and J. Fischer, 2001.*** "Numerical simulation of the light field in the atmosphere-ocean system using the matrix-operator method", *Journal of Quantitative Spectroscopy & Radiative Transfer*: 69 (3), 351-388.
[RD-3]	***Deuzé, J.L., M. Herman, and R. Santer, 1989.*** "Fourier series expansion of the transfer equation in the atmosphere-ocean system", *Journal of Quantitative Spectroscopy & Radiative Transfer*: ***41*** (6), 483-494.
[RD-4]	***Lenoble, J., M. Herman, J.L. Deuzé, B. Lafrance, R. Santer and D. Tanré, 2007.*** "A successive order of scattering code for solving the vector equation of transfer in the Earth's atmosphere with aerosols", *Journal of Quantitative Spectroscopy & Radiative Transfer*, 107, pp. 479-507 (*doi: 10.1016/j.jqsrt.2007.03.010*).
[RD-5]	***Vermote, E., D. Tanré, J.L. Deuzé, M. Herman, and J.J. Morcrette, 1997.*** "Second simulation of the satellite signal in the solar spectrum, 6S: An overview", *I.E.E.E. Transactions on Geoscience & Remote Sensing*: ***35*** (3), 675-687.
[RD-6]	***Hansen, J.E., and L. Travis, 1974.*** "Light scattering in planetary atmospheres", *Space Science Reviews*: ***16***, 527-610.
[RD-7]	***Cox, C., and W. Munk, 1954.*** "Measurements of roughness of the sea surface from photographs of the sun glitter", *Journal of the Optical Society of America*: ***44*** (11), 838-888.
[RD-8]	***Shettle, E.P., and R.W. Fenn, 1979.*** "Models for the aerosols of the lower atmosphere and the effects of humidity variations on their optical properties", *Environmental Research Papers, AFGL-TR-79-0214*, Hanscom (Mass.).
[RD-9]	***Kaufman, Y.J., and D. Tanré, 1992.*** "Atmospherically resistant vegetation index (ARVI) for EOS-MODIS", *I.E.E.E. Transactions on Geoscience & Remote Sensing*: ***30***, 261-270.
[RD-10]	***Morel, A., and B. Gentili, 1996.*** "Diffuse reflectance of oceanic waters. III- Implications of bidirectionality for the remote-sensing problem", *Applied Optics*: ***35***, 261-270.
[RD-11]	***Prieur, L., and S. Sathyendranath, 1981.*** " An optical classification of coastal and oceanic waters based on the specific spectral absorption curves of phytoplankton pigments, dissolved organic matter, and other particulate materials", *American Society of Limnology & Oceanography*: ***26***, 671-689.
[RD-12]	***Morel, A., and M. André, 1991.*** " Pigment distribution and primary production in the western Mediterranean as derived and modeled from Coastal Zone Color Scanner observations", *Journal of Geophysical Research*: ***96***, 12685-12698.
[RD-13]	***Pope, R.M., and E.S. Fry, 1997.*** "Absorption spectrum (380-700nm) of pure water: II. Integrating cavity measurements", *Applied Optics*: ***36***, 8710-8723.

[RD-14] ***Hale, G.M., and M.R. Querry, 1973***. "Optical constants of water in the 200nm to 200µm wavelength region", *Applied Optics*: ***12***, 555-563.

[RD-15] ***Santer, R., and F. Zagolski, 2010***. "Inherent optical properties of the aerosols – IOPA", in reponse to RFQ/3-11641/06/I-OL, Intended Rider 1 to ESRIN Contract 18109/04/I-OL for Atmospheric Correction for MERIS Over Coastal Waters: Towards a New Aerosol Climatology: 40 p.

1.6 DEFINITION

The 15 MERIS bands are described in table below:

Band #	*λ (nm)*	*Δλ (nm)*	*Description*
1	412.50	10	*Aerosol and ocean color retrieval*
2	442.50	10	*Aerosol and ocean color retrieval*
3	490.00	10	*Aerosol and ocean color retrieval*
4	510.00	10	*Aerosol and ocean color retrieval*
5	560.00	10	*Aerosol and ocean color retrieval*
6	620.00	10	*Aerosol and ocean color retrieval*
7	665.00	10	*Aerosol and ocean color retrieval*
8	681.25	7.5	*Aerosol and ocean color retrieval*
9	708.75	10	*Aerosol and ocean color retrieval*
10	753.75	7.5	*Clouds*
11	761.875	3.75	*Clouds*
12	778.75	15	*Aerosol and ocean color retrieval*
13	865.00	20	*Aerosol and ocean color retrieval*
14	885.00	10	*Water vapor*
15	900.00	10	*Water vapor*

1.7 CODING / SIZING

The following data types are used to code the MERIS level-1b & 2 auxiliary data products:

Variable Type	*Type*	*Size*	*Description*
Character	char	1 byte	*sc: signed char* *uc: unsigned char*
2-byte Integer	short	2 bytes	*ss: signed short integer* *us: unsigned short integer*
4-byte Integer	long	4 bytes	*sl: signed long integer* *ul: unsigned long integer*
8-byte Integer	long long	8 bytes	*sd: signed long long integer* *ud: unsigned long long integer*
Single precision floating point	float	4 bytes	*fl: single precision floating point*
Double precision floating point	double	8 bytes	*db: double precision floating point*

Conventions used for byte and bit numbering in bit fields are:

- bytes and bits numbering always starts at 0
- byte 0 is always the most significant

2. OVERVIEW OF SPECIFICATION

2.1 APPROACH OF AUXILIARY DATA PRODUCT SPECIFICATION

For each auxiliary data product field described, the information is presented following a standardized template. The specification is provided for the following categories: reference, dependencies, tool, procedure, scientific content, resources and acceptance. In this section, each category is defined and the descriptors used are presented.

Reference:

References to applicable documents are given. The variable name given corresponds to the output variable used in [AD-3] & [AD-4], and provides the means of tracing where the LUT is being used. When "no variable used" is specified, the field is used only for the generation of the LUT described under "Dependencies".

Dependencies:

In this section, all the LUTs that depend on the given auxiliary data product field are listed.

Tool:

A description of the tool modules which will be used for the generation of the field is given.

Procedure:

A description of the procedure that will be used for the generation of the field is given. It specifies mainly the inputs/outputs and the processing steps in the sequence of modules. In the outputs, the variable name is given, as well the units and the dimensions of the variable. Under unit description, [*dl*] means that the variable is dimensionless.

Scientific content:

The level of scientific content or a relevant physical description is given to help understanding the purpose of the LUT. For more details on the algorithms used, refer to [AD-5] or [AD-6].

Resources:

An evaluation of the computer resources required to generate the data for the specified accuracy is given. It includes the Output disk space and the CPU time for a typical case.

Acceptance:

A description of the procedure which will be used in the acceptance for the data generated.

2.2 SUMMARY OF TOOLS / MODULES REQUIRED

These tools / modules are summarized in table hereafter, and a full description (*i.e.*, theory and data dictionary) for each of them is given in [AD-7].

Tools/Modules required	*Status*
LISE/UdL Modules	
OTC/SCAMAT	Available
OTC/COMPUTE_FSP	Available
RTC/UPRAD (GAME, SO)	Available
RTC/GAUSS	Available
RTC/MOS (lut_rhob_aR, lut_rhob_agddv, lut_rhob_Rgddv, lut_alb_gddv)	Available
OTC/OZONE	Available
OTC/RAYLEIGH	Available
FUB Modules	
OTC/MIE	Available
OTC/SCFP_2	Available
RTC/MOMO	Available
MERISAT Modules	
Integration	Available
Interpolation	Available
Simplex	Available
Polynomial fit	Available

2.3 SUMMARY OF COMPUTER RESOURCE REQUIREMENTS

This summary is limited to the LUTs generated on a single computer equipped with a linux operting system. The CPU time was obtained using the MERISAT-S/W v2.0 on a single computer.

Reference to [AD-8]	*LUT #*	*CPU time [s]*	*Disk space [bytes]*
L1b CONTROL PARAMETERS			
✓Section 6.2.20, ADS field 1	017	26	10944
L2 CONTROL PARAMETERS			
✓Section 6.10.8, ADS record 1 field 1	303	3243243243 2432432432 4324	5928
✓Section 6.10.8, ADS record 2 field 1	303	685	5928

Reference to [AD-8]	*LUT #*	*CPU time [s]*	*Disk space [bytes]*
ATMOSPHERE PARAMETERS			
✓Section 6.11.4, GADS field 1	074	21	12
✓Section 6.11.5, GADS field 4	097	1	60
✓Section 6.11.5, GADS field 5	098	1	60
✓Section 6.11.6, GADS field 2	106	55674	336
✓Section 6.11.6, GADS field 3	100	39767	240
✓Section 6.11.7, GADS field 1, 2 & 3	101	691	3744
✓Section 6.11.8, GADS field 1	102	17	68
✓Section 6.11.12, GADS fields 1, 2 & 3	110	[FUB] 1024 [UdL] 259	1345500
OCEAN-AEROSOL PARAMETERS			
✓Section 6.13.5, GADS field 1	138	[FUB] 3 [UdL] 3	14280
✓Section 6.13.6, GADS field 1	139	[FUB] 1 [UdL] 1	952
✓Section 6.13.7, GADS field 1	140	[FUB] 1 [UdL] 1	2040
✓Section 6.13.8, GADS field 1	141	[FUB] 2 [UdL] 2	2040
✓Section 6.13.9, ADSR field 1	142	31	29900
✓Section 6.13.10, ADSR field 1, 2 & 3	143	[FUB] 101663 [UdL] 47841	137241000
✓Section 6.13.11, ADSR field 1, 2 & 3	485	21600	985320
✓Section 6.13.12, ADSR field 1	486	7200	185640
LAND-AEROSOL PARAMETERS			
✓Section 6.14.5, ADSR field 2	159	7078	5928
✓Section 6.14.5, ADSR field 4	438	7078	5928
✓Section 6.14.6, ADSR field 1	160	94428	118560
✓Section 6.14.8, ADSR field 1	167	2044	4992
✓Section 6.14.9, ADSR field 1	168	1022	59904
✓Section 6.14.10, ADSR field 1	169	177329	606528
✓Section 6.14.11, ADSR field 1	170	2458	25896
✓Section 6.14.12, ADSR field 1	315	363	1080
✓Section 6.14.13, ADSR field 1	316	183	12960
✓Section 6.14.14, ADSR field 1	317	40	14940
✓Section 6.14.16, ADSR field 1	320	5	3840
✓Section 6.14.16, ADSR field 2	321	6	9734400
✓Section 6.14.16, ADSR field 3	322	7	320
✓Section 6.14.17, ADSR field 1	324	54	14976
✓Section 6.15.6, GADS field 8	197	24	51300
✓Section 6.15.8, GADS field 1, 2, 3 & 4	203	4356	786240
✓Section 6.17.6, GADS field 1, 2 & 3	220	1312200	1312200
✓Section 6.17.7, GADS field 1, 2, 3 & 4	223	19016	1749600
Total		**1904530**	**154343584**

C.P. Sections	*Number of LUTs*	*Disk space per LUT [bytes]*	*Total disk space [bytes]*
L1b CONTROL PARAMETERS			
✓3.1	1	60	60
✓3.2	1	1820	1820
ATMOSPHERE PARAMETERS			
✓6.11.1.1	1	60	60
OCEAN-AEROSOL PARAMETERS			
✓6.13.1.1	1	952	952
✓6.13.1.2	1	952	952
✓6.13.1.3	1	952	952
✓6.13.1.4	1	4140	4140
✓6.13.1.5	1	3060	3060
✓6.13.1.6	9180 4320	29900 29900	274482000 129168000
✓6.13.1.7	1	24480	24480
✓6.13.1.8	1	14280	14280
LAND-AEROSOL PARAMETERS			
✓6.14.1.1	1	312	312
OCEAN CASE-I PARAMETERS			
✓6.15.1.1	1	216	216
CLOUD PARAMETERS			
✓6.17.1.1	1754	48600	85244400
✓6.17.1.2	1754	108	189432
Total			**489135116**

3. SPECIFICATION OF MERISAT INTERNAL AUXILIARY DATA PRODUCT

3.1 C.P. MERIS WAVELENGTH FOR BAND *B*

Reference: Wvl[b] LUT400

[AD-8] Section 5.3.1.4, SPH field 31

PARBLEU provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values) *see* Section3.1,(LUT400)

Output: *Wvl[b]* Nominal MERIS wavelengths for the 15 spectral bands

units: [*nm*]

Step: User specified.

Scientific content:

Nominal wavelengths of the 15 MERIS spectral bands

Current baseline: {412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75, 753.75, 761.875, 778.75, 865.0, 885.0, 900.0} *nm*

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Correspond to the latest definition.

3.2 C.P. FRESNEL REFLECTION COEFFICIENTS FOR OCEAN CASE-I & II

Reference: FR[w_s,θ'] LUT417

Configuration file

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: w_s Wind-speed above sea level (5 values: {0; 0.0001;4;8;16} *m/s*)
θ' Zenith angles in water (91 values: [0;90] *deg.* with step of 1 *deg.*)

Output: *FR[w_s,θ']* *Fresnel* reflection coefficients $\mathcal{R}$(w_s,θ')
units: [*dl*]

Step: User specified.

Scientific content:

Fresnel reflection coefficients $\mathcal{R}$(w_s,θ') tabulated for 5 wind-speeds (w_s) and for 91 zenith angles in water (θ')

Current baseline: 5 × 91 values (*see* table below)

Resources:

Estimated CPU time: -
Output disk space: 5 × 91 x 4 bytes/fl = 1820 bytes

Acceptance:

Correspond to the latest definition.

θ (deg)	$\mathcal{R}(\theta,w_s)$ $w_s=0$	$\mathcal{R}(\theta,w_s)$ $w_s=0.0001$	$\mathcal{R}(\theta,w_s)$ $w_s=4$	$\mathcal{R}(\theta,w_s)$ $w_s=8$	$\mathcal{R}(\theta,w_s)$ $w_s=16$
0	0.02125	0.02094	0.02097	0.02105	0.02150
1	0.02125	0.02091	0.02099	0.02110	0.02147
2	0.02125	0.02092	0.02094	0.02114	0.02144
3	0.02125	0.02095	0.02102	0.02104	0.02144
4	0.02125	0.02097	0.02094	0.02101	0.02148
5	0.02126	0.02096	0.02090	0.02105	0.02147
6	0.02126	0.02095	0.02100	0.02104	0.02154
7	0.02126	0.02099	0.02099	0.02105	0.02183
8	0.02126	0.02100	0.02097	0.02098	0.02191
9	0.02127	0.02099	0.02095	0.02115	0.02206
10	0.02127	0.02099	0.02094	0.02116	0.02241
11	0.02127	0.02091	0.02090	0.02133	0.02306
12	0.02128	0.02093	0.02109	0.02145	0.02327
13	0.02133	0.02094	0.02114	0.02159	0.02370
14	0.02137	0.02100	0.02128	0.02167	0.02463
15	0.02143	0.02107	0.02145	0.02199	0.02545
16	0.02146	0.02122	0.02155	0.02241	0.02638
17	0.02155	0.02123	0.02175	0.02256	0.02804
18	0.02170	0.02138	0.02187	0.02286	0.03022
19	0.02178	0.02144	0.02202	0.02350	0.03208
20	0.02190	0.02156	0.02242	0.02391	0.03372
21	0.02210	0.02171	0.02276	0.02443	0.03703
22	0.02237	0.02190	0.02317	0.02601	0.04076
23	0.02261	0.02213	0.02374	0.02730	0.04486
24	0.02294	0.02255	0.02447	0.02884	0.05001
25	0.02335	0.02285	0.02474	0.03106	0.05483
26	0.02386	0.02329	0.02618	0.03357	0.06144
27	0.02438	0.02376	0.02703	0.03644	0.06865
28	0.02508	0.02446	0.02831	0.04031	0.07668
29	0.02593	0.02540	0.03089	0.04533	0.08664
30	0.02681	0.02624	0.03378	0.05231	0.09773
31	0.02794	0.02756	0.03732	0.05971	0.10897
32	0.02909	0.02897	0.04139	0.06869	0.12166
33	0.03091	0.03072	0.04670	0.07954	0.13646
34	0.03338	0.03311	0.05447	0.09248	0.15212
35	0.03570	0.03572	0.06500	0.10751	0.16927
36	0.03878	0.03907	0.07689	0.12445	0.18823
37	0.04205	0.04314	0.09238	0.14488	0.20682
38	0.04649	0.04886	0.11208	0.16743	0.22797
39	0.05268	0.05539	0.13472	0.19266	0.25123
40	0.05972	0.06439	0.16347	0.21976	0.27463
41	0.06838	0.07594	0.19647	0.24938	0.29938
42	0.07985	0.09529	0.23428	0.28338	0.32753
43	0.09589	0.12213	0.27621	0.31770	0.35511
44	0.11899	0.16774	0.32387	0.35947	0.38285
45	0.15238	0.23620	0.37676	0.39986	0.41170

θ (deg)	$\mathcal{R}(\theta,w_s)$ $w_s=0$	$\mathcal{R}(\theta,w_s)$ $w_s=0.0001$	$\mathcal{R}(\theta,w_s)$ $w_s=4$	$\mathcal{R}(\theta,w_s)$ $w_s=8$	$\mathcal{R}(\theta,w_s)$ $w_s=16$
46	0.20426	0.33440	0.43319	0.44050	0.43934
47	0.30306	0.46703	0.49054	0.48138	0.46729
48	0.57047	0.61171	0.54910	0.52514	0.50016
49	0.99998	0.74817	0.60431	0.56677	0.52962
50	0.99998	0.86008	0.65845	0.60953	0.56041
51	0.99998	0.93299	0.71357	0.64918	0.58925
52	0.99998	0.97398	0.76274	0.68827	0.61775
53	0.99998	0.99172	0.80779	0.72825	0.64609
54	0.99998	0.99793	0.84699	0.76455	0.67473
55	0.99998	0.99958	0.88388	0.79884	0.70134
56	0.99998	0.99994	0.91470	0.83069	0.73117
57	0.99998	0.99998	0.93960	0.86141	0.75837
58	0.99998	0.99998	0.95909	0.88965	0.78525
59	0.99998	0.99998	0.97386	0.91423	0.81158
60	0.99998	0.99998	0.98385	0.93457	0.83643
61	0.99998	0.99997	0.99101	0.95198	0.86142
62	0.99998	0.99997	0.99533	0.96662	0.88457
63	0.99998	0.99997	0.99773	0.97731	0.90681
64	0.99998	0.99996	0.99907	0.98569	0.92587
65	0.99998	0.99996	0.99963	0.99151	0.94327
66	0.99998	0.99996	0.99982	0.99508	0.95829
67	0.99998	0.99997	0.99995	0.99764	0.97085
68	0.99998	0.99997	0.99995	0.99880	0.98037
69	0.99998	0.99997	0.99997	0.99941	0.98752
70	0.99998	0.99997	0.99997	0.99979	0.99265
71	0.99998	0.99997	0.99999	0.99997	0.99625
72	0.99998	0.99997	0.99999	0.99998	0.99814
73	0.99998	0.99997	0.99999	0.99999	0.99921
74	0.99998	0.99997	1.00000	0.99999	0.99970
75	0.99998	0.99997	0.99998	1.00000	0.99995
76	0.99998	0.99996	0.99999	1.00000	0.99999
77	0.99998	0.99997	1.00000	1.00000	0.99998
78	0.99998	0.99995	1.00000	0.99998	1.00000
79	0.99998	0.99995	0.99999	1.00000	0.99999
80	0.99998	0.99994	0.99999	1.00000	0.99999
81	0.99998	0.99995	0.99998	0.99998	0.99997
82	0.99998	0.99993	0.99996	0.99998	0.99997
83	0.99998	0.99995	0.99996	0.99995	0.99996
84	0.99998	0.99996	0.99994	0.99995	0.99995
85	0.99998	0.99996	0.99995	0.99994	0.99994
86	0.99998	0.99996	0.99993	0.99992	0.99994
87	0.99998	0.99991	0.99992	0.99992	0.99993
88	0.99997	0.99992	0.99993	0.99994	0.99994
89	0.99991	0.99990	0.99991	0.99991	0.99991
90	1.00000	1.00000	1.00000	1.00000	1.00000

4. MERIS PRODUCTS OVERVIEW

Not covered in this document

5. SPECIFICATION OF L1B/L2 DATA PRODUCT

Not covered in this document

6. SPECIFICATION OF L1B/L2 AUXILIARY DATA PRODUCT

6.1 MERIS INSTRUMENT

Not covered in this document

6.2 LEVEL-1B CONTROL PARAMETERS

6.2.1 C.P.

None

6.2.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.2.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.2.4 GADS General

6.2.4.1 Julian day to milliseconds conversion factor

Reference: MS_to_JD, LUT001

[AD-8] Section 6.2.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MS_to_JD* *Julian* day to milliseconds conversion factor

units: [*ms/day*]

Step: User specified.

Scientific content:

Conversion factor used to convert variables expressed as *Julian* day into milliseconds

Current baseline: 86400000 *ms*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/sl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.4.2 Maximum number of missing packets allowed

Reference: Max_gap_P, LUT002

[AD-8] Section 6.2.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Max_gap_P* Maximum number of missing packets allowed

units: [*dl*]

Step: User specified.

Scientific content:

Maximum number of packets that can be missed

Current baseline: 16

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.5 (Deleted)

Reference:

[AD-8] Section 6.2.5

6.2.6 GADS Solar Parameters

6.2.6.1 Solar flux reference values

Reference: $F_0[b]$, LUT224

[AD-8] Section 6.2.6, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: $F_0[b]$ Solar flux reference values in the 15 MERIS bands (15 values)
units: $[W.m^{-2}.\mu m^{-1}]$

Step: User specified.

Scientific content:

Extraterrestrial spectral solar irradiance in the 15 MERIS bands

Current baseline: {1714.7673340, 1878.8929443, 1928.3371582, 1928.9362793, 1803.0762939, 1650.7738037, 1531.6264648, 1472.1680908, 1407.9426270, 1266.0428467, 1254.5811768, 1177.2595215, 958.38519287, 929.83801270, 895.45959473} $W.m^{-2}.\mu m^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.2.6.2 Square of Sun-Earth distance at reference date

Reference: $\mathrm{Dsun0}^2$, LUT225

[AD-8] Section 6.2.6, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Dsun0^2$ Square of *Sun-Earth* distance at reference date
units: $[m^2]$

Step: User specified.

Scientific content:

Sun-Earth distance given a reference date used to compute the corrcetive factor ($1/Dsun0^2$) to apply tpo the extraterrestrial solar irradiance

Current baseline: $2.2402379\ 10^{22}\ m^2$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Correspond to the latest definition.

6.2.7 (Deleted)

Reference:

[AD-8] Section 6.2.7

6.2.8 GADS Exception Handling

6.2.8.1 Default radiance values for saturated samples

Reference: Def_rad[b], LUT226

[AD-8] Section 6.2.8, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Def_rad[b]* Default radiance values for saturated samples in the 15 MERIS bands

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

Default radiance values in the 15 MERIS spectral bands used for the saturated samples

Current baseline: {619.98608398, 693.83856201, 758.02069092, 700.52618408, 610.46539307, 535.78985596, 448.10375977, 453.98617554, 412.82760620, 566.97033691, 580.60144043, 237.70004272, 232.57832336, 399.39666748, 355.34863281} $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.2.8.2 Default radiance values for above range samples

Reference: Def_rad0[b], LUT227

[AD-8] Section 6.2.8, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Def_rad0[b]* Default radiance values for above range samples in the 15 MERIS bands

units: [$W.m^{-2}.\mu m^{-1}.sr^{-1}$]

Step: User specified.

Scientific content:

Default radiance values in the 15 MERIS spectral bands used for above range samples

Current baseline: {620.93359375, 694.89892578, 759.17913818, 701.59674072, 611.39831543, 536.60864258, 448.78857422, 454.67996216, 413.45849609, 567.83679199, 581.48876953, 238.06330872, 232.93376160, 400.00704956, 355.89169312} $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.2.9 GADS Level-0 Extraction

6.2.9.1 Blank sample thresholds

Reference: Blank_thr[b], LUT228

[AD-8] Section 6.2.9, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Blank_thr[b]* Blank sample thresholds in the 15 MERIS bands (15 values)
units: [*dl*]

Step: User specified.

Scientific content:

Blank sample thresholds used for the 15 MERIS spectral bands

Current baseline: {52, 52, 52, 52, 52, 52, 52, 52, 52, 26, 52, 52, 26, 26, 26}

Resources:

Estimated CPU time: -
Output disk space: 16 × 2 bytes/us = 32 bytes

Acceptance:

Corresponds to the latest definition.

6.2.9.2 Blank sample difference thresholds

Reference: Blank_dif_thr[b], LUT229

[AD-8] Section 6.2.9, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section3.1,(LUT400)

Output: *Blank_dif_thr[b]*
Blank sample difference thresholds in the 15 MERIS bands (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Blank sample difference thresholds used for the 15 MERIS spectral bands

Current baseline: {4, 4, 4, 4, 4, 4, 4, 4, 4, 2, 4, 4, 2, 2, 2} [*dl*]

Resources:

Estimated CPU time: -
Output disk space: 16 × 2 bytes/us = 32 bytes

Acceptance:

Corresponds to the latest definition.

6.2.9.3 Scaling factor for floating point values coding

Reference: PK_scale, LUT230

[AD-8] Section 6.2.9, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *PK_scale* Scaling factor for floating point values coding

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for coding the floating point values

Current baseline: -32768

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

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6.2.10 GADS Geolocation

6.2.10.1 Mean Earth radius

Reference: Re, LUT231

[AD-8] Section 6.2.10, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Re* Mean Earth radius

units: [m]

Step: User specified.

Scientific content:

Mean value used for the Earth radius

Current baseline: 6363885 m

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.10.2 Number of tie points per frame for full swath

Reference: NJ, LUT232

[AD-8] Section 6.2.10, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *NJ* Number of tie points per frame for full swath

units: [*dl*]

Step: User specified.

Scientific content:

Number of tie points per frame used for the full swath

Current baseline: 71

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.10.3 AC distance between tie points

Reference: Dx_t, LUT233

[AD-8] Section 6.2.10, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Dx_t* AC distance between tie points

units: [*m*]

Step: User specified.

Scientific content:

Distance between tie points used in the atmospheric correction procedure

Current baseline: 16640 *m*

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.10.4 FR product AC pixel size

Reference: Pix^{FR}, LUT234

[AD-8] Section 6.2.10, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: Pix^{FR} FR product AC pixel size units: [*m*]

Step: User specified.

Scientific content:

Pixel size of the atmospherically corrected product in the full resolution mode

Current baseline: 260 *m*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.10.5 RR product AC pixel size

Reference: Pix^{RR}, LUT235

[AD-8] Section 6.2.10, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: Pix^{RR} RR product AC pixel size

units: [*m*]

Step: User specified.

Scientific content:

Pixel size of the atmospherically corrected product in the reduced resolution mode

Current baseline: 1040 *m*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11 GADS Flagging

6.2.11.1 Width of blooming contamination for FR

Reference: $\mathrm{Glint\_bloom\_K}^{FR}$, LUT236

[AD-8] Section 6.2.11, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Glint\_bloom\_K^{FR}$
Width of blooming contamination for FR

units: [*dl*]

Step: User specified.

Scientific content:

Width (in pixels) of blooming contamination in the full resolution mode

Current baseline: 5

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.2 Width of blooming contamination for RR

Reference: Glint_bloom_K^{RR}, LUT237

[AD-8] Section 6.2.11, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Glint_bloom_*K^{RR}
Width of blooming contamination for RR

units: [*dl*]

Step: User specified.

Scientific content:

Width (in pixels) of blooming contamination in the reduced resolution mode

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.3 Saturation recovery width for FR

Reference: Sat_Rec_K^{FR}, LUT238

[AD-8] Section 6.2.11, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Sat\_Rec\_K^{FR}$ Saturation recovery width for FR

units: [dl]

Step: User specified.

Scientific content:

Width (in pixels) of saturation recovery in the full resolution mode

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.4 Saturation recovery width for RR

Reference: Sat_Rec_K^{RR}, LUT239

[AD-8] Section 6.2.11, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Sat\_Rec\_K^{RR}$

Saturation recovery width for RR

units: [dl]

Step: User specified.

Scientific content:

Width (in pixels) of saturation recovery in the reduced resolution mode

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.5 Azimuth angle range for sun glint risk

Reference: Glint_thr_azi, LUT240

[AD-8] Section 6.2.11, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Glint_thr_azi*
Atzimuth angle range for sun glint risk

units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Threshold in azimuth angle to avoid the risk of sun glint contamination

Current baseline: 1.064 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.6 Zenith angle range for sun glint risk

Reference: Glint_thr_zen, LUT241

[AD-8] Section 6.2.11, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Glint_thr_zen*

Zenith angle range for sun glint risk

units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Threshold in zenith angle to avoid the risk of sun glint contamination

Current baseline: 1.064 *deg*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.7 Band saturation levels for FR samples

Reference: Sat_sample^{FR}[b], LUT242

[AD-8] Section 6.2.11, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Sat_sampleFR[b]*

Band saturation levels for FR samples in band #0 and 15 MERIS bands (16 values)

units: [*nc*]

Step: User specified.

Scientific content:

16 values of band saturation levels for the full resolution mode. 16 bands are considered: band#0 + 15 MERIS spectral bands

Current baseline: {8190, 8190, 8190, 8190, 8190, 8190, 8190, 8190, 8190, 8190, 4095, 8190, 8190, 4095, 4095, 4095} *nc*

Resources:

Estimated CPU time: -
Output disk space: 16 × 2 bytes/us = 32 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.8 Maximum valid radiances

Reference: Sat_rad[b], LUT243

[AD-8] Section 6.2.11, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Sat_rad[b]* Maximum valid radiances in the 15 MERIS bands (15 values)

units: [$W.m^{-2}.\mu m^{-1}.sr^{-1}$]

Step: User specified.

Scientific content:

Maximum valid radiances in the 15 MERIS spectral bands

Current baseline: {615.86456299, 689.22607422, 752.98150635, 695.86920166, 606.40710449, 532.22802734, 445.12484741, 450.96813965, 410.08322144, 563.20117188, 576.74169922, 236.11985779, 231.03218079, 396.74154663, 352.98632812} $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.9 Threshold value for percentage of out of range image samples

Reference: Pc_thresh_image, LUT244

[AD-8] Section 6.2.11, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Pc_thresh_image*
Threshold value for percentage of out of range image samples

units: [%]

Step: User specified.

Scientific content:

Threshold value for the percentage of acceptable out of range image samples

Current baseline: 25 %

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.10 Threshold value for percentage of out of range blank samples

Reference: Pc_thresh_blank, LUT245

[AD-8] Section 6.2.11, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Pc_thresh_image*
Threshold value for percentage of out of range image samples

units: [%]

Step: User specified.

Scientific content:

Threshold value for the percentage of acceptable out of range blank samples

Current baseline: 25 [%]

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.11 Land processing bands

Reference: land_proc[*b*], LUT246

[AD-8] Section 6.2.11, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *land_proc[b]* Flag to activate the land processing in the 15 MERIS bands (15 values)
units: [*dl*]

Step: User specified.

Scientific content:

Flag for activating [1] or not [0] the processing over land for each of the 15 MERIS spectral bands

Current baseline: {1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1}

Resources:

Current baseline:

Resources:

Estimated CPU time: -

Output disk space: 15 × 1 byte/uc = 15 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.12 Threshold for setting transmission error flag (mean number of errors per packet)

Reference: Trans_thresh, LUT247

[AD-8] Section 6.2.11, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Trans_thresh* Threshold for setting transmission error flag (mean number of errors per packet)

units: [*dl*]

Step: User specified.

Scientific content:

Threshold to set the data transmission error flag

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.11.13 Threshold for setting format error flag (mean number of errors per packet)

Reference: Format_thresh, LUT248

[AD-8] Section 6.2.11, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Format_thresh*
Threshold for setting format error flag (mean number of errors per packet)

units: [*dl*]

Step: User specified.

Scientific content:

Threshold to set the data format error flag

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.12 GADS Radiometric

6.2.12.1 Switch enabling FR non-linearity corrections

Reference: FR_NonLin_F, LUT249

[AD-8] Section 6.2.12, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *FR_NonLin_F*
Switch enabling FR non-linearity corrections

units: [*dl*]

Step: User specified.

Scientific content:

Switch used to launch the non-linearity corrections in the full resolution mode

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.12.2 Switch enabling RR non-linearity corrections

Reference: RR_NonLin_F, LUT250

[AD-8] Section 6.2.12, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RR_NonLin_F*
Switch enabling RR non-linearity corrections

units: [*dl*]

Step: User specified.

Scientific content:

Switch used to launch the non-linearity corrections in the reduced resolution mode

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.12.3 Switch enabling AC straylight correction

Reference: Stray_corr_AC_s, LUT251

[AD-8] Section 6.2.12, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Stray_corr_AC_s*
Switch enabling AC straylight correction

units: [*dl*]

Step: User specified.

Scientific content:

Switch used to launch the non-linearity corrections in the reduced resolution mode

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.12.4 (Spare)

Reference:

[AD-8] Section 6.2.12, GADS field 4

6.2.13 GADS Classification

6.2.13.1 View zenith angles for GADS radiometric thresholds

Reference: VZA, LUT253

[AD-8] Section 6.2.13, GADS field 1.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA* View zenith angles (12 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 12 view zenith angles (θ_v) selected from a *Gauss* quadrature generated for 24 discrete directions with the RTC/Gauss tool (UdL)

Current baseline: 12 *Gaussian* angles

i	θ_v [*deg.*]
0	2.840906
1	17.638419
2	28.768427
3	36.189726
4	43.611442
5	51.033390

i	θ_v [*deg.*]
6	58.455477
7	65.877652
8	69.588762
9	73.299882
10	77.011011
11	80.722147

Resources:

Estimated CPU time: -
Output disk space: 12 × 4 bytes/ul = 48 bytes

Acceptance:

Corresponds to the latest definition

6.2.13.2 Sun zenith angles for GADS radiometric thresholds

Reference: SZA, LUT254

[AD-8] Section 6.2.13, GADS field 2.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angles (12 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 12 solar zenith angles (θ_s) selected from a *Gauss* quadrature generated for 24 discrete directions with the RTC/Gauss tool (UdL)

Current baseline: 12 *Gaussian* angles

i	θ_s [*deg.*]
0	2.840906
1	17.638419
2	28.768427
3	36.189726
4	43.611442
5	51.033390

i	θ_s [*deg.*]
6	58.455477
7	65.877652
8	69.588762
9	73.299882
10	77.011011
11	80.722147

Resources:

Estimated CPU time: -
Output disk space: 12 × 4 bytes/ul = 48 bytes

Acceptance:

Corresponds to the latest definition

6.2.13.3 Relative azimuth angles for GADS radiometric thresholds

Reference: RAA, LUT255

[AD-8] Section 6.2.13, GADS field 3.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angles (19 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 19 relative azimuth angles ($\Delta\phi$) regularly spaced

Current baseline: 19 angles in $[0;180]$*deg*. by step of 10*deg*.

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definition

6.2.13.4 (Spare)

Reference:

[AD-8] Section 6.2.13, GADS field 4.

6.2.13.5 (Spare)

Reference:

[AD-8] Section 6.2.13, GADS field 5.

6.2.13.6 (Spare)

Reference:

[AD-8] Section 6.2.13, GADS field 6.

6.2.13.7 (Spare)

Reference:

[AD-8] Section 6.2.13, GADS field 7.

6.2.13.8 Index of band for GADS radiometric thresholds

Reference: b_{test}, LUT256

[AD-8] Section 6.2.13, GADS field 8.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: b_{test} Index of band for GADS radiometric thresholds

units: [*dl*]

Step: User specified.

Scientific content:

MERIS spectral band selected for computing the radiometric thresholds (LUT017)

Current baseline: 2

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.13.9 (Spare)

Reference:

[AD-8] Section 6.2.13, GADS field 9.

6.2.14 GADS Resampling

6.2.14.1 Resampling switch

Reference: Resampling_switch, LUT257

[AD-8] Section 6.2.14, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Resampling_switch* Resampling switch

units: [*dl*]

Step: User specified.

Scientific content:

Swith used for the resampling

Current baseline: 1

Resources:

Estimated CPU time: -

Output disk space: 1×1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.14.2 Number of AC samples used in product FR imagette

Reference: NC^{IM}, LUT258

[AD-8] Section 6.2.14, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: NC^{IM} Number of AC samples used in product FR imagette

units: $[dl]$

Step: User specified.

Scientific content:

Number of AC samples used in the product imagette for the full resolution mode

Current baseline: 1153

Resources:

Estimated CPU time: -
Output disk space: 1×2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.14.3 Number of AC samples used in product FR scene

Reference: NC^{FR}, LUT259

[AD-8] Section 6.2.14, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: NC^{FR} Number of AC samples used in product FR scene

units: [*dl*]

Step: User specified.

Scientific content:

Number of AC samples used in the product scene for the full resolution mode

Current baseline: 2241

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.14.4 Number of AC samples used in product RR

Reference: NC^{RR}, LUT260

[AD-8] Section 6.2.14, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: NC^{RR} Number of AC samples used in product RR

units: $[dl]$

Step: User specified.

Scientific content:

Number of AC samples used in the product for the reduced resolution mode

Current baseline: 1121

Resources:

Estimated CPU time: -
Output disk space: 1×2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.14.5 FR across track pixel to tie point sub-sampling factor (number of samples)

Reference: DJ^{FR} , LUT261

[AD-8] Section 6.2.14, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: DJ^{FR} FR across track pixel to tie point sub-sampling factor (number of samples)

units: [dl]

Step: User specified.

Scientific content:

Number of samples (in full resolution mode) used to tie point sub-sampling factor

Current baseline: 64

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.14.6 RR across track pixel to tie point sub-sampling factor (number of samples)

Reference: DJ^{RR} , LUT262

[AD-8] Section 6.2.14, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: DJ^{RR} RR across track pixel to tie point sub-sampling factor (number of samples)

units: [*dl*]

Step: User specified.

Scientific content:

Number of samples (in reduced resolution mode) used to tie point sub-sampling factor

Current baseline: 16

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.14.7 FR frame to tie frame sub-sampling factor (number of samples)

Reference: DF^{FR}, LUT263

[AD-8] Section 6.2.14, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: DF^{FR} FR frame to tie frame sub-sampling factor (number of samples)

units: [*dl*]

Step: User specified.

Scientific content:

Number of samples (in full resolution mode) used to tie frame sub-sampling factor

Current baseline: 64

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.14.8 RR frame to tie frame sub-sampling factor (number of samples)

Reference: DF^{RR} , LUT264

[AD-8] Section 6.2.14, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: DF^{RR} RR frame to tie frame sub-sampling factor (number of samples)

units: [*dl*]

Step: User specified.

Scientific content:

Number of samples (in reduced resolution mode) used to tie frame sub-sampling factor

Current baseline: 16

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.14.9 Tie frame to summary quality ADS frame sub-sampling factor

Reference: DFSQ, LUT265

[AD-8] Section 6.2.14, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *DFSQ* Tie frame to summary quality ADS frame sub-sampling factor
units: [*dl*]

Step: User specified.

Scientific content:

Tie frame used for quality of frame sub-sampling factor

Current baseline: 8

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.2.14.10 Maximum across track angular distance allowing pixel selection in FR

Reference: $Max\_d\psi^{FR}$, LUT266

[AD-8] Section 6.2.14, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Max\_d\psi^{FR}$ Maximum across track angular distance allowing pixel selection in FR

units: $[10^{-6} deg.]$

Step: User specified.

Scientific content:

Maximum across track angular distance used for the pixel selection in the full resolution mode

Current baseline: 0.038311 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.14.11 Maximum across track angular distance allowing pixel selection in RR

Reference: $Max\_d\psi^{RR}$, LUT267

[AD-8] Section 6.2.14, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Max\_d\psi^{RR}$ Maximum across track angular distance allowing pixel selection in RR

units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Maximum across track angular distance used for the pixel selection in the full resolution mode

Current baseline: 0.153243 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15 GADS Scaling Factor

6.2.15.1 Scaling factor - altitude

Reference: Alt_scale, LUT268

[AD-8] Section 6.2.15, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Alt_scale* Scaling factor for altitude

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for altitude level

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.2 Scaling factor - roughness

Reference: Rough_scale, LUT269

[AD-8] Section 6.2.15, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Rough_scale* Scaling factor for roughness

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for roughness level

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.3 Scaling factor - zonal wind

Reference: Zwind_scale, LUT270

[AD-8] Section 6.2.15, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Zwind_scale* Scaling factor for zonal wind

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for zonal wind

Current baseline: 0.1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.4 Scaling factor - meridional wind

Reference: Mwind_scale, LUT271

[AD-8] Section 6.2.15, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Mwind_scale* Scaling factor for meridional wind
units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for meridional wind

Current baseline: 0.1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.5 Scaling factor - atmospheric pressure

Reference: Patm_scale, LUT272

[AD-8] Section 6.2.15, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Patm_scale* Scaling factor for atmospheric pressure
units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for atmospheric pressure

Current baseline: 0.1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.6 Scaling factor - ozone

Reference: O3_scale, LUT273

[AD-8] Section 6.2.15, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *O3_scale* Scaling factor for ozone content

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for ozone content

Current baseline: 0.01

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.7 Scaling factor - relative humidity

Reference: RH_scale, LUT274

[AD-8] Section 6.2.15, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RH_scale* Scaling factor for relative humidity

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor used for relative humidity

Current baseline: 0.1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.15.8 Scaling factor - radiances

Reference: Rad_scale[b], LUT275

[AD-8] Section 6.2.15, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Rad_scale* Scaling factor for radiances (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factors (15 MERIS spectral bands) used for radiances

Current baseline: {0.0094748391, 0.0106034772, 0.0115843304, 0.0107056797, 0.0093293404, 0.0081881238, 0.0068480745, 0.0069379713, 0.0063089724, 0.0086646341, 0.0088729495, 0.0036326132, 0.0035543414, 0.0061037163, 0.0054305592}

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16 GADS Straylight Evaluation Parameters

6.2.16.1 Number of spectral regions

Reference: SR, LUT276

[AD-8] Section 6.2.16, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SR* Number of spectral regions (5 values)

units: [*dl*]

Step: User specified.

Scientific content:

Number of spectral regions used for strayligh evaluation parameters

Current baseline: 5

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16.2 Band index of default radiance for pixels with all bands saturated

Reference: b_satpix, LUT277

[AD-8] Section 6.2.16, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_satpix* Band index of default radiance for pixels with all bands saturated

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band # to be used for setting default radiance for pixels having all the spectral band saturated.

Current baseline: 10

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16.3 Default radiance for pixels with all bands saturated

Reference: rad_satpix, LUT278

[AD-8] Section 6.2.16, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rad_satpix* Default radiance for pixels with all bands saturated

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

Default radiance to be used for pixels having all the spectral band saturated.

Current baseline: 844.80181885 $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16.4 (Spare)

Reference:

[AD-8] Section 6.2.16, GADS field 4

6.2.16.5 (Spare)

Reference:

[AD-8] Section 6.2.16, GADS field 5

6.2.16.6 Interpolation coefficients for spectral region flux estimation

Reference: P[b,SR], LUT281

[AD-8] Section 6.2.16, GADS field 6

ACRI provided

Dependencies:

None

Tool:

LUT276

Procedure:

Inputs:	*b*	MERIS spectral band# (15 values), *see* Section3.1 for the nominal wavelengths (LUT400)
	SR	Spectral region # (5 values), *see* Section 6.2.16.1, (LUT276)
Output:	*P[b,SR]*	Interpolation coefficients for spectral region flux estimation given in each of the 15 MERIS bands

units: [*dl*]

Step: User specified.

Scientific content:

Default radiance to be used for pixels having all the spectral band saturated.

Current baseline: 15 x 5 values (see table below)

λ [nm]	SR-1	SR-2	SR-3	SR-4	SR-5
412.500	0.20192300	0.00000000	0.00000000	0.00000000	0.00000000
442.500	0.29807699	0.00000000	0.00000000	0.00000000	0.00000000
490.000	0.25961500	0.00000000	0.00000000	0.00000000	0.00000000
510.000	0.14615400	0.12307700	0.00000000	0.00000000	0.00000000
560.000	0.00769231	0.41538501	0.00000000	0.00000000	0.00000000
620.000	0.00000000	0.38461500	0.01923080	0.00000000	0.00000000
665.000	0.00000000	0.07692310	0.15865400	0.00000000	0.00000000
681.250	0.00000000	0.00000000	0.16826899	0.00000000	0.00000000
708.750	0.00000000	0.00000000	0.27884600	0.00000000	0.00000000
753.750	0.00000000	0.00000000	0.19951899	0.00000000	0.00000000
761.875	0.00000000	0.00000000	0.09615380	0.00000000	0.00000000
778.750	0.00000000	0.00000000	0.07925720	0.32218501	0.00000000
865.000	0.00000000	0.00000000	0.00006968	0.40858400	0.00000000
885.000	0.00000000	0.00000000	0.00000000	0.13461500	0.00000000
900.000	0.00000000	0.00000000	0.00000000	0.13186800	0.46428600

Resources:

Estimated CPU time: -
Output disk space: $15 \times 5 \times 4$ bytes/fl = 300 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16.7 Flag register showing bands which can be used for radiance estimation of saturated samples

Reference: Bs, LUT282

[AD-8] Section 6.2.16, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Bs* Flag register showing bands which can be used for radiance estimation of saturated samples

units: [*dl*]

Step: User specified.

Scientific content:

Flag register indicating bands which can be used to estimate the radiance for saturated samples

Current baseline: 15871

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16.8 FR threshold on satured samples counts to flag for straylight risk

Reference: $Sat\_Stray\_Thr^{FR}$, LUT283

[AD-8] Section 6.2.16, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Sat_Stray_Thr^FR^*

FR threshold on satured samples counts to flag for straylight risk

units: [*dl*]

Step: User specified.

Scientific content:

Threshold on saturated samples counts used in the full resolution mode to flag the risk of straylight

Current baseline: 2775

Resources:

Estimated CPU time: -

Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.16.9 RR threshold on satured samples counts to flag for straylight risk

Reference: $Sat\_Stray\_Thr^{RR}$, LUT284

[AD-8] Section 6.2.16, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Sat\_Stray\_Thr^{RR}$

RR threshold on satured samples counts to flag for straylight risk

units: [*dl*]

Step: User specified.

Scientific content:

Threshold on saturated samples counts used in the reduced resolution mode to flag the risk of straylight

Current baseline: 693

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.2.17 (Deleted)

Reference:

[AD-8] Section 6.2.17

6.2.18 (Deleted)

Reference:

[AD-8] Section 6.2.18

6.2.19 (Deleted)

Reference:

[AD-8] Section 6.2.19

6.2.20 GADS Radiometric Thresholds LUT

6.2.20.1 Radiometric thresholds, $L_{TOA\_2}(\theta_s, \theta_v, \Delta\varphi)$

Reference: Class_thr_t[$\theta_s, \theta_v, \Delta\varphi$], LUT017

[AD-8] Section 6.2.20, ADS field 1.

Dependencies:

LUT253, LUT254, LUT255, LUT256

Tools:

OTC/RAYLEIGH
RTC/UPRAD (SO)

Procedure:

Inputs:

θ_v	View zenith angle [*deg.*], *see* Section 6.2.13.1, (LUT253)
θ_s	Sun zenith angle [*deg.*], *see* Section 6.2.13.2, (LUT254)
$\Delta\phi$	Relative azimuth angle [*deg.*], *see* Section 6.2.13.3, (LUT255)
$n(\lambda)$	MERIS band index [*dl*], *see* Section 6.2.13.8, (LUT256)

Output: $class\_thr\_t[\theta_s, \theta_v, \Delta\phi]$

Radiometric thresholds on TOA reflectance at λ *nm* as a function of the sun zenith angle, view zenith angle and relative azimuth angle between the illumination and viewing directions.

units: [*dl*]

Step-1: Generate TOA normalized radiance L_{TOA_2} $[\theta_s,\theta_v,\Delta\phi]$ with the RTC/UPRAD (SO) over a slightly reflective surface under a continental atmosphere. The selected aerosol model is the *Junge* model#27 (m=1.44,α=0).

RTC/UPRAD (SO) Inputs (LAND)

Variable	Value	Comments
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	2	442.5 *nm* (*see* Section 6.2.13.8)
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./INPUT/sc_land27_b05"	*Junge* model #27 (m=1.44,α=0)
$\tau^{a1}(550)$	1.2	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A

Variable	***Value***	***Comments***
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*;H_R=8 *km*)
I_s	79	
ρ_s	0.08	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 18	
θ_s	values stored in θ_s[]	*see* Section 6.2.13.2
θ_v	values stored in θ_v[]	*see* Section 6.2.13.1
$\Delta\phi$	values stored in $\Delta\phi$[]	*see* Section 6.2.13.3
pol	1	

$n(2), \theta_s, \theta_v, \Delta\phi$

↓

RTC/UPRAD(SO)

↓

$L_{TOA\_2}[\theta_s, \theta_v, \Delta\phi]$

Step-2: Build $class\_thr\_t[\theta_s, \theta_v, \Delta\phi]$ as follows,

$$class\_thr\_t[\theta_s, \theta_v, \Delta\phi] = \frac{\pi \,.\, L_{TOA\_2}[\theta_s, \theta_v, \Delta\phi]}{\cos\theta_s}$$

If $class\_thr\_t[\theta_s, \theta_v, \Delta\phi] > 1$ then $class\_thr\_t[\theta_s, \theta_v, \Delta\phi] = 1$

Scientific content:

In the pixels classification algorithm, the MERIS reflectances at 442.5 nm are respectively compared with these radiometric thresholds $class\_thr\_t[\theta_s, \theta_v, \Delta\phi]$. If the reflectance is lower than the corresponding threshold value then the pixel is not considered as a bright pixel. The thresholds are computed with inputs which generate the high boundary of a mean range of reflectance.

Resources:

Estimated CPU time: 26 *sec*
Output disk space: 12 × 12 × 19 × 4 bytes/fl = 10944 bytes

Acceptance:

Comparison with another RTC.

6.2.21 GADS Browse Configuration Parameters

Reference: CP, LUT285

[AD-8] Section 6.2.21

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

None

Scientific content:

Configuration parameters

Current baseline: 816 values [*dl*]

Resources:

Estimated CPU time: -
Output disk space: 816 x 1 bytes/uc = 816 bytes

Acceptance:

Corresponds to the latest definition.

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6.3 RADIOMETRIC CALIBRATION

Not covered in this document

6.4 DIGITAL ELEVATION & ROUGHNESS MODEL

Not covered in this document

6.5 LAND/SEA MASK

Not covered in this document

6.6 ECMWF

Not covered in this document

6.7 AEROSOL CLIMATOLOGY

Not covered in this document

6.8 ENVISAT-1 ORBIT STATE VECTORS

Not covered in this document

6.9 ENVISAT-1 PLATFORM ATTITUDE

Not covered in this document

6.10 LEVEL-2 CONTROL PARAMETERS

6.10.1 C.P.

Not covered in this document (*see* [AD-8] for a detailed description)

6.10.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.10.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.10.4 GADS General

6.10.4.1 Number of iterations for Chl1 calculation

Reference: Niter, LUT018

[AD-8] Section 6.10.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Niter* Number of iterations for Chl1 calculation

units: [*dl*]

Step: User specified.

Scientific content:

Number of iterations used for chlorophyll calculation (*see Morel*'s algorithm)

Current baseline: 3

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

If convergence is not achieved within the specified number of iterations (3), some other problems could be present.

6.10.4.2 Flag indicating the presence of stratospheric aerosols

Reference: Strat_Corr, LUT019

[AD-8] Section 6.10.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Strat_Corr* Flag indicating the presence of stratospheric aerosols

units: [*dl*]

Step: User specified.

Scientific content:

Flag used to indicate the presence of stratospheric aerosols

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.4.3 Default radiances for saturated pixels

Reference: rad_satpix2[b], LUT020

[AD-8] Section 6.10.4, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *rad_satpix2[b]*
Default radiances for saturated pixels in the 15 MERIS bands (15 values)

units: [$W.m^{-2}.\mu m^{-1}.sr^{-1}$]

Step: User specified.

Scientific content:

Default radiances in the 15 MERIS spectral bands used for the saturated pixels

Current baseline: {619.98608398, 693.83856201, 758.02069092, 700.52618408, 610.46539307, 535.78985596, 448.10375977, 453.98617554, 412.82760620, 566.97033691, 580.60144043, 237.70004272, 232.57832336, 399.39666748, 355.34863281} $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.4 Maximum optical thickness for land aerosols

Reference: AOT_max, LUT021

[AD-8] Section 6.10.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AOT_max* Maximum optical thickness for land aerosols

units: [*dl*]

Step: User specified.

Scientific content:

Maximum aerosol optical thickness used in the land aerosol algorithm

Current baseline: 2.0

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.5 Scaling factor - reflectances

Reference: Refl_scale[b], LUT022

[AD-8] Section 6.10.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Refl_scale[b]* Scaling factor for reflectance in each of the 15 MERIS bands(15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factors to be applied to reflectances in the 15 MERIS spectral bands

Current baseline: {$1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$, $1.8311106\ 10^{-5}$}

Resources:

Estimated CPU time: -
Output disk space: 15×4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.6 Scaling factor - algal pigment index

Reference: Chl_scale, LUT023

[AD-8] Section 6.10.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl_scale* Scaling factor for algal pigment index

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to algal pigment index

Current baseline: 0.0157480314

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.7 Scaling factor - yellow substance

Reference: ODOC_scale, LUT024

[AD-8] Section 6.10.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ODOC_scale* Scaling factor for yellow substance

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to yellow substance

Current baseline: 0.0137898242

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.8 Scaling factor - suspended sediments

Reference: SPM_scale, LUT025

[AD-8] Section 6.10.4, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SPM_scale* Scaling factor for suspended sediments

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to suspended sediments

Current baseline: 0.0157480314

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.9 Scaling factor - aerosol Angstroem exponent

Reference: alpha_scale, LUT412

[AD-8] Section 6.10.4, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *alpha_scale* Scaling factor for the Angstroem exponent of the aerosols (spectral dependence)

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the aerosol spectral dependence (*Angstroem exponent* - α) computed between 778.75 and 865 nm as follows:

$$\alpha = -\frac{Log[\tau_{865}^{a} / \tau_{778.75}^{a}]}{Log[865 / 778.75]}$$

Current baseline: 0.0110236220

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.10 Scaling factor - aerosol optical thickness

Reference: AOT_scale, LUT026

[AD-8] Section 6.10.4, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AOT_scale* Scaling factor for aerosol optical thickness

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the aerosol optical thickness

Current baseline: 0.0062992126

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.11 Scaling factor - cloud optical thickness

Reference: COT_scale, LUT027

[AD-8] Section 6.10.4, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *COT_scale* Scaling factor for cloud optical thickness

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the cloud optical thickness

Current baseline: 1.0

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.12 Scaling factor - surface pressure

Reference: Press_scale, LUT028

[AD-8] Section 6.10.4, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Press_scale* Scaling factor for surface pressure

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the surface pressure

Current baseline: 2.5590550900

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.13 Scaling factor - water vapour

Reference: WV_scale, LUT029

[AD-8] Section 6.10.4, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *WV_scale* Scaling factor for water vapour content

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the water-vapour content

Current baseline: 0.0299999993

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.14 Scaling factor - photosynthetically active radiation

Reference: PAR_scale, LUT030

[AD-8] Section 6.10.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *PAR_scale* Scaling factor for photosynthetically active radiation

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the photosynthetically active radiation (PAR)

Current baseline: 6.6399998665

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.15 Scaling factor - TOA vegetation index

Reference: TOAVI_scale, LUT031

[AD-8] Section 6.10.4, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *TOAVI_scale* Scaling factor for TOA vegetation index

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the vegetation index computed at TOA

Current baseline: 0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.16 Scaling factor - BOA vegetation index

Reference: BOAVI_scale, LUT032

[AD-8] Section 6.10.4, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_scale* Scaling factor for BOA vegetation index
units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the vegetation index computed at BOA

Current baseline: 0.0216535442

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.17 Scaling factor - cloud albedo

Reference: CA_scale, LUT033

[AD-8] Section 6.10.4, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *CA_scale* Scaling factor for cloud albedo
units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the cloud albedo

Current baseline: 0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.18 Scaling factor - cloud top pressure

Reference: CTP_scale, LUT034

[AD-8] Section 6.10.4, GADS field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *CTP_scale* Scaling factor for cloud top pressure

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the cloud albedo

Current baseline: 4.0275592804

Resources:

Estimated CPU time: -

Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.19 Offset - reflectances

Reference: Refl_offset[b], LUT035

[AD-8] Section 6.10.4, GADS field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Refl_offset[b]* Offset factor for reflectance in each of the 15 MERIS bands(15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Offset factors to be applied to the reflectances in the 15 MERIS spectral bands

Current baseline: {-0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317, -0.200018317}

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.20 Offset - algal pigment index

Reference: Chl_offset, LUT036

[AD-8] Section 6.10.4, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl_offset* Offset factor for algal pigment index

units: $[Log_{10}(mg.m^{-3})]$

Step: User specified.

Scientific content:

Offset factor to be applied to algal pigment index

Current baseline: -2.0157480240 $Log_{10}(mg.m^{-3})$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.21 Offset - yellow substance

Reference: ODOC_offset, LUT037

[AD-8] Section 6.10.4, GADS field 21

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ODOC_offset* Offset factor for yellow substance

units: $[Log_{10}(m^{-1})]$

Step: User specified.

Scientific content:

Offset factor to be applied to yellow substance

Current baseline: -2.5513918400 $Log_{10}(m^{-1})$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.22 Offset - suspended sediments

Reference: SPM_offset, LUT038

[AD-8] Section 6.10.4, GADS field 22

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SPM_offset* Offset factor for suspended sediments

units: $[Log_{10}(g.m^{-3})]$

Step: User specified.

Scientific content:

Offset factor to be applied to suspended sediments

Current baseline: -2.0157480240 $Log_{10}(g.m^{-3})$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.23 Offset - aerosol Angstroem exponent

Reference: alpha_offset, LUT413

[AD-8] Section 6.10.4, GADS field 23

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *alpha_offset* Offset factor for the Angstroem exponent of the aerosols (spectral dependence)

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the aerosol spectral dependence (*Angstroem exponent* - α) computed between 778.75 and 865 *nm*.

Current baseline: -0.3110236230

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.24 Offset - aerosol optical thickness

Reference: AOT_offset, LUT039

[AD-8] Section 6.10.4, GADS field 24

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AOT_offset* Offset factor for aerosol optical thickness
units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the aerosol optical thickness

Current baseline: -0.0062992130

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.25 Offset - cloud optical thickness

Reference: COT_offset, LUT040

[AD-8] Section 6.10.4, GADS field 25

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *COT_offset* Offset factor for cloud optical thickness

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the cloud optical thickness

Current baseline: -1.0

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.26 Offset - surface pressure

Reference: Press_offset, LUT041

[AD-8] Section 6.10.4, GADS field 26

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Press_offset* Offset factor for surface pressure

units: [*hPa*]

Step: User specified.

Scientific content:

Offset factor to be applied to the surface pressure

Current baseline: 447.4409484900 *hPa*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.27 Offset - water vapour

Reference: WV_offset, LUT042

[AD-8] Section 6.10.4, GADS field 27

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *WV_offset* Offset factor for water vapour content

units: [$g.cm^{-2}$]

Step: User specified.

Scientific content:

Offset factor to be applied to the water-vapour content

Current baseline: -0.0299999993 $g.cm^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.28 Offset - photosynthetically active radiation

Reference: PAR_offset, LUT043

[AD-8] Section 6.10.4, GADS field 28

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *PAR_offset* Offset factor for photosynthetically active radiation

units: [$\mu Einstein.m^{-2}$]

Step: User specified.

Scientific content:

Offset factor to be applied to the photosynthetically active radiation (PAR)

Current baseline: 513.0302124 $\mu Einstein.m^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.29 Offset - TOA vegetation index

Reference: TOAVI_offset, LUT044

[AD-8] Section 6.10.4, GADS field 29

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *TOAVI_offset* Offset factor for TOA vegetation index

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the vegetation index computed at TOA

Current baseline: -0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.30 Offset - BOA vegetation index

Reference: BOAVI_offset, LUT045

[AD-8] Section 6.10.4, GADS field 30

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_offset* Offset factor for BOA vegetation index

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the vegetation index computed at BOA

Current baseline: -0.0216535442

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.31 Offset - cloud albedo

Reference: CA_offset, LUT046

[AD-8] Section 6.10.4, GADS field 31

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *CA_offset* Offset factor for cloud albedo

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the cloud albedo

Current baseline: -0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.32 Offset - cloud top pressure

Reference: CTP_offset, LUT047

[AD-8] Section 6.10.4, GADS field 32

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *CTP_offset* Offset factor for cloud top pressure

units: [*hPa*]

Step: User specified.

Scientific content:

Offset factor to be applied to the cloud albedo

Current baseline: -4.0275592804 *hPa*

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.33 Scaling factor - rectified near-infrared reflectance

Reference: NIR_refl_scale, LUT048

[AD-8] Section 6.10.4, GADS field 33

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *NIR_refl_scale*
Scaling factor for rectified near-infrared reflectance

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the rectified near-infrared reflectance

Current baseline: 0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.34 Offset - rectified near-infrared reflectance

Reference: NIR_refl_offset, LUT049

[AD-8] Section 6.10.4, GADS field 34

ACRI provided

Dependencies:

None

Tool:

Input: none

Output: *NIR_refl_offset*
Offset factor for rectified near-infrared reflectance

units: [*dl*]

Step: User specified.

Procedure:

None

Scientific content:

Offset factor to be applied to the rectified near-infrared reflectance

Current baseline: -0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.35 Scaling factor - rectified red reflectance

Reference: Red_refl_scale, LUT050

[AD-8] Section 6.10.4, GADS field 35

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Red_refl_scale*

Scaling factor for rectified red reflectance

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor to be applied to the rectified red reflectance

Current baseline: 0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.4.36 Offset - rectified red reflectance

Reference: Red_refl_offset, LUT051

[AD-8] Section 6.10.4, GADS field 36

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Red_refl_offset*
Offset factor for rectified red reflectance

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor to be applied to the rectified red reflectance

Current baseline: -0.0039370079

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5 GADS Smile Effect Correction

6.10.5.1 Square of Sun-Earth distance at reference date

Reference: $Dsun0^2$, LUT420

[AD-8] Section 6.10.5.1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Dsun0^2$ Square of *Sun-Earth* distance at reference date

units: $[m^2]$

Step: User specified.

Scientific content:

Square of *Sun-Earth* distance at a reference date used for the corrective factor ($1/Dsun0^2$) to be applied to the extraterrestrial solar irradiance.

Current baseline: $2.2402379\ 10^{22}\ m^2$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.2 Array of per band switches enabling smile effect correction for land pixels reflectance

Reference: (No variable used), LUT421

[AD-8] Section 6.10.5.2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Array of per band switches enabling smile effect correction for land pixels reflectance (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Array of per band switches allowing to correct for the smile effect the land pixels reflectance

Current baseline: {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0}

Resources:

Estimated CPU time: -
Output disk space: 15 × 1 byte/uc = 15 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.3 Array of per band switches enabling smile effect correction for water pixels reflectance

Reference: (No variable used), LUT422

[AD-8] Section 6.10.5.3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Array of per band switches enabling smile effect correction for water pixels reflectance (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Array of per band switches allowing to correct for the smile effect the water pixels reflectance

Current baseline: {1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0}

Resources:

Estimated CPU time: -
Output disk space: 15 × 1 byte/uc = 15 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.4 Array of pairs of band indices for estimating reflectance spectral derivative (land pixels)

Reference: (No variable used), LUT423

[AD-8] Section 6.10.5.4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Array of pairs of band indices for estimating reflectance spectral derivative (land pixels) (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Array of per band indices to estimate the reflectance spectral derivative over land pixels

Current baseline: {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1}

Resources:

Estimated CPU time: -
Output disk space: 15 × 2 × 1 byte/uc = 30 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.5 Array of pairs of band indices for estimating reflectance spectral derivative (water pixels)

Reference: (No variable used), LUT424

[AD-8] Section 6.10.5.5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Array of pairs of band indices for estimating reflectance spectral derivative (water pixels) (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Array of per band indices to estimate the reflectance spectral derivative over water pixels

Current baseline: {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1}

Resources:

Estimated CPU time: -
Output disk space: 15 × 2 × 1 byte/uc = 30 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.6 Theoretical central wavelengths of MERIS spectral bands

Reference: Wvl[b], LUT425

[AD-8] Section 6.10.5.6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *Wvl[b]* Theoretical central wavelengths of MERIS spectral bands (15 values)

units: [*nm*]

Step: User specified.

Scientific content:

Nominal wavelengths of the 15 MERIS spectral bands

Current baseline: {412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75, 753.75, 761.875, 778.75, 865.0, 885.0, 900.0} *nm*

Resources:

Estimated CPU time: -
Output disk space: 15×4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.7 Reference solar fluxes at theoretical central wavelengths and bandwidths

Reference: $F_0[b]$, LUT426

[AD-8] Section 6.10.5.7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: $F_0[b]$ Reference solar fluxes at theoretical central wavelengths and bandwidths (15 values)

units: $[W.m^{-2}.\mu m^{-1}]$

Step: User specified.

Scientific content:

Reference extraterrestrial solar fluxes in the 15 MERIS spectral filters

Current baseline: {1713.6920166, 1877.5660400, 1929.2629395, 1926.8909912, 1800.4580078, 1649.7049561, 1530.9270020, 1470.2290039, 1405.4739990, 1266.1999512, 1253.0040283, 1175.7370605, 958.76300049, 929.78601074, 895.46002197} $W.m^{-2}.\mu m^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.8 MERIS RR pixels characterized wavelengths

Reference: Wvl_RR[b,p], LUT427

[AD-8] Section 6.10.5.8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: *b* MERIS spectral band# (15 values), *see* Section3.1 for the nominal wavelengths (LUT400) *p* MERIS RR pixel# (925 values)

Output: *Wvl_RR[b,p]* MERIS RR pixels characterized wavelengths (15 x 925 values)

units: [*nm*]

Step: User specified.

Scientific content:

15 wavelengths given for each of the 925 MERIS-RR pixels

Current baseline: 15 x 925 values

Resources:

Estimated CPU time: -
Output disk space: 15 × 925 × 4 bytes/fl = 55500 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.9 Reference solar fluxes for MERIS RR pixels

Reference: F_0_RR[b,p], LUT428

[AD-8] Section 6.10.5.9

ACRI provided

Dependencies:

None

Tool:

Inputs: *b* MERIS spectral band# (15 values), *see* Section3.1 for the nominal wavelengths (LUT400)

p MERIS RR pixel# (925 values)

Output: F_0*_RR[b,p]* Reference solar fluxes for MERIS RR pixels (15 x 925 values)

units: [*nm*]

Step: User specified.

Procedure:

None

Scientific content:

15 reference values of extraterrestrial solar flux given for each of the 925 MERIS-RR pixels

Current baseline: 15 x 925 values [$W.m^{-2}.\mu m^{-1}$]

Resources:

Estimated CPU time: -
Output disk space: 15 × 925 × 4 bytes/fl = 55500 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.10 MERIS FR pixels characterized wavelengths

Reference: Wvl_FR[b,p], LUT429

[AD-8] Section 6.10.5.10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: *b* MERIS spectral band# (15 values), *see* Section3.1,(LUT400)
p MERIS FR pixel# (3700 values)

Output: *Wvl_FR[b,p]* MERIS FR pixels characterized wavelengths (15 x 3700 values)
units: [*nm*]

Step: User specified.

Scientific content:

15 wavelengths given for each of the 3700 MERIS-FR pixels

Current baseline: 15 x 3700 values [*nm*]

Resources:

Estimated CPU time: -
Output disk space: 15 × 3700 × 4 bytes/fl = 222000 bytes

Acceptance:

Corresponds to the latest definition.

6.10.5.11 Reference solar fluxes for MERIS FR pixels

Reference: F_0_FR[b,p], LUT430

[AD-8] Section 6.10.5.11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: *b* MERIS spectral band# (15 values), *see* Section3.1,(LUT400)
p MERIS FR pixel# (3700 values)

Output: $F_0\_FR[b,p]$ Reference solar fluxes for MERIS FR pixels (15 x 3700 values)
units: [*nm*]

Step: User specified.

Scientific content:

15 reference values of extraterrestrial solar flux given for each of the 3700 MERIS-FR pixels

Current baseline: 15 x 3700 values [$W.m^{-2}.\mu m^{-1}$]

Resources:

Estimated CPU time: -
Output disk space: 15 × 3700 × 4 bytes/fl = 222000 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6 GADS Atmospheric Corrections for Case-I Waters

6.10.6.1 Reflectance thresholds to set the negative reflectance flag

Reference: DRO_thresh[b], LUT054

[AD-8] Section 6.10.6, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *b* MERIS spectral band# (15 values), *see* Section 3.1 for the nominal wavelengths (LUT400)

Output: *DRO_thresh[b]* Reflectance thresholds to set the negative reflectance flag (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

Thresholds on reflectance for the 15 MERIS spectral bands to set negative reflectance flag

Current baseline: {-0.005799998, -0.004600000, -0.002900000, -0.002400000, -0.001700000, -0.001200000, -8.300004 10^{-4}, -7.100002 10^{-4}, -6.500001 10^{-4}, 0., 0., 0., 0., 0., 0.}

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.2 Threshold for absorbing aerosol test at 510 nm

Reference: DRO510_thresh1, LUT055

[AD-8] Section 6.10.6, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *DRO510_thresh1*
Threshold for absorbing aerosol test at 510 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

DRO510_thresh1 is a threshold defined in the atmospheric correction algorithm above case-1 waters useful to break the loop of convergence. A change could be expected if MERIS sensitivity is better than the expected value and the algorithm can handle this enhancement. This parameter is also related to the selected absorbing aerosol model.

Current baseline: 0.003

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

According to the instrument specification.

6.10.6.3 Threshold for blue aerosol test at 510 nm

Reference: DRO510_thresh2, LUT056

[AD-8] Section 6.10.6, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *DRO510_thresh2*
Threshold for blue aerosol test at 510 nm

units: [dl]

Step: User specified.

Scientific content:

DRO510_thresh2 is a threshold defined in the atmospheric correction algorithm above case-1 waters useful to break the loop of convergence. A change could be expected if MERIS sensitivity is better than the expected value and the algorithm can handle this enhancement. This parameter is also related to the selected blue aerosol model.

Current baseline: 1000

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

According to the instrument specification.

6.10.6.4 List of indices of aerosol assemblages

Reference: list_of_iaer, LUT057

[AD-8] Section 6.10.6, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *list_of_iaer* List of indices of aerosol assemblages

units: [*dl*]

Step: User specified.

Scientific content:

The list of indices of aerosol assemblages is tabulated as an array of 10 by 20 values. Indices of aerosol assemblages, between 1 and 34, refer to these assemblages described in the '*Ocean aerosols*' file (*see* [AD-8] Section 6.13 and [AD-6]). Each 5-element sub-array correspond to one pass of the atmospheric correction algorithm. The total number of passes is specified in Section 6.10.6.6, which does not mean that the remaining sub-arrays of the list are void. Within each sub-array, the algorithm employs a fixed number of models, specified in Section 6.10.6.21.

Current baseline: 10 x 20 values (reference numbers defined according to [AD-8])

Resources:

Estimated CPU time: -
Output disk space: 10 × 20 × 1 byte/uc = 200 bytes

Acceptance:

According to the current accepted definition for the list of aerosol models.

6.10.6.5 Total number of ocean-aerosol assemblages

Reference: N_aer, LUT058

[AD-8] Section 6.10.6, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *N_aer* Total number of ocean-aerosol assemblages

units: [*dl*]

Step: User specified.

Scientific content:

N_aer specifies the total number of aerosol assemblages used in the atmospheric corrections algorithm over case-1 waters. This parameter depends on the selected aerosol models. For more details, refer to [AD-6].

Current baseline: 34

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.6.6 Number of passes within the algorithm

Reference: N_pass, LUT059

[AD-8] Section 6.10.6, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *N_pass* Number of passes within the algorithm

units: [*dl*]

Step: User specified.

Scientific content:

N_pass specifies the maximum number of aerosol assemblages, which are passed through the aerosol database used in the atmospheric corrections algorithm.

Current baseline: 4

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.6.7 Number of polynomial coefficients relating (ρ_{path}/ρ_R) to the aerosol optical thickness (τ^a)

Reference: N_coef, LUT060

[AD-8] Section 6.10.6, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *N_coef* Number of polynomial coefficients relating (ρ_{path}/ρ_R) to the aerosol optical thickness (τ^a)

units: [*dl*]

Step: User specified.

Scientific content:

N_co defines the number of polynomial coefficients fit used for determining the aerosol optical thickness from the path to *Rayleigh* reflectances ratio (ρ^*/ρ_R). This relation is defined as follows ([AD-9], slide 7/41):

$$\frac{\rho^*(\lambda, w_s, \tau^a, \vartheta_s, \vartheta_v, \Delta\phi)}{\rho_R(\lambda, w_s, \tau^a, \vartheta_s, \vartheta_v, \Delta\phi)} = \sum_{i=0}^{2} k_i(\lambda, w_s, \vartheta_s, \vartheta_v, \Delta\phi) . (\tau^a)^i$$

Current baseline: 3

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

An error analysis should be performed within the process to extract the k_i coefficients. The acceptable error has to be specified by the user.

6.10.6.8 Indices of models that shall trigger the AERO_BLUE flag

Reference: iaer_blue, LUT0465

[AD-8] Section 6.10.6, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *iaer_blue* Indices of models that trigger the AERO_BLUE flag (50 values)

units: [*dl*]

Step: User specified.

Scientific content:

iaer_blue is an index used to trigger the blue aerosol models

Current baseline: {32, 33, 34, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}

Resources:

Estimated CPU time: -
Output disk space: 50 × 1 byte/uc = 50 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.9 (Spare)

Reference:

[AD-8] Section 6.10.6, GADS field 9

6.10.6.10 (Spare)

Reference:

[AD-8] Section 6.10.6, GADS field 10

6.10.6.11 Maximum allowed value for aerosol optical thickness at 865 nm

Reference: AOT_max, LUT064

[AD-8] Section 6.10.6, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AOT_max* Maximum allowed value for aerosol optical thickness at 865 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Maximum allowed value for aerosol optical thickness at 865 *nm*

Current baseline: 0.8

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.12 Threshold on depth for flagging shallow water

Reference: Depth_limit, LUT065

[AD-8] Section 6.10.6, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Depth_limit* Threshold on depth for flagging shallow water

units: [*m*]

Step: User specified.

Scientific content:

Threshold on the depth used to flag shallow water

Current baseline: 40

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.13 (Spare)

Reference:

[AD-8] Section 6.10.6, GADS field 13

6.10.6.14 (Spare)

Reference:

[AD-8] Section 6.10.6, GADS field 14

6.10.6.15 Threshold for flagging aerosol optical thickness

Reference: AOT865_thresh, LUT068

[AD-8] Section 6.10.6, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AOT865_thresh*
Threshold for flagging aerosol optical thickness

units: [*dl*]

Step: User specified.

Scientific content:

If the derived aerosol optical thickness is larger than the threshold value, *AOT865_thresh*, an annotation flag will be raised. This threshold value cannot be freely changed due to the fact that the tables for the atmospheric corrections would need to be then modified accordingly.

Current baseline: 0.6

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.16 Switch to test for absorbing aerosols

Reference: Test_abs_aer, LUT069

[AD-8] Section 6.10.6, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Test_abs_aer*
Switch to test for absorbing aerosols

units: [*dl*]

Step: User specified.

Scientific content:

Switch used for testing the absorbing aerosols: ([0]/[1]: off / on)

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.6.17 Ceiling value of solar zenith angle for modifying annotation flag

Reference: SZA_limit, LUT070

[AD-8] Section 6.10.6, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA_limit* Ceiling value of solar zenith angle for modifying annotation flag

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

This *SZA_limit* threshold defines an angular limit beyond which an annotation flag will be raised, indicating that the solar zenith angle θ_s is out of range. This value can be changed in the case where the data far from the zenith appear not to be reliable.

Current baseline: 70 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.18 (Spare)

Reference:

[AD-8] Section 6.10.6, GADS field 18

6.10.6.19 Threshold for pressure correction

Reference: Press_tolerance, LUT072

[AD-8] Section 6.10.6, GADS field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Press_tolerance*
Threshold for pressure correction

units: [*hPa*]

Step: User specified.

Scientific content:

This threshold is used to activate a pressure correction.

Current baseline: 5 *hPa*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.6.20 Number of wavelengths used in the LUTs

Reference: N_wvl, LUT073

[AD-8] Section 6.10.6, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *N_wvl* Number of wavelengths used in the LUTs
units: [*dl*]

Step: User specified.

Scientific content:

N_wvl corresponds to the number of selected wavelengths according to their relevance to the physical problem study.

Current baseline: 15

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Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.6.21 Number of aerosol models used at each pass

Reference: N_basic_aer, LUT286

[AD-8] Section 6.10.6, GADS field 21

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *N_basic_aer* Number of aerosol models used at each pass
units: [*dl*]

Step: User specified.

Scientific content:

N_basic_aer corresponds to the number of standard aerosol models (SAMs) in list (Section 6.10.6.4) selected according to the relevance of their inherent optical properties.

Current baseline: 16

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.6.22 Switch to use an aerosol climatology

Reference: Climato_aux, LUT287

[AD-8] Section 6.10.6, GADS field 22

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Climato_aux* Switch to use an aerosol climatology

units: [*dl*]

Step: User specified.

Scientific content:

Switch to activate the use of an aerosol climatology: ([0]/[1]: off / on).

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

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6.10.7 GADS Classification Parameters

6.10.7.1 Threshold on MERIS differential snow index (MDSI)

Reference: MDSI_thresh, LUT288

[AD-8] Section 6.10.7, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MDSI_thresh* Threshold on MERIS differential snow index

units: [*dl*]

Step: User specified.

Scientific content:

Threshold on MERIS differential snow index.

Current baseline: 0.014

Resources:

Estimated CPU time: -

Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.2 Numerator band index for spectral ratio 1

Reference: b_slope1_n, LUT289

[AD-8] Section 6.10.7, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_slope1_n* Numerator band index for spectral ratio 1

units: [*dl*]

Step: User specified.

Scientific content:

Numerator band index used in the spectral ratio 1

Current baseline: 2

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.7.3 Denominator band index for spectral ratio 1

Reference: b_slope1_d, LUT290

[AD-8] Section 6.10.7, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_slope1_d* Denominator band index for spectral ratio 1

units: [*dl*]

Step: User specified.

Scientific content:

Denominator band index used in the spectral ratio 1

Current baseline: 10

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.7.4 Lower threshold for spectral ratio 1

Reference: Slope_1_low, LUT291

[AD-8] Section 6.10.7, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Slope_1_low* Lower threshold for spectral ratio 1

units: [*dl*]

Step: User specified.

Scientific content:

Lower threshold for the spectral ratio 1

Current baseline: 0.

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.5 Upper threshold for spectral ratio 1

Reference: Slope_1_high, LUT292

[AD-8] Section 6.10.7, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Slope_1_high* Upper threshold for spectral ratio 1

units: [*dl*]

Step: User specified.

Scientific content:

Upper threshold for the spectral ratio 1

Current baseline: 10^6

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.6 Numerator band index for spectral ratio 2

Reference: b_slope2_n, LUT293

[AD-8] Section 6.10.7, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_slope2_n* Numerator band index for spectral ratio 2
units: [*dl*]

Step: User specified.

Scientific content:

Numerator band index used in the spectral ratio 2

Current baseline: 9

Resources:

Estimated CPU time: -

Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.7.7 Denominator band index for spectral ratio 2

Reference: b_slope2_d, LUT294

[AD-8] Section 6.10.7, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_slope2_d* Denominator band index for spectral ratio 2

units: [*dl*]

Step: User specified.

Scientific content:

Denominator band index used in the spectral ratio 2

Current baseline: 14

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.7.8 Lower threshold for spectral ratio 2

Reference: Slope_2_low, LUT295

[AD-8] Section 6.10.7, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Slope_2_low* Lower threshold for spectral ratio 2

units: [*dl*]

Step: User specified.

Scientific content:

Lower threshold for the spectral ratio 2

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.9 Upper threshold for spectral ratio 2

Reference: Slope_2_high, LUT296

[AD-8] Section 6.10.7, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Slope_2_high* Upper threshold for spectral ratio 2

units: [*dl*]

Step: User specified.

Scientific content:

Upper threshold for the spectral ratio 2

Current baseline: 10^6

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.10 Index of band for test on TOA reflectance (with band numbering starting at 1)

Reference: b_bright2, LUT297

[AD-8] Section 6.10.7, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_bright2* Index of band for test on TOA reflectance (with band numbering starting at 1)

units: [*dl*]

Step: User specified.

Scientific content:

Band index (*b_bright2*) used to test the TOA reflectance

Current baseline: 2

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.11 Thresholds on TOA reflectance at band b_bright2

Reference: rho_thresh1, rho_thresh2, LUT298

[AD-8] Section 6.10.7, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rho_thresh1, rho_thresh2*
Thresholds (min, max) on TOA reflectance at band *b_bright2* (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

Range of thresholds on TOA reflectance at band *b_bright2*

Current baseline: {0.185, 0.03}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.12 Index of band for GADS threshold on Rayleigh corrected reflectance

Reference: b_bright, LUT299

[AD-8] Section 6.10.7, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *b_bright* Index of band for GADS threshold on *Rayleigh* corrected reflectance

units: [*dl*]

Step: User specified.

Scientific content:

Band index (*b_bright*) used for testing threshold on the *Rayleigh* corrected reflectance

Current baseline: 2

Resources:

Estimated CPU time: -
Output disk space: 1×1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.10.7.13 Zenith angles for GADS threshold on Rayleigh corrected reflectance

Reference: ZA, LUT300

[AD-8] Section 6.10.7, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ZA* Zenith angles (12 values)

units: $[10^{-6}\ deg]$

Step: User specified.

Scientific content:

Set of 12 zenith angles (θ) selected from the *Gauss* quadrature generated for 24 discrete directions with the RTC/Gauss tool (UdL)

Current baseline: 12 *Gaussian* angles (*see* Section 6.2.13.1)

Resources:

Estimated CPU time: -
Output disk space: 12×4 bytes/ul = 48 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.14 Stored indices for (θ_s x θ_v) combinations for GADS threshold on Rayleigh corrected reflectance

Reference: SVZA_index, LUT301

[AD-8] Section 6.10.7, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SVZA_index* Stored indices for (θ_sxθ_v) combinations (78 values)

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: 78 angular combinations (SZA x VZA)

Note: Due to the fact that the matrix is symmetrical in the ($\theta_s \times \theta_v$) directions, we can then store only a half triangular matrix, *i.e.*, N(N+1)/2 instead of N^2 elements (78 instead of 144).

Table of indices associated with each of the 78 (θ_s x θ_v) combinations

i \ *j*	θ[0]	θ[1]	θ[2]	θ[3]	θ[4]	θ[5]	θ[6]	θ[7]	θ[8]	θ[9]	θ[10]	θ[11]
θ[0]	1											
θ[1]	2	13										
θ[2]	3	14	24									
θ[3]	4	15	25	34								
θ[4]	5	16	26	35	43							

θ[5]	6	17	27	36	44	51						
θ[6]	7	18	28	37	45	52	58					
θ[7]	8	19	29	38	46	53	59	64				
θ[8]	9	20	30	39	47	54	60	65	69			
θ[9]	10	21	31	40	48	55	61	66	70	73		
θ[10]	11	22	32	41	49	56	62	67	71	74	76	
θ[11]	12	23	33	42	50	57	63	68	72	75	77	78

θ[i] see Section 6.10.7.13

Resources:

Estimated CPU time: -
Output disk space: 78 × 2 × 1 byte/uc = 156 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.15 Relative azimuth angles for GADS threshold on Rayleigh corrected reflectance

Reference: RAA, LUT302

[AD-8] Section 6.10.7, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angles (19 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 19 relative azimuth angles ($\Delta\phi$) regularly spaced

Current baseline: 19 values in [0;180]deg. by step of 10deg.

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.16 Apparent pressure thresholds over land (off/close to the coastline)

Reference: Ps_thresh_L1, Ps_thresh_L2, LUT466

[AD-8] Section 6.10.7, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ps_thresh_L1, Ps_thresh_L2*
Apparent surface pressure thresholds over land, off the coastline and close to the coastline respectively.

units: [hPa]

Step: User specified.

Scientific content:

Threshold on the apparent surface pressure over land

Current baseline: 200 hPa

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.17 Apparent pressure threshold over water

Reference: Ps_thresh_W, LUT467

[AD-8] Section 6.10.7, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ps_thresh_W* Apparent surface pressure threshold over water
units: [*hPa*]

Step: User specified.

Scientific content:

Threshold on the apparent surface pressure over water

Current baseline: 500 *hPa*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.18 Minimum reflectance value at 753.75 nm to consider apparent pressure over land

Reference: rho754_min, LUT468

[AD-8] Section 6.10.7, GADS field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rho754_min* Minimum reflectance value at 753.75 nm to consider apparent pressure over land

units: [dl]

Step: User specified.

Scientific content:

Minimum reflectance at 753.75 nm to consider apparent surface pressure over land

Current baseline: 500

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.19 Minimum spectral slope between 753.75 nm and 778.75 nm to consider apparent pressure over water

Reference: slope754_779_min, LUT469

[AD-8] Section 6.10.7, GADS field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *slope754_779_min*
Minimum spectral slope between 753.75 *nm* and 778.75 *nm* to consider apparent pressure over water

units: [*dl*]

Step: User specified.

Scientific content:

Minimum spectral slope between 753.75 *nm* and 778.75 *nm* to consider apparent surface pressure over water

Current baseline: 0.0799999982

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.10.7.20 Band indices for MDSI computation

Reference: MDSI_b1, MDSI_b2 LUT470

[AD-8] Section 6.10.7, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MDSI_b1, MDSI_b2*
Band indices (*b1*,*b2*) for MDSI computation (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

Band indices selected to compute the MERIS differential snow index

Current baseline: {62, 25}

Resources:

Estimated CPU time: -
Output disk space: 2 × 1 byte/uc = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.10.8 GADS Reflectance Thresholds

6.10.8.1 Thresholds on Rayleigh-corrected TOA reflectance above land, $\rho_{Rc\_2}(\theta_s \times \theta_v, \Delta\varphi)$

Reference: Rho_rc_LUT, LUT303

[AD-8] Section 6.10.8, ADS record 1 field 1

Dependencies:

LUT299, LUT300, LUT301, LUT302

Tools:

OTC/RAYLEIGH

RTC/UPRAD (SO)

Procedure:

Inputs:

$n(\lambda)$	MERIS band index [*dl*], *see* Section 6.10.7.12, (LUT299).
$\theta_s \times \theta_v$	Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.10.7.14, (LUT301).
θ	Zenith angle [*deg*], *see* Section 6.10.7.13, (LUT300).
$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.10.7.15, (LUT302).

Output: $Rho\_rc\_LUT[\theta_s \times \theta_v, \Delta\phi]$

Radiometric thresholds on *Rayleigh* corrected TOA reflectance at λ *nm* as a function of the solar zenith angle, view zenith angle and relative azimuth angle between sun and viewing directions.

units: [*dl*]

Step-1: Generate TOA normalized radiance $L_{TOA\_2}[\theta_s,\theta_v,\Delta\phi]$ with the RTC/UPRAD (SO) over a reflective land surface under a continental atmosphere. The selected aerosol model is the *Junge* model #37 (m=1.44,α=-1).

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	2	442.5 *nm* (*see* Section 6.10.7.12)
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./INPUT/sc_land37_b02"	*Junge* model #37 (m=1.44,α=-1)
$\tau^{a1}(550)$	2.0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A
spm	-	N/A

Variable	*Value*	*Comments*
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*;H_R=8 *km*)
I_s	79	
ρ_s	0.1	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	
θ_s	values stored in θ_s[ ]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
θ_v	values stored in θ_v[ ]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
$\Delta\phi$	values stored in $\Delta\phi$[ ]	*see* Section 6.10.7.15
pol	1	

Step-2: Generate TOA *Rayleigh* normalized radiance $L_{R\_2}[\theta_s,\theta_v,\Delta\phi]$ with the RTC/UPRAD (SO) over a black land surface (*i.e.*, without specular reflection).

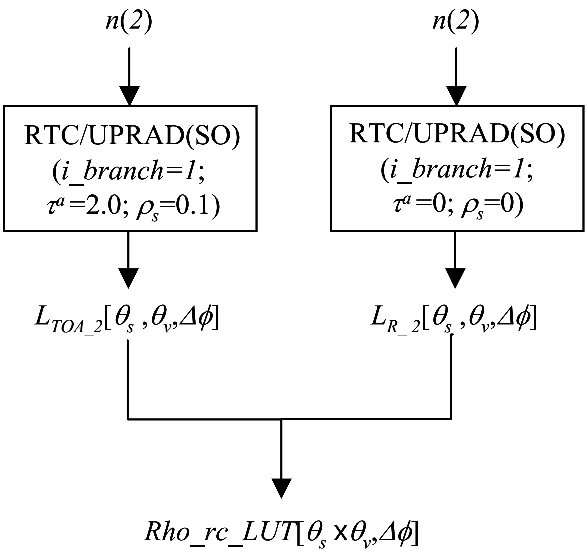
RTC/UPRAD (SO) Inputs (LAND)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	2	442.5 *nm* (*see* Section 6.10.7.12)
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	

Variable	*Value*	*Comments*
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma_{e,\lambda}^{p}$	-	N/A
$\omega_{o,\lambda}^{p}$	-	N/A
spm	-	N/A
$\sigma_{e,\lambda}^{spm}$	-	N/A
$\omega_{o,\lambda}^{spm}$	-	N/A
$\sigma_{e,\lambda}^{ys}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	79	
ρ_s	0	
E_o	1	
$\sigma_{e,\lambda}^{w}$	-	N/A
$\omega_{o,\lambda}^{w}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	
θ_s	values stored in θ_s[ ]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
θ_v	values stored in θ_v[ ]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
$\Delta\phi$	values stored in $\Delta\phi$[ ]	*see* Section 6.10.7.15
pol	1	

Step-3: Build *Rho_rc_LUT*[$\theta_s \times \theta_v,\Delta\phi$] such as,

$$Rho\_rc\_LUT[\theta_s \times \theta_v, \Delta\phi] = \pi \frac{L_{TOA\_2}[\theta_s, \theta_v, \Delta\phi] - L_{R\_2}[\theta_s, \theta_v, \Delta\phi]}{\cos\theta_s}$$



Scientific content:

In the pixels classification algorithm over land, the *Rayleigh*-corrected MERIS reflectances at 442.5 *nm* are respectively compared with these radiometric thresholds $Rho\_rc\_LUT[\theta_s \times \theta_v, \Delta\phi]$. If the *Rayleigh*-corrected reflectance is lower than the threshold then the pixel is not considered as a bright pixel. The thresholds are computed with inputs which generate the high boundary of a mean range of *Rayleigh*-corrected reflectance.

Resources:

Estimated CPU time: 324 *sec*
Output disk space: 78 × 19 × 4 bytes/fl = 5928 bytes

Acceptance:

Comparison with another RTC.

6.10.8.2 Thresholds on Rayleigh-corrected TOA reflectance above ocean, $\rho_{Rc\_2}(\theta_s \times \theta_v, \Delta\phi)$

Reference: Rho_rc_LUT, LUT303

[AD-8] Section 6.10.8, ADS record 2 field 1

Dependencies:

LUT299, LUT300, LUT301, LUT302

Tools:

OTC/RAYLEIGH
RTC/UPRAD (SO)

Procedure:

Inputs:

- $n(\lambda)$ MERIS band index [*dl*], *see* Section 6.10.7.12, (LUT299).
- $\theta_s \times \theta_v$ Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.10.7.14, (LUT301).
- θ Zenith angle [*deg*], *see* Section 6.10.7.13, (LUT300).
- $\Delta\phi$ Relative azimuth angle [*deg*], *see* Section 6.10.7.15, (LUT302).

Output: $Rho\_rc\_LUT[\theta_s \times \theta_v, \Delta\phi]$

Radiometric thresholds on *Rayleigh* corrected TOA reflectance at λ *nm* as a function of the solar zenith angle, view zenith angle and relative azimuth angle between sun and viewing directions.

units: [*dl*]

Step-1: Generate TOA normalized radiance $L_{TOA\_2}[\theta_s,\theta_v,\Delta\phi]$ with the RTC/UPRAD (SO) over a wind-roughened reflective sea surface (*i.e.*, including the glitter contribution or the multiple specular reflections) under a maritime atmosphere. The ocean aerosol assemblage #3 is selected (*see* Table in Section 6.13.5.1).

RTC/UPRAD (SO) Inputs (OCEAN)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	2	
$n(\lambda)$	2 (442.5 *nm*)	442.5 *nm* (*see* Section 6.10.7.12)
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGHh
aerosol1	"./INPUT/sc_mar90_b02"	Ocean aerosol assemblage#3 (MAR90)
$\tau^{a1}(550)$	2.0	
aerosol2	"./INPUT/sc_conti_b02"	Ocean aerosol assemblage#3 (CONTI)
$\tau^{a2}(550)$	0.025	
aerosol3	"./INPUT/sc_H2SO4_b02"	Ocean aerosol assemblage#3 (H2SO4)
$\tau^{a3}(550)$	0.005	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A

Variable	Value	Comments
spm	-	N/A
$\sigma_{e,\lambda}^{spm}$	-	N/A
$\omega_{o,\lambda}^{spm}$	-	N/A
$\sigma_{e,\lambda}^{ys}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (optically homogeneous layers)
I_s	79	
ρ_s	0.036	
E_o	1	
$\sigma_{e,\lambda}^{w}$	-	N/A
$\omega_{o,\lambda}^{w}$	-	N/A
w_s	5.0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	
θ_s	values stored in θ_s[ ]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
θ_v	values stored in θ_v[ ]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
$\Delta\phi$	values stored in $\Delta\phi$[ ]	*see* Section 6.10.7.15
pol	1	

Step-2: Generate TOA *Rayleigh* normalized radiance $L_{R\_2}[\theta_s,\theta_v,\Delta\phi]$ with the RTC/UPRAD (SO) over a wind-roughened black sea surface (*i.e.*, including the glitter contribution or the multiple specular reflections).

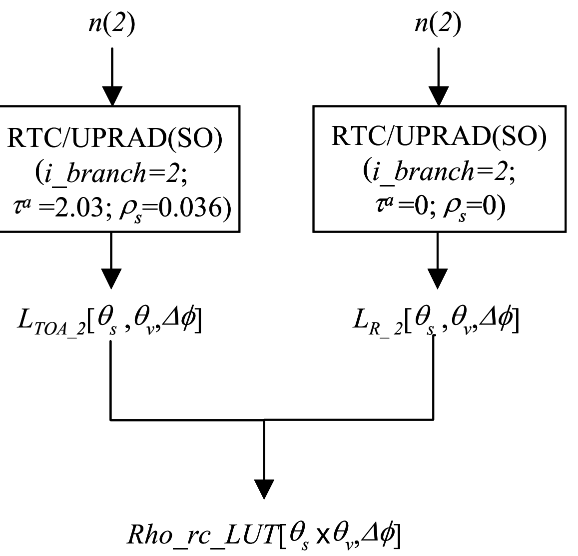
RTC/UPRAD (SO) Inputs (LAND)

Variable	Value	Comments
out_file	"./OUTPUT/uprad_out"	
i_branch	2	
$n(\lambda)$	2 (442.5 *nm*)	442.5 *nm* (Section 6.10.7.12)
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	

Variable	***Value***	***Comments***
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	79	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	5.0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	
θ_s	values stored in θ_s[]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
θ_v	values stored in θ_v[]	For all angular combinations, *see* Section 6.10.7.14 and Section 6.10.7.13
$\Delta\phi$	values stored in $\Delta\phi$[]	*see* Section 6.10.7.15
pol	1	

Step-3: Build *Rho_rc_LUT*[$\theta_s \times \theta_v, \Delta\phi$] such as,

$$Rho\_rc\_LUT[\theta_s \times \theta_v, \Delta\phi] = \pi \frac{L_{TOA\_2}[\theta_s, \theta_v, \Delta\phi] - L_{R\_2}[\theta_s, \theta_v, \Delta\phi]}{\cos\theta_s}$$



Scientific content:

In the pixels classification algorithm over ocean, the *Rayleigh*-corrected MERIS reflectances at 442.5 nm are respectively compared with these radiometric thresholds $Rho\_rc\_LUT[\theta_s \times \theta_v, \Delta\phi]$. If the *Rayleigh*-corrected reflectance is lower than the corresponding threshold value then the pixel is not considered as a bright pixel. The thresholds are computed with inputs which generate the high boundary of a mean range of *Rayleigh*-corrected reflectance.

Resources:

Estimated CPU time: 685 *sec*
Output disk space: 78 × 19 × 4 bytes/fl = 5928 bytes

Acceptance:

Comparison with another RTC.

6.11 ATMOSPHERE PARAMETERS

6.11.1 C.P.

6.11.1.1 C.P. Rayleigh optical thickness, $\tau^R(\lambda,P_s)$

Reference: tauR LUT410

Configuration file

PARBLEU provided

Dependencies:

LUT076, LUT092

Tool:

OTC/RAYLEIGH

Procedure:

Inputs: λ MERIS wavelength [*nm*], *see* Section 6.11.4.3, (LUT076)
P_s Standard surface pressure [*hPa*], *see* Section 6.11.4.19, (LUT092)

Output: τ^R *Rayleigh* optical thickness (tauR)

units: [*dl*]

Step: User specified.

Scientific content:

Rayleigh optical thicknesses in the 15 MERIS spectral bands coputed with Travis/Hansen formulation.

Current baseline: {0.3152799904, 0.2359099984, 0.1551550031, 0.1317140013, 0.0899119973, 0.0594329983, 0.0447300002, 0.0405620001, 0.0345579982, 0.0269440003, 0.0258019995, 0.0236169994, 0.0154590001, 0.0140990000, 0.0131759997}

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.11.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.11.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.11.4 GADS General

6.11.4.1 Rayleigh transmittance coefficients

Reference: t_0, t_1, t_2, LUT074

[AD-8] Section 6.11.4, GADS field 1.

Dependencies:

LUT075, LUT080

Tools:

RTC/UPRAD (SO)
Polynomial fit

Procedure:

Inputs: θ_s Solar zenith angle [*deg*], *see* Section 6.11.4.4, (LUT080)
τ^R *Rayleigh* optical thickness [*dl*], *see* Section 6.11.4.2, (LUT075)

Output: t_0, t_1, t_2 *Rayleigh* transmittance coefficients (second order polynomial)
units: [*dl*]

Step-1: Calculate the *Rayleigh* transmittance $T_{R\_RTC}[\tau^R,\theta_s]$ corresponding to the first order of *Legendre* decomposition ($I_s=0$) of phase function with the RTC/UPRAD (SO). For extracting the total atmospheric transmittance, we need to set $I_s=0$ and $\theta_v=-1$.

RTC/UPRAD (SO) Inputs (LAND)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1	Not used. *Rayleigh* transmittance is compu-ted

Variable	***Value***	***Comments***
		as function of τ^R (tabulated values).
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	*see* inputs	*see* Section 6.11.4.2
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	0	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 1, 1	Use a loop for 12 θ_s
θ_s	*see* inputs	*see* Section 6.11.4.4
θ_v	-1	To get the total atmospheric transmittance
$\Delta\phi$	0	
pol	1	

Input table

↓

RTC/UPRAD(SO)

↓

$T_{R\_RTC}[\tau^R, \theta_s]$

Step-2: Calculate the corresponding value of $T_{R\_ANA}[\tau^R, \theta_s]$ with the analytical expression used in the 6S code [RD-5].

$$T_{R\_ANA}(\tau^R, \theta_s) = [(2/3+\cos\theta_s) + (2/3-\cos\theta_s)\ \exp(-\tau^R/\cos\theta_s)]\ /\ [4/3+\tau^R]$$

Step-3: Calculate t_0, t_1 and t_2 coefficients with the polynomial fit as follows,

$$T_{R\_RTC}(\tau^R, \theta_s) = t_0 + t_1 \ .\ T_{R\_ANA}(\tau^R, \theta_s) + t_2 \ .\ [T_{R\_ANA}(\tau^R, \theta_s)]^2$$

Scientific content:

Compute the *Rayleigh* transmittance for removing the *Rayleigh* scattering effects in MERIS data. The *Rayleigh* optical thicknesses (τ^R) and the solar zenith angles (θ_s) have to cover the MERIS range.

Resources:

Estimated CPU time: 21 *sec*
Output disk space: 3 × 4 bytes/fl = 12 bytes

Acceptance:

Comparison with another RTC.

6.11.4.2 Rayleigh optical thicknesses

Reference: tauR, LUT075

[AD-8] Section 6.11.4, GADS field 2.

ACRI provided

Dependencies:

None

Tool:

Input: none

Output: tauR *Rayleigh* optical thickness (17 values)

units: [*dl*]

Step: User specified.

Procedure:

None

Scientific content:

Set of 17 values of *Rayleigh* optical thicknesses.

Current baseline: tauR values in [0.02;0.34] by step of 0.02

Resources:

Estimated CPU time: -
Output disk space: 17 × 4 bytes/fl = 68 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.3 Nominal wavelengths of MERIS spectral bands

Reference: Wvl, LUT076

[AD-8] Section 6.11.4, GADS field 3.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl* Nominal wavelengths of MERIS spectral bands (15 values)

units: [*nm*]

Step: User specified.

Scientific content:

Nominal wavelengths for the 15 MERIS spectral bands

Current baseline: {412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75, 753.75, 761.875, 778.75, 865.0, 885.0, 900.0} *nm*

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.4 Solar zenith angles for GADS Rayleigh reflectance over ocean

Reference: SZA, LUT077

[AD-8] Section 6.11.4, GADS field 4.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angle (23 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 23 solar zenith angles (θ_s) selected from the *Gauss* quadrature generated for 25 discrete directions (including zenith) with the RTC/Gauss tool (UdL).

Current baseline: 23 values corresponding to the first 23 angles from the *Gauss* quadrature

θ_s [*deg.*]	θ_s [*deg.*]	θ_s [*deg.*]	θ_s [*deg.*]
0.000000	21.347983	43.611442	65.877652
2.840906	25.058051	47.322394	69.588762
6.521063	28.768427	51.033390	73.299882
10.222955	32.479006	54.744420	77.011011
13.929756	36.189726	58.455477	80.722147
17.638419	39.900547	62.166556	

Resources:

Estimated CPU time: -
Output disk space: 23 × 4 bytes/ul = 92 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.5 View zenith angles for GADS Rayleigh reflectance over ocean

Reference: VZA, LUT078

[AD-8] Section 6.11.4, GADS field 5.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA* View zenith angle (13 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 13 view zenith angles (θ_v) selected from the *Gauss* quadrature generated for 25 discrete directions (including nadir) with the RTC/Gauss tool (UdL).

Current baseline: 13 values corresponding to the first 13 angles from the *Gauss* quadrature

θ_v [deg.]
0.000000
2.840906
6.521063
10.222955
13.929756
17.638419
21.347983

θ_v [deg.]
25.058051
28.768427
32.479006
36.189726
39.900547
43.611442

Resources:

Estimated CPU time: -
Output disk space: 13 × 4 bytes/ul = 52 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.6 Relative azimuth angles for GADS Rayleigh reflectances over ocean (tabulated values)

Reference: RAA, LUT079

[AD-8] Section 6.11.4, GADS field 6.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle (25 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 25 relative azimuth angles ($\Delta\phi$) between illumination and viewing directions regularly spaced

Current baseline: 25 values within [0;180] *deg*., with a step of 7.5 *deg*.

$\Delta\phi[deg.]$	$\Delta\phi[deg.]$	$\Delta\phi[deg.]$	$\Delta\phi[deg.]$	$\Delta\phi[deg.]$
0.00	37.50	75.00	112.50	150.00
7.50	45.00	82.50	120.00	157.50
15.00	52.50	90.00	127.50	165.00
22.50	60.00	97.50	135.00	172.50
30.00	67.50	105.00	142.50	180.00

Resources:

Estimated CPU time: -
Output disk space: 25 × 4 bytes/ul = 100 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.7 Zenith angles for GADS Rayleigh scattering function

Reference: ZA, LUT080

[AD-8] Section 6.11.4, GADS field 7.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ZA* Zenith angle (12 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 12 angles (θ) selected from the *Gauss* quadrature generated for 24 discrete directions with the RTC/Gauss tool (UdL)

Current baseline: 12 *Gaussian* angles (*see* Section 6.10.7.13)

Resources:

Estimated CPU time: -
Output disk space: 12 × 4 bytes/ul = 48 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.8 Stored indices for ($\theta_s x \theta_v$) combinations for GADS Rayleigh scattering function

Reference: SVZA_index, LUT081

[AD-8] Section 6.11.4, GADS field 8.

ACRI provided

Dependencies:

None

Tool:

Input: none

Output: *SVZA_index* Stored indices for ($\theta_s x \theta_v$) combinations (78 values)

units: [*dl*]

Step: User specified.

Procedure:

None

Scientific content:

Current baseline: 78 angular combinations (SZA x VZA) (*see* Section 6.10.7.14)

Note: Due to the fact that the matrix is symmetrical in the ($\theta_s \times \theta_v$) directions, we can then store only a half triangular matrix, *i.e.*, N(N+1)/2 instead of N^2 elements (78 instead of 144).

Resources:

Estimated CPU time: -
Output disk space: 78 × 2 × 1 byte/uc = 156 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.9 Constants used for Rayleigh phase function (A,B)

Reference: {A,B}, LUT082

[AD-8] Section 6.11.4, GADS field 9.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *A, B* Constants used for the anisotropy of *Rayleigh* phase function (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

These 2 contants (A,B) are used to correct the *Rayleigh* phase function for the molecular anisotropy. The latters which derive from the 6S code [RD-5] are determined empirically.

Current baseline: A = 0.9587256; B = 0.0412744

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.10 Air masses (downward and upward atmospheric paths)

Reference: AM, LUT083

[AD-8] Section 6.11.4, GADS field 10.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AM* Air mass for the 2 atmospheric paths (up/down) (6 values)

units: [*dl*]

Step: User specified.

Scientific content:

The air mass (M) is defined as,

$$M = \frac{1}{\cos \vartheta_s} + \frac{1}{\cos \vartheta_v}$$

This requires a set of θ_s and θ_v values which falls in a given range of MERIS air mass values.

Current baseline: $M = \{2.0; 2.3; 2.6; 2.9; 3.2; 3.5\}$

Resources:

Estimated CPU time: -
Output disk space: 6 × 4 bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.11 Reference wavelengths for GADS O2 transmittances around 778.75 nm

Reference: Wvl_FiltO2, LUT095

[AD-8] Section 6.11.4, GADS field 11.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl_FiltO2* Nominal wavelengths for the 21 MERIS O2 filters around 778.75 *nm* (21 values)

units: [*nm*]

Step: User specified.

Scientific content:

Set of 21 MERIS O2 filters (around 778.5 *nm*) used for computation of residual O2 absorption around 778.75 *nm*.

Current baseline: {777.5, 777.6, 777.7, 777.8, 777.9, 778.0, 778.1, 778.2, 778.3, 778.4, 778.5, 778.6, 778.7, 778.8, 778.9, 779.0, 779.1, 779.2, 779.3, 779.4, 779.5} *nm*

Resources:

Estimated CPU time: -
Output disk space: 21 × 4 bytes/fl = 84 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.12 TOA normalized radiances at 778.75 nm for GADS O2 transmittances around 778.75 nm

Reference: LN_779, LUT085

[AD-8] Section 6.11.4, GADS field 12.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *LN_779* TOA normalized radiance at 778.75 nm (25 values)

units: $[sr^{-1}]$

Step: User specified.

Scientific content:

$L_{TOA\_779}[\ ]$ is a vector which contains 25 typical values of TOA normalized radiances at 778.75 *nm*.

Current baseline: L_{TOA_779} = {0.002, 0.012, 0.022, 0.032, 0.042, 0.052, 0.062, 0.072, 0.082, 0.092, 0.102, 0.112, 0.122, 0.132, 0.142, 0.152, 0.162, 0.172, 0.182, 0.192, 0.202, 0.212, 0.222, 0.232, 0.242} sr^{-1}

Resources:

Estimated CPU time: -
Output disk space: 25 × 4 bytes/fl = 100 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.13 Solar zenith angles for GADS O2 transmittances around 778.75 nm

Reference: SZA_TO2, LUT086

[AD-8] Section 6.11.4, GADS field 13.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA_TO2* Solar zenith angle ($\theta_{s,\ TO2}$) (15 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 15 solar zenith angles ($\theta_{s,\ TO2}$) regularly spaced.

Current baseline: 15 values within [10;80] *deg*., with a step of 5 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/ul = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.14 View zenith angles for GADS O2 transmittances around 778.75 nm

Reference: VZA_TO2, LUT087

[AD-8] Section 6.11.4, GADS field 14.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA_TO2* View zenith angle ($\theta_{v,\ TO2}$) (10 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 10 view zenith angles ($\theta_{v,\ TO2}$) regularly spaced.

Current baseline: 10 values within [0;45] *deg*., with a step of 5 *deg*

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/ul = 40 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.15 Relative azimuth angles for GADS O2 transmittances around 778.75 nm

Reference: RAA_TO2, LUT088

[AD-8] Section 6.11.4, GADS field 15.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA_TO2* Relative azimuth angle ($\Delta\phi_{TO2}$) (19 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 19 relative azimuth angles ($\Delta\phi_{TO2}$) between illumination and viewing directions regularly spaced

Current baseline: 19 values within [0;180] *deg*., with a step of 10 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.16 Threshold for flagging low pressure water

Reference: $P_{thresh,}$ LUT089

[AD-8] Section 6.11.4, GADS field 16.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: P_{thresh} Threshold for flagging low pressure water

units: [*hPa*]

Step: User specified.

Scientific content:

This threshold is applied on pressure to discriminate high elevation inland waters. The value is determined empirically.

Current baseline: $P_{thresh} = 900\ hPa$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.17 Standard water vapour content

Reference: uH2O_std, LUT090

[AD-8] Section 6.11.4, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *uH2O_std* Standard water vapour content
units: $[g.cm^{-2}]$

Step: User specified.

Scientific content:

u_{H20std} defines the standard total water vapor content in the atmosphere (Mid-Latitude Summer) to be considered in the computations. It represents a weight of the total atmospheric column. The LUT will be produced based on this value; the atmospheric transmission will be influenced by how much water vapor is considered by the radiative transfer model.

Current baseline: 1.42 $g.cm^{-2}$

This value defines also the standard water vapor content for field 1 from Section 6.11.4 [AD-8].

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.18 Standard ozone content

Reference: uO3_std, LUT091

[AD-8] Section 6.11.4, GADS field 18.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *uO3_std* Standard ozone content
units: [*cm-atm*]

Step: User specified.

Scientific content:

The clear-sky atmospheric correction algorithm requires a standard value of the total ozone amount. This value is used to generated the LUT of the ozone optical thickness (*see* Section 6.11.5.5) and is set up to the value corresponding to the Mid-Latitude Summer profile (WRCP) which is 350 *DU* (or 0.35 *cm-atm*).

Current baseline: 0.35 *cm-atm*

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.19 Standard surface pressure

Reference: Ps_std, LUT092

[AD-8] Section 6.11.4, GADS field 19.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ps_std* Standard surface pressure

units: [*hPa*]

Step: User specified.

Scientific content:

The clear sky atmospheric correction algorithm requires a standard value of the surface pressure. This value is used to generate the LUT of the *Rayleigh* optical thickness (*see* Section 6.11.5.5) and is set up to the surface pressure from the Mid-Latitude Summer profile (WRCP) which is 1013.25 *hPa*.

Current baseline: 1013.25 *hPa*

This value defines also the standard surface pressure for field 2 from Section 6.11.4 [AD-8].

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.20 Wind-speeds for GADS Rayleigh reflectance over ocean

Reference: Ws, LUT093

[AD-8] Section 6.11.4, GADS field 20.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ws* Wind-speed just above sea level (3 values)

units: $[m.s^{-1}]$

Step: User specified.

Scientific content:

For the atmospheric corrections over ocean, the wind-speed values will be set to 1.5, 5.0 and 10 $m.s^{-1}$.

Current baseline: {1.5, 5.0, 10.0} $m.s^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 3 × 4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.21 Maximum valid pressure

Reference: Max_Press, LUT304

[AD-8] Section 6.11.4, GADS field 21.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Max_Press* Maximum valid surface pressure

units: [*hPa*]

Step: User specified.

Scientific content:

Maximum valid value of surface pressure

Current baseline: 1050 *hPa*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.22 Angstroem exponents for ADS photosynthetically active radiation (PAR)

Reference: alpha_PAR, LUT305

[AD-8] Section 6.11.4, GADS field 22.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *alpha_PAR* *Angstroem* exponent used for PAR (20 values)

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: {-0.8, -0.653, -0.505, -0.358, -0.210, -0.063, 0.084, 0.232, 0.379, 0.526, 0.674, 0.821, 0.969, 1.116, 1.263, 1.411, 1.558, 1.706, 1.853, 2.000}

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 bytes/fl = 80 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.23 Ozone contents for ADS photosynthetically active radiation (PAR)

Reference: uO3_PAR, LUT306

[AD-8] Section 6.11.4, GADS field 23.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *uO3_PAR* Ozone content used for PAR (20 values)

units: [10^{-3} *cm-atm*] or [*DU*]

Step: User specified.

Scientific content:

Set of 20 ozone contents used for the PAR computation

Current baseline: {200.000, 210.526, 221.052, 231.578, 242.104, 252.630, 263.156, 273.682, 284.208, 294.734, 305.260, 315.786, 326.312, 336.838, 347.364, 357.890, 368.416, 378.942, 389.468, 399.994} 10^{-3} *cm-atm*

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 bytes/fl = 80 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.24 Aerosol optical thicknesses at 865 nm for ADS photosynthetically active radiation (PAR)

Reference: AOT865_PAR, LUT307

[AD-8] Section 6.11.4, GADS field 24.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *AOT865_PAR* Aerosol optical thickness at 865 *nm* used for PAR (20 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 20 AOT-865 values used for the PAR computation

Current baseline: {0.15, 0.30, 0.45, 0.60, 0.75, 0.90, 1.05, 1.20, 1.35, 1.50, 1.65, 1.80, 1.95, 2.10, 2.25, 2.40, 2.55, 2.70, 2.85, 3.00}

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 bytes/fl = 80 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.25 Water vapour contents for photosynthetically active radiation (PAR)

Reference: uH2O_PAR, LUT094

[AD-8] Section 6.11.4, GADS field 25.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *uH2O_PAR* Water vapour content for PAR (20 values)
units: $[g.cm^{-2}]$

Step: User specified.

Scientific content:

Set of 20 water vapour contents used for the PAR computation

Current baseline: {0.0, 0.3, 0.6, 0.9, 1.2, 1.5, 1.8, 2.1, 2.4, 2.7, 3.0, 3.3, 3.6, 3.9, 4.2, 4.5, 4.8, 5.1, 5.4, 5.7} $g.cm^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 bytes/fl = 80 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.26 Reference wavelengths for GADS apparent pressure parameters

Reference: Wvl_FiltPs, LUT471

[AD-8] Section 6.11.4, GADS field 26.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl_FiltPs* Nominal wavelengths for the 21 MERIS O2 filters around 761.7 *nm* (21 values)

units: [*nm*]

Step: User specified.

Scientific content:

Set of 21 MERIS O2 filters (around 761.7 *nm*) used for computation of apparent pressure parameters

Current baseline: {760.7, 760.8, 760.9, 761.0, 761.1, 761.2, 761.3, 761.4, 761.5, 761.6,.761.7, 761.8, 761.9, 762.0, 762.1, 762.2, 762.3, 762.4, 762.5, 762.6, 762.7} *nm*

Resources:

Estimated CPU time: -
Output disk space: 21 × 4 bytes/fl = 84 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.27 Reference wavelengths for GADS polynomial coefficients for H2O transmittance retrieval at 708.75 nm

Reference: Wvl_FiltH2O, LUT096

[AD-8] Section 6.11.4, GADS field 27.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl_FiltH2O* Nominal wavelengths for the 21 MERIS O2 filters around 708.75 *nm* (21 values)

units: [*nm*]

Step: User specified.

Scientific content:

Set of 21 MERIS H2O filters (around 708.75 *nm*) used for computation of polynomials of H2O retrieval at 708.75 *nm*.

Current baseline: {707.75, 707.85, 707.95, 708.05, 708.15, 708.25, 708.35, 708.45, 708.55, 708.65, 708.75, 708.85, 708.95, 709.05, 709.15, 709.25, 709.35, 709.45, 709.55, 709.65, 709.75} *nm*

Dependencies:

None

Resources:

Estimated CPU time: -

Output disk space: 21 × 4 bytes/fl = 84 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.28 Pressure scale height to account for altitude

Reference: Hp, LUT414

[AD-8] Section 6.11.4, GADS field 28.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Hp* Pressure scale height

units: [*m*]

Step: User specified.

Scientific content:

H_p corresponds to the standard *Rayleigh* scale height useful to define the vertical distribution of the molecules in the atmosphere. A typical value is around 8 *km*.

Current baseline: 8430 *m*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.29 Zenith angles for GADS apparent pressure parameters

Reference: ZA_Ps, LUT472

[AD-8] Section 6.11.4, GADS field 29.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ZA_Ps* Zenith angle (24 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 24 zenith angles (θ_{Ps}) selected from the *Gauss* quadrature generated for 24 discrete directions with the RTC/Gauss tool (UdL)

Current baseline: 24 *Gaussian* angles

{2.840906, 6.521063, 10.222955, 13.929756, 17.638419, 21.347983, 25.058051, 28.768427, 32.479006, 36.189726, 39.900547, 43.611442, 47.322394, 51.033390, 54.744420, 58.455477, 62.166556, 65.877652, 69.588762, 73.299882, 77.011011, 80.722147, 84.433286, 88.144429} *deg.*

Current baseline: 24 *Gaussian* angles

i	θ_{Ps} [*deg.*]	*i*	θ_{Ps} [*deg.*]	*i*	θ_{Ps} [*deg.*]	*i*	θ_{Ps} [*deg.*]
1	2.840906	7	58.455477	13	58.455477	18	58.455477
2	17.638419	8	65.877652	14	65.877652	19	65.877652
3	28.768427	9	69.588762	15	69.588762	20	69.588762
4	36.189726	10	73.299882	16	73.299882	21	73.299882
5	43.611442	11	77.011011	17	77.011011	22	77.011011
6	51.033390	12	80.722147	18	80.722147	124	80.722147

Resources:

Estimated CPU time: -
Output disk space: 24 × 4 bytes/ul = 96 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.30 Reference pressure levels for GADS apparent pressure parameters

Reference: Ps_level, LUT473

[AD-8] Section 6.11.4, GADS field 30.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ps_level* Pressure level (21 values)
units: [*hPa*]

Step: User specified.

Scientific content:

Ps_level corresponds to a reference level of pressure within the atmosphere. A set of 21 reference pressure levels has been defined to compute the O2 transmittance in the atmospheric layers.

Current baseline: {3.963, 64.35, 124.10, 177.00, 228.30, 279.10, 329.70, 380.50, 430.50, 480.00, 529.60, 579.70, 629.80, 679.70, 729.40, 778.30, 827.60, 877.00, 926.40, 975.50, 1007.00} *hPa*

Resources:

Estimated CPU time: -
Output disk space: 21 × 4 bytes/fl = 84 bytes

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Acceptance:

Corresponds to the latest definition.

6.11.4.31 Aerosol scattering phase function

Reference: P[Theta], LUT474

[AD-8] Section 6.11.4, GADS field 31.

FUB/ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *P[Theta]* Aerosol scattering phase function (181 values)

units: [*dl*]

Step: User specified.

Scientific content:

P[Theta] corresponds to a reference aerosol scattering phase function used to estimate the aerosol reflectance in the algorithm of the apparent surface pressure retrieval over ocean.

Current baseline: 181 values (*see* table below)

Θ	$P(\Theta)$	Θ	$P(\Theta)$	Θ	$P(\Theta)$	Θ	$P(\Theta)$	Θ	$P(\Theta)$
0.00	162.99707031	36.00	2.18402076	72.00	0.35232785	108.00	0.11797373	144.00	0.15353890
1.00	146.77873230	37.00	2.07215595	73.00	0.34090927	109.00	0.11851433	145.00	0.16376551
2.00	107.48479462	38.00	1.98779583	74.00	0.33279648	110.00	0.11922964	146.00	0.17394768
3.00	65.62915039	39.00	1.88332319	75.00	0.31797865	111.00	0.11565626	147.00	0.18173359
4.00	37.43303299	40.00	1.75853372	76.00	0.29913065	112.00	0.11080770	148.00	0.19141671
5.00	25.55327416	41.00	1.65484393	77.00	0.28656775	113.00	0.11004089	149.00	0.20750234
6.00	22.46920776	42.00	1.58498788	78.00	0.28102630	114.00	0.11214274	150.00	0.22815083
7.00	20.33006477	43.00	1.51557219	79.00	0.27285829	115.00	0.11143742	151.00	0.24914345
8.00	16.86425018	44.00	1.42409563	80.00	0.25816941	116.00	0.10724268	152.00	0.27072391

Θ	P(Θ)	Θ	P(Θ)	Θ	P(Θ)	Θ	P(Θ)	Θ	P(Θ)
9.00	13.76597023	45.00	1.33284354	81.00	0.24484374	117.00	0.10491300	153.00	0.29469413
10.00	12.28894234	46.00	1.26866007	82.00	0.23910907	118.00	0.10687347	154.00	0.31666332
11.00	11.66075325	47.00	1.21956766	83.00	0.23540635	119.00	0.10863673	155.00	0.32848474
12.00	10.71770287	48.00	1.15709174	84.00	0.22592986	120.00	0.10633057	156.00	0.32964382
13.00	9.43953133	49.00	1.08264983	85.00	0.21342674	121.00	0.10311270	157.00	0.32967153
14.00	8.49027920	50.00	1.02221227	86.00	0.20622739	122.00	0.10385237	158.00	0.33588240
15.00	8.04110909	51.00	0.98243231	87.00	0.20435572	123.00	0.10703281	159.00	0.34421989
16.00	7.65051746	52.00	0.94140410	88.00	0.19978008	124.00	0.10733543	160.00	0.34724367
17.00	7.03037500	53.00	0.88575059	89.00	0.18984088	125.00	0.10450944	161.00	0.34656248
18.00	6.38895464	54.00	0.83101839	90.00	0.18137538	126.00	0.10374737	162.00	0.34989890
19.00	5.98838997	55.00	0.79422116	91.00	0.17912635	127.00	0.10701992	163.00	0.35779950
20.00	5.74152136	56.00	0.76624566	92.00	0.17798997	128.00	0.10983634	164.00	0.36203635
21.00	5.41101217	57.00	0.72823948	93.00	0.17169216	129.00	0.10876875	165.00	0.35879293
22.00	4.98262072	58.00	0.68236607	94.00	0.16311909	130.00	0.10715967	166.00	0.35511181
23.00	4.63211727	59.00	0.64657664	95.00	0.15929438	131.00	0.10953519	167.00	0.35756677
24.00	4.42061949	60.00	0.62444222	96.00	0.15970851	132.00	0.11408349	168.00	0.36152691
25.00	4.22177887	61.00	0.60025442	97.00	0.15733890	133.00	0.11572338	169.00	0.35930768
26.00	3.94303012	62.00	0.56547582	98.00	0.15029354	134.00	0.11460783	170.00	0.35453612
27.00	3.65591860	63.00	0.53184748	99.00	0.14465398	135.00	0.11588175	171.00	0.35852292
28.00	3.45675206	64.00	0.51096666	100.00	0.14413634	136.00	0.12112684	172.00	0.37301677
29.00	3.31405163	65.00	0.49544522	101.00	0.14396863	137.00	0.12577237	173.00	0.38728613
30.00	3.13546038	66.00	0.47191370	102.00	0.13895395	138.00	0.12677671	174.00	0.39612490
31.00	2.91700602	67.00	0.44287798	103.00	0.13207152	139.00	0.12775595	175.00	0.41098920
32.00	2.73442030	68.00	0.42159078	104.00	0.12942442	140.00	0.13301189	176.00	0.44470310
33.00	2.61357641	69.00	0.40985852	105.00	0.13017468	141.00	0.14043850	177.00	0.49079248
34.00	2.49636769	70.00	0.39567378	106.00	0.12814954	142.00	0.14515032	178.00	0.52844256
35.00	2.34108186	71.00	0.37335825	107.00	0.12218850	143.00	0.14777000	179.00	0.54623860
								180.00	0.55010635

Resources:

Estimated CPU time: -
Output disk space: 181 × 4 bytes/fl = 724 bytes

Acceptance:

Corresponds to the latest definition.

6.11.4.32 Fresnel reflection coefficients, FR(thetaw)

Reference: FR[thetaw], LUT475

[AD-8] Section 6.11.4, GADS field 32.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *FR[thetaw]* *Fresnel* reflection coefficients (91 values)

units: [*dl*]

Step: User specified.

Scientific content:

Fresnel reflection coefficients $\mathcal{R}(\theta')$ are tabulated for 91 zenith angles in water (θ')

Current baseline: 91 values (*see* table below)

θ'	$\mathcal{R}(\theta')$	θ'	$\mathcal{R}(\theta')$	θ'	$\mathcal{R}(\theta')$	θ'	$\mathcal{R}(\theta')$	θ'	$\mathcal{R}(\theta')$
0.00	0.02111184	18.00	0.02123160	36.00	0.02363891	54.00	0.04210184	72.00	0.16209671
1.00	0.02111184	19.00	0.02126205	37.00	0.02399266	55.00	0.04449888	73.00	0.17775223
2.00	0.02111186	20.00	0.02129826	38.00	0.02438855	56.00	0.04715630	74.00	0.19517079
3.00	0.02111193	21.00	0.02134103	39.00	0.02483108	57.00	0.05010236	75.00	0.21455821
4.00	0.02111211	22.00	0.02139124	40.00	0.02532520	58.00	0.05336849	76.00	0.23614559
5.00	0.02111250	23.00	0.02144984	41.00	0.02587637	59.00	0.05698968	77.00	0.26019257
6.00	0.02111321	24.00	0.02151788	42.00	0.02649064	60.00	0.06100485	78.00	0.28699115
7.00	0.02111438	25.00	0.02159653	43.00	0.02717467	61.00	0.06545739	79.00	0.31687006
8.00	0.02111619	26.00	0.02168708	44.00	0.02793583	62.00	0.07039560	80.00	0.35019988
9.00	0.02111884	27.00	0.02179092	45.00	0.02878228	63.00	0.07587335	81.00	0.38739878
10.00	0.02112257	28.00	0.02190961	46.00	0.02972304	64.00	0.08195070	82.00	0.42893934
11.00	0.02112764	29.00	0.02204485	47.00	0.03076811	65.00	0.08869468	83.00	0.47535643
12.00	0.02113435	30.00	0.02219852	48.00	0.03192854	66.00	0.09618008	84.00	0.52725661
13.00	0.02114306	31.00	0.02237268	49.00	0.03321659	67.00	0.10449042	85.00	0.58532888
14.00	0.02115415	32.00	0.02256960	50.00	0.03464583	68.00	0.11371904	86.00	0.65035748
15.00	0.02116804	33.00	0.02279179	51.00	0.03623134	69.00	0.12397022	87.00	0.72323740
16.00	0.02118522	34.00	0.02304200	52.00	0.03798980	70.00	0.13536061	88.00	0.80499220
17.00	0.02120621	35.00	0.02332325	53.00	0.03993977	71.00	0.14802073	89.00	0.89679611
								90.00	1.00000000

Resources:

Estimated CPU time: -
Output disk space: 91 × 4 bytes/fl = 364 bytes

Acceptance:

Corresponds to the latest definition.

6.11.5 GADS Optical Thicknesses

6.11.5.1 (Spare)

Reference:

[AD-8] Section 6.11.5, GADS field 1.

6.11.5.2 (Spare)

Reference:

[AD-8] Section 6.11.5, GADS field 2.

6.11.5.3 (Spare)

Reference:

[AD-8] Section 6.11.5, GADS field 3.

6.11.5.4 Rayleigh optical thicknesses for standard pressure, $\tau^R(\lambda,P_s)$

Reference: tauR, LUT097

[AD-8] Section 6.11.5, GADS field 4.

Dependencies:

LUT076, LUT092

Tool:

OTC/RAYLEIGH

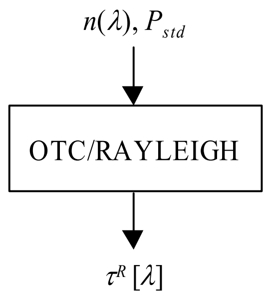
Procedure:

Inputs: λ Wavelength [*nm*], *see* Section 6.11.4.3, (LUT076)
P_{std} Surface pressure [*hPa*], *see* Section 6.11.4.19, (LUT092)

Output: $\tau^R[\lambda]$ *Rayleigh* optical thickness for each band λ

units: $[dl]$

Step: Compute the *Rayleigh* optical thickness $\tau^R[\lambda]$ using the OTC/RAYLEIGH.



Scientific content:

The *Rayleigh* optical thicknesses $\tau^R[\lambda]$ are computed with formula from *Hansen and Travis* [RD-6] using a standard surface pressure ($1013.25\,hPa$). The latters are essential in the atmospheric correction algorithm for removing the *Rayleigh* scattering effects from TOA reflectances.

Resources:

Estimated CPU time: 1 *sec*
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Comparison with other OTC.

6.11.5.5 Ozone optical thicknesses for 1 cm-atm, $\tau^{O_3}(\lambda)$

Reference: tauO3_norm, LUT098

[AD-8] Section 6.11.5, GADS field 5.

Dependencies:

LUT076

Tool:

OTC/OZONE

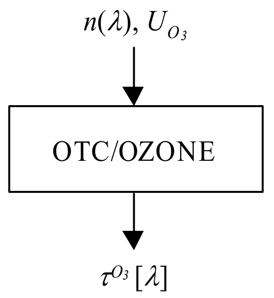
Procedure:

Inputs: λ Wavelength [*nm*], *see* Section 6.11.4.3, (LUT076)
U_{O_3} Total ozone amount [*cm-atm*], value fixed to 1 *cm-atm*

Output: $\tau^{O_3}[\lambda]$ Ozone optical thickness for each band λ

units: [*dl*]

Step: Compute the ozone optical thickness $\tau^{O_3}[\lambda]$ using OTC/OZONE.



Scientific content:

The ozone optical thicknesses $\tau^{O_3}[\lambda]$ are computed with a LBL code using a total ozone amount of 1 *cm-atm*. The latters are essential in the atmospheric correction algorithm for computing the total O_3 transmittivity.

Resources:

Estimated CPU time: 1 *sec*
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Comparison with $\tau^{O_3}[\lambda]$ derived from a LBL code.

6.11.6 GADS H2O Transmission

6.11.6.1 (Spare)

Reference:

[AD-8] Section 6.11.6, GADS field 1.

6.11.6.2 Polynomial coefficients for H2O transmittance retrieval around 708.75 nm (21 shifted filters)

NOTE: The recipe of this LUT is presently not included in the MERISAT tool. This LUT is currently generated with an input user specified file.

Reference: H2OCorr_Poly_LUT[λ', k], LUT106

[AD-8] Section 6.11.6, GADS field 2

Dependencies:

LUT096

Tools:

RTC/UPRAD (GAME)
RTC/GAUSS
Polynomial fit

Procedure:

Inputs: λ' 21 reference wavelengths [nm] corresponding to the 21 spectral shifts ($\Delta\lambda$) of $\pm 0.1\,nm$ applied on the MERIS H_2O filter centred at $708.75\,nm$, *see* Section 6.11.4.26, (LUT096)

k Polynomial coefficient orders [dl], k = [0;3]

Output: *H2OCorr_Poly_LUT*[λ', k]
H_2O transmittance polynomial coefficients

units: [dl]

Warning: The process for generating this table is time-consuming. To avoid loosing data in case of a power failure, several temporary binary files are created after few hours of processing: *X_xx.LUT100* and *TH2O_xx.LUT100 (xx stands for the 21 reference wavelengths)*. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

Step-1: Compute *Gaussian* angles (n=6) for a total of 21 [$n.(n+1)/2$] indices of ($\theta_s \times \theta_v$) combinations with the RTC/GAUSS. Due to the large time of processing, use only a subset of 21 indices of (θ_s x θ_v) combinations to generate this table.

Step-2: Generate TOA normalized radiances $L_{TOA\_14}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ and $L_{TOA\_15}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ for a non-absorbing/absorbing H_2O atmosphere over a black/reflective surface with the RTC/UPRAD (GAME).

RTC/UPRAD (GAME) Inputs (LAND)

Variable	***Value***	***Comments***

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	14 and 15	885 *nm* & 900 *nm*
U_{H2O}	1 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 12.0	For GAME computations without H_2O For GAME computations with H_2O
U_{O2}	0	
ESFT	"./INPUT/RKLM_NO", "./INPUT/RKLM_AL"	For case u_{H2O}=1 (without H_2O absorption) For case $u_{H2O}\neq 1$ (with H_2O absorption)
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_conti_b14", "./INPUT/sc_conti_b15"	Continental aerosols
$\tau^{a1}(550)$	0.1, 0.3 and 0.6	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Vertical distribution of the aerosols as a decreasing exponential (H_a=2 *km*)
I_s	60	
ρ_s	0, 0.2, 0.4 and 0.6	Only the first value is considered for reducing the computation time
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	6, 6, 1	Loop for 21 θ_sxθ_v combinations
θ_s	*Gaussian* angles	Computed with RTC/GAUSS
θ_v	*Gaussian* angles	Computed with RTC/GAUSS

Variable	*Value*	*Comments*
$\Delta\phi$	0	
pol	0	

Note: In order to reduce the computation times, the upwelling TOA radiances will be simulated over a black surface only (which allows to include the oceanic surface cases) and with a subset of 21 indices of (θ_s x θ_v) combinations.

$n(14), \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}$ → RTC/UPRAD (GAME) → $L_{TOA\_14}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}]$

$n(15), \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}$ → RTC/UPRAD (GAME) → $L_{TOA\_15}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}]$

Step-3: Compute the ratio $x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ as follows,

$$x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] = L_{TOA\_15}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] \,/\, L_{TOA\_14}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$$

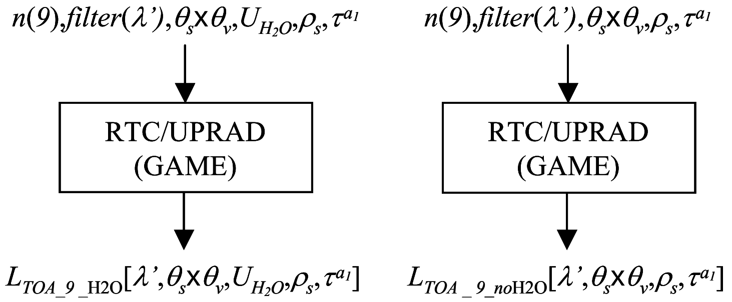
Step-4: Select a shifted MERIS H_2O filter (λ') and generate TOA normalized radiances $L_{TOA\_9\_H2O}[\lambda', \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ for an absorbing H_2O atmosphere and $L_{TOA\_9\_noH2O}[\lambda', \theta_s \times \theta_v, \rho_s, \tau^{a1}]$ for a non-absorbing H_2O atmosphere, over a black/reflective surface with the RTC/UPRAD (GAME).

RTC/UPRAD (GAME) Inputs (LAND)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	9	708.75 *nm*
U_{H2O}	1 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 12.0	For GAME computations without H_2O For GAME computations with H_2O
U_{O2}	0	
ESFT	"./INPUT/RKLM_NO", "./INPUT/RKLM_H2O_*xx*"	For case u_{H2O}=1 (without H_2O absorption) For case $u_{H2O}\neq 1$ (with H_2O absorption), *xx* varies from 0 to (NbFiltH2O-1), *see* Section 6.11.4.26
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_conti_b09"	
$\tau^{a1}(550)$	0.1, 0.3 and 0.6	
aerosol2	-	

Variable	*Value*	*Comments*
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Vertical distribution of the aerosols as a decreasing exponential (H_a=2 *km*)
I_s	60	
ρ_s	0, 0.2, 0.4 and 0.6	Only the first value is considered for reducing the computation time
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	6, 6, 1	Loop for 21 θ_sxθ_v combinations
θ_s	*Gaussian* angles	Computed with RTC/GAUSS
θ_v	*Gaussian* angles	Computed with RTC/GAUSS
$\Delta\phi$	0	
pol	0	

Note: In order to reduce the computation times, the upwelling TOA radiances will be simulated over a black surface only (which allows to include the oceanic surface cases) and with a subset of 21 indices of (θ_s x θ_v) combinations. Moreover,each of the 'RKLM_H2O_xx' files (xx=[0..20]) contains the ESFT coefficients for computing H2O and O2 transmittances, both for all the 15 MERIS bands. Only the H20 ESFT coefficients for the MERIS band#9 differ between these 21 files.



Step-5: Compute the H_2O transmittance in the selected shifted MERIS H2O filter λ' as follows,

$$T_{H2O\_9}[\lambda', \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] = L_{TOA\_9\_H2O}[\lambda', \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] \,/\, L_{TOA\_9\_noH2O}[\lambda', \theta_s \times \theta_v, \rho_s, \tau^{a1}]$$

Step-6: Repeat steps 4 and 5 for each shifted MERIS H_2O filter λ'.

Step-7: For each shifted MERIS H_2O filter λ', apply a polynomial fit on the ratio $x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ as function of the H_2O transmittance in the selected shifted MERIS H2O filter λ', $T_{H2O\_9}[\lambda', \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$, for retrieving polynomial coefficients $a_h[\lambda']$, $b_h[\lambda']$, $c_h[\lambda']$ and $d_h[\lambda']$,

$$\begin{aligned} T_{H2O\_9}[\lambda', \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] = {} & a_h[\lambda'] \\ & + b_h[\lambda'] \,.\, x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] \\ & + c_h[\lambda'] \,.\, x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]^2 \\ & + d_h[\lambda'] \,.\, x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]^3 \end{aligned}$$

Scientific content:

These sets of polynomial coefficients are useful to compute the residual H_2O absorption within the 21 shifted MERIS band #9 (708.75 *nm*) (*i.e.*, by taking the smile effect into account) whatever the illumination (θ_s) and viewing (θ_v) configuration, whatever the absorber amount, whatever the surface reflectance (ρ_s), and whatever the aerosol optical thickness (τ^{a1}), by using the H_2O transmittance in the MERIS band #15 (900 *nm*).

Note that up today the receipe for generating this LUT is not yet included in the MERISAT tool v1.4. This LUT should have to be completed for a MLS profile with several water vapor amounts (U_{H2O}), using a continental aerosol model with several aerosol optical thicknesses (τ^{a1}), and over a black surface (ρ_s=0) for reducing the computation times.

Resources:

Estimated CPU time:	55674 *sec*
Output disk space:	21 × 4 × 4 bytes/fl = 336 bytes

Acceptance:

These polynomial coefficients can be tested by applying them to the ratio $x[\theta_s\times\theta_v,U_{H_2O},\rho_s,\tau^{a1}]$ computed with another RTC, and by comparing the H_2O transmittances (within the 21 shifted MERIS band #9) derived from these polynomial fits with those generated using the same other RTC.

6.11.6.3 Polynomial coefficients for H2O transmittance retrieval at the 15 MERIS wavelengths

Reference: $a_h(b)$, $b_h(b)$, $c_h(b)$, $d_h(b)$, LUT100

[AD-8] Section 6.11.6, GADS field 3.

Dependencies:

LUT076

Tools:

RTC/UPRAD (GAME)
RTC/GAUSS

Procedure:

Inputs: λ 15 MERIS wavelengths [*nm*], *see* Section 6.11.4.3, (LUT076)
k Polynomial coefficient orders [*dl*], k = [0;3]

Output: $a_h[\lambda]$, $b_h[\lambda]$, $c_h[\lambda]$, $d_h[\lambda]$
H_2O transmittance polynomial coefficients for 10 MERIS wavelengths λ [*nm*], {510, 560, 620, 665, 681.25, 708.75, 753.75, 778.75, 865, 885}.

units: [*dl*]

Warning: The process for generating this table is time-consuming. To avoid loosing data in case of a power failure, several temporary binary files are created after few hours of processing: *X.LUT100* and *TH2O.LUT100*. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

Step-1: Compute *Gaussian* angles (n=12) for a total of 78 [$n.(n+1)/2$] indices of ($\theta_s\times\theta_v$) combinations with the RTC/GAUSS. Due to the large time of processing, use only a subset of 21 indices of ($\theta_s\times\theta_v$) combinations to generate this table.

Step-2: Generate TOA normalized radiances $L_{TOA\_14}[\theta_s\times\theta_v,U_{H_2O},\rho_s,\tau^{a1}]$ and $L_{TOA\_15}[\theta_s\times\theta_v,U_{H_2O},\rho_s,\tau^{a1}]$ for a non-absorbing/absorbing H_2O atmosphere over a black/reflective surface with the RTC/UPRAD (GAME).

RTC/UPRAD (GAME) Inputs (LAND)

Variable	***Value***	***Comments***

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	14 and 15	885 *nm* & 900 *nm*
U_{H2O}	1 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 12.0	For GAME computations without H_2O For GAME computations with H_2O
U_{O2}	0	
ESFT	"./INPUT/RKLM_NO", "./INPUT/RKLM_AL"	For case u_{H2O}=1 (without H_2O absorption) For case $u_{H2O}\neq1$ (with H_2O absorption)
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_conti_b14", "./INPUT/sc_conti_b15"	Continental aerosols
$\tau^{a1}(550)$	0.1, 0.3 and 0.6	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Vertical distribution of the aerosols as a decreasing exponential (H_a=2 *km*)
I_s	60	
ρ_s	0, 0.2, 0.4 and 0.6	Only the first value is considered for reducing the computation time
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s, n_v , $n_{\Delta\phi}$	12, 12, 1	Use a loop for 78 θ_sxθ_v combinations only for minimizing the computation time.
θ_s	*Gaussian* angles	Computed with RTC/GAUSS

Variable	***Value***	***Comments***
θ_v	*Gaussian* angles	Computed with RTC/GAUSS
$\Delta\phi$	0	
pol	0	

<u>Note</u>: In order to reduce the computation times, the upwelling TOA radiances will be simulated over a black surface only (which allows to include the oceanic surface cases) and with a subset of 21 indices of (θ_s x θ_v) combinations.

$n(14), \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}$ → RTC/UPRAD (GAME) → $L_{TOA\_14}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}]$

$n(15), \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}$ → RTC/UPRAD (GAME) → $L_{TOA\_15}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a_1}]$

Step-3: Compute the ratio $x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ as follows,

$$x[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] = L_{TOA\_15}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}] \,/\, L_{TOA\_14}[\theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$$

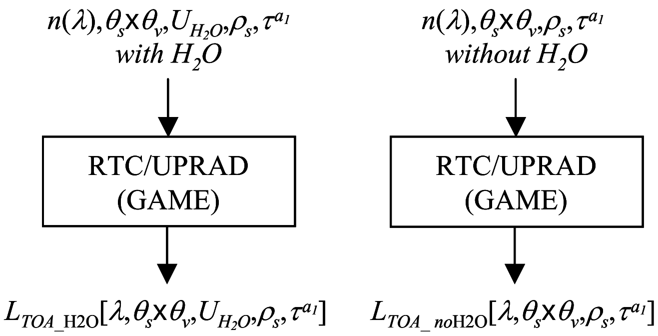
Step-4: Generate TOA normalized radiances with H_2O absorption $L_{TOA\_H2O}[\lambda, \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$ and without H_2O absorption $L_{TOA\_noH2O}[\lambda, \theta_s \times \theta_v, U_{H_2O}, \rho_s, \tau^{a1}]$, over a black surface with the RTC/UPRAD (GAME) for each of the 10 specified MERIS spectral bands $n(\lambda)$.

RTC/UPRAD (GAME) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./INPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	4, 5, 6, 7, 8, 9, 10, 12, 13 and 14	510, 560, 620, 665, 681.25, 708.75, 753.75, 778.75, 865 &885 *nm*
U_{H2O}	1 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 12.0	For GAME computations without H_2O For GAME computations with H_2O
U_{O2}	0	
ESFT	"./INPUT/RKLM_NO", "./INPUT/RKLM_AL"	For case u_{H2O}=1 (without H_2O absorption) For case $u_{H2O}\neq1$ (with H_2O absorption)
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_conti_b*xx*"	Continental aerosols, *xx* depends on $n(\lambda)$
$\tau^{a1}(550)$	0.1, 0.3 and 0.6	
aerosol2	-	
$\tau^{a2}(550)$	0	

Variable	Value	Comments
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Vertical distribution of the aerosols as a decreasing exponential (H_a=2 *km*)
I_s	60	
ρ_s	0, 0.2, 0.4 and 0.6	Only the first value is considered for reducing the computation time
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 1	Use a loop for 78 θ_sxθ_v combinations only for minimizing the computation time.
θ_s	*Gaussian* angles	Computed with RTC/GAUSS
θ_v	*Gaussian* angles	Computed with RTC/GAUSS
$\Delta\phi$	0	
pol	0	

<u>Note</u>: In order to reduce the computation times, the upwelling TOA radiances will be simulated over a black surface only (which allows to include the oceanic surface cases) and with a subset of 21 indices of (θ_s x θ_v) combinations.



Step-5: Compute the H_2O transmittance in the 10 MERIS bands as follows,

$$T_{\mathrm{H2O}}[\lambda,\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}] = L_{TOA\_\mathrm{H2O}}[\lambda,\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}] \,/\, L_{TOA\_no\mathrm{H2O}}[\lambda,\theta_s\mathrm{x}\theta_v,\rho_s,\tau^{a1}]$$

Step-6: Apply a polynomial fit on the ratio $x[\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}]$ as function of the H_2O transmittance in each λ of 10 selected MERIS bands $T_{\mathrm{H2O}}[\lambda,\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}]$, for retrieving polynomial coefficients $a_h[\lambda]$, $b_h[\lambda]$, $c_h[\lambda]$ and $d_h[\lambda]$,

$$\begin{aligned} T_{\mathrm{H2O}}[\lambda,\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}] = \; & a_h[\lambda] \\ & + b_h[\lambda] \,.\, x[\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}] \\ & + c_h[\lambda] \,.\, x[\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}]^2 \\ & + d_h[\lambda] \,.\, x[\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}]^3 \end{aligned}$$

Scientific content:

These sets of polynomial coefficients are useful to compute the residual H_2O absorptions within the 10 selected MERIS band (510, 560, 620, 665, 681.25, 708.75, 753.75, 778.75, 865, and 885 *nm*) whatever the illumination (θ_s) and viewing (θ_v) configuration, whatever the absorber amount, whatever the surface reflectance (ρ_s), and whatever the aerosol optical thickness (τ^{a1}), by using the corresponding H_2O transmittance in the MERIS band #15 (900 *nm*). For the other MERIS bands (412.5, 442.5, 490, 761.875, 900 *nm*) $a_h[\lambda]$ are set to 1 and $b_h[\lambda]$, $c_h[\lambda]$, $d_h[\lambda]$ are set to 0.

Note that here, all the computations are completed for a MLS profile with several water vapor amounts (u_{H2O}), using a continental aerosol model with several aerosol optical thicknesses (τ^{a1}), and over a black surface (ρ_s=0) for reducing the computation times.

Resources:

Estimated CPU time:	39767 *sec*
Output disk space:	15 × 4 × 4 bytes/fl = 240 bytes

Acceptance:

These polynomial coefficients can be tested by applying them to the ratio $x[\theta_s\mathrm{x}\theta_v,U_{H_2O},\rho_s,\tau^{a1}]$ computed with another RTC, and by comparing the H_2O transmittances (within each of these 10 selected MERIS bands) derived from these polynomial fits with those generated using the same other RTC.

6.11.7 GADS Rayleigh Scattering Function

6.11.7.1 Fourier series terms of polynomial coefficients for multiplicative Rayleigh scattering function retrieval

Reference: Rayscatt_coef_LUT, LUT101

[AD-8] Section 6.11.7, GADS field 1, 2 & 3.

Dependencies:

LUT075, LUT080, LUT081

Tools:

RTC/UPRAD (SO)
Polynomial fit

Procedure:

Inputs:

	τ^R	*Rayleigh* optical thickness [*dl*], *see* Section 6.11.4.2, (LUT075)
	θ	*Gaussian* angle [*deg*], *see* Section 6.11.4.7, (LUT080)
	$\theta_s \times \theta_v$	Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.11.4.8, (LUT081)
	s	*Fourier* series term [*dl*], s = [0;2]
	k	Polynomial coefficient order [*dl*], k = [0;3]

Output: $Rayscatt\_coef\_LUT[s,\theta_s \times \theta_v,k]$

Fourier series terms of multiplicative *Rayleigh* scattering function polynomial coefficients as function of the acceptable combinations (sun/view zenith angles)

units: [*dl*]

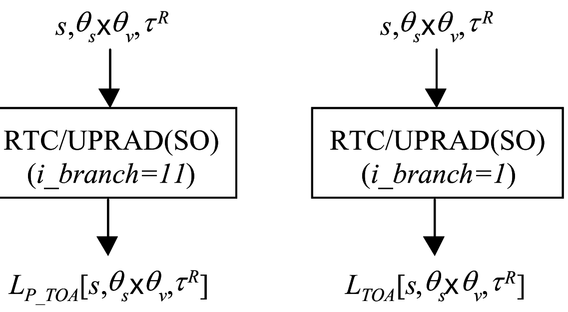
Warning: One temporary file is created during the procedure: *RayFactor.LUT101*. If we want fully restart the generation procedure, then the temporary binary file should be first deleted before relaunching the process.

Step-1: Compute the normalized TOA radiances $L_{TOA}[s,\theta_s \text{x} \theta_v,\tau^R]$ and the primary scattering radiance $L_{P\_TOA}[s,\theta_s \text{x} \theta_v, \tau^R]$ for the first 3 *Fourier* series terms (s varying between 0 and I_s=2) and the last *Fourier* series term (I_s=79), computed with the RTC/UPRAD (SO) for a pure *Rayleigh* atmosphere over a black surface.

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1 and 11	1 for L_{TOA}, and 11 for L_{P_TOA}
$n(\lambda)$	1	412.5 *nm*
U_{H2O}	0	
U_{O2}	0	
ESFT		N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	*see* Section 6.11.4.2
aerosol1	-	
$\tau^{a1}(550)$	0	

Variable	Value	Comments
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	0, 1, 2 79	For *i_branch* = 11 For *i_branch* = 1
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 1	Use a loop for 78 θ_sxθ_v combinations only for minimizing the computation time
θ_s	*see* inputs	*see* Section 6.11.4.7 and Section 6.11.4.8
θ_v	*see* inputs	*see* Section 6.11.4.7 and Section 6.11.4.8
$\Delta\phi$	0	
pol	1	



Step-2: Compute the multiplicative *Rayleigh* scattering function $f_R[s,\theta_s\times\theta_v,\tau^R]$, as follows,

$$f_R[s,\theta_s\times\theta_v,\tau^R] = L_{TOA}[s,\theta_s\times\theta_v,\tau^R] \,/\, L_{P\_TOA}[s,\theta_s\times\theta_v,\tau^R]$$

Step-3: Apply a polynomial fit on the multiplicative *Rayleigh* scattering function $f_R[s,\theta_s\times\theta_v,\tau^R]$ as function of the *Rayleigh* optical thickness (τ^R) for retrieving polynomial coefficients *Rayscatt_coef_LUT*$[s,\theta_s\times\theta_v,k]$,

$$\begin{aligned} f_R[s,\theta_s\times\theta_v,\tau^R] = \; & Rayscatt\_coef\_LUT[s,\theta_s\times\theta_v,0] \\ & + Rayscatt\_coef\_LUT[s,\theta_s\times\theta_v,1] \,.\, (\tau^R) \\ & + Rayscatt\_coef\_LUT[s,\theta_s\times\theta_v,2] \,.\, (\tau^R)^2 \\ & + Rayscatt\_coef\_LUT[s,\theta_s\times\theta_v,3] \,.\, (\tau^R)^3 \end{aligned}$$

Scientific content:

These sets of polynomial coefficients are useful to compute the multiplicative *Rayleigh* scattering function whatever the illumination (θ_s) and viewing (θ_v) configuration, whatever the *Rayleigh* optical thickness (τ^R), and for each *Fourier* series (s) term used in the *Fourier* series expansion of the TOA normalized radiance. This multiplicative *Rayleigh* scattering function is then used to correct the *Rayleigh* primary TOA radiance for the multiple scattering.

Note:

To reduce the size of the LUT related to the *Rayleigh* reflectance (ρ_R) computations, the latter is expanded into a *Fourier* series to cancel the azimuthal dependence,

$$\rho_R(\vartheta_s,\vartheta_v,\Delta\phi) = \sum_{s=0}^{2}(2-\delta_{0,s}) \,.\, \rho_R^{(s)}(\vartheta_s,\vartheta_v) \,.\, \cos(s.\Delta\phi)$$

with $\delta_{0,s}$ the *Dirac*'s function, and the scattering phenomenon for each *Fourier* series term s is treated as a primary scattering term $\rho_{R,P}^{(s)}$ corrected by a multiplicative function $f_R^{(s)}$ which accounts for the multiple scattering. Thus the *Rayleigh* reflectance $\rho_R^{(s)}$ for each *Fourier* series term s is written as:

$$\rho_R^{(s)}(\vartheta_s,\vartheta_v,\tau^R) = \rho_{R,P}^{(s)}(\vartheta_s,\vartheta_v,\tau^R) \,.\, f_R^{(s)}(\vartheta_s,\vartheta_v,\tau^R)$$

where $\rho_{R,P}^{(s)}$, the primary scattering reflectance for *Rayleigh*, is determined in the atmospheric correction algorithm over land. Note that the *Rayleigh* scattering functions $(f_R^{(s)})$ are pre-computed as function of *Rayleigh* optical thickness (τ^R) instead of the MERIS wavelength (λ) because of the barometric pressure variation with the terrain elevation.

The multiplicative *Rayleigh* scattering function $(f_R^{(s)})$ for each of the first 3 *Fourier* series terms (s) is then deduced by simulating $\rho_R^{(s)}$ with the RTC/UPRAD(SO) and computing $\rho_{R,P}^{(s)}$ as:

$$\rho_{R,P}^{(s)}(\vartheta_s,\vartheta_v,\tau^R) = P_R^{(s)}(\vartheta_s,\vartheta_v) \,.\, \frac{(1-e^{-M.\tau_R})}{4\,.\,(\cos\vartheta_s + \cos\vartheta_v)}$$

with M the airmass and $P_R^{(s)}$ the *Rayleigh* phase function for each *Fourier* series term s expressed as:

$$\begin{cases} P_R^{(0)}(\vartheta_s,\vartheta_v) = \dfrac{3A}{4}.\left(1+\cos^2\vartheta_s\,.\cos^2\vartheta_v + \dfrac{\sin^2\vartheta_s\,.\sin^2\vartheta_v}{2}\right)+B \\ P_R^{(1)}(\vartheta_s,\vartheta_v) = -\dfrac{3A}{8}.\cos\vartheta_s\,.\cos\vartheta_v\,.\sin\vartheta_s\,.\sin\vartheta_v \\ P_R^{(2)}(\vartheta_s,\vartheta_v) = \dfrac{3A}{16}.\sin^2\vartheta_s\,.\sin^2\vartheta_v \end{cases}$$

A and B are the 2 coefficients which account for the molecular asymmetry, $A = 0.9587256$, $B = 1 - A$ (*see* Section 6.11.4.9 and [RD-5]).

A third order polynomial fit (k = [0;3]) as function of τ^R has then been applied on the set of multiplicative *Rayleigh* scattering functions $(f_R^{(s)})$ determined for each of the first 3 *Fourier* series terms (s = [0;2]):

$$f_R^{(s)}(\vartheta_s,\vartheta_v,\tau^R) = \sum_{k=0}^{3} C_i^{(s)}(\vartheta_s,\vartheta_v)\,.\,(\tau^R)^i$$

with $C_k^{(s)}$ the polynomial coefficients for the *Fourier* series term s.

Moreover, the multiplicative *Rayleigh* scattering function (f_R) will be computed by recombining the first 3 *Fourier* series terms as follows:

$$f_R(\vartheta_s,\vartheta_v,\Delta\phi,\tau^R) = \sum_{s=0}^{2}(2-\delta_{0,s})\,.\,f_R^{(s)}(\vartheta_s,\vartheta_v,\tau^R)\,.\cos(s.\Delta\phi)$$

Resources:

Estimated CPU time: 691 *sec*
Output disk space: 3 × 78 × 4 × 4 bytes/fl = 3744 bytes

Acceptance:

These polynomial coefficients can be tested by comparing the derived multiplicative *Rayleigh* scattering functions to those generated with another RTC based on the *Fourier* series expansion of the radiative transfer equation.

6.11.8 GADS Rayleigh Spherical Albedo

6.11.8.1 Rayleigh spherical albedo, $S_R(\tau^R)$

Reference: Rayalb_LUT, LUT102

[AD-8] Section 6.11.8, GADS field 1.

Dependencies:

LUT075

Tools:

RTC/UPRAD (SO)
RTC/GAUSS
Polynomial fit

Procedure:

Input: τ^R *Rayleigh* optical thickness, *see* Section 6.11.4.2 (LUT075)

Output: $Rayalb\_LUT[\tau^R]$
Rayleigh spherical albedo (17 values)

units: [*dl*]

Step-1: Compute *Gaussian* angles (n=24) and associated weights $w[\mu]$ with the RTC/GAUSS.

Step-2: Calculate the *Rayleigh* transmittance $T_R[\tau^R,\mu_s]$ corresponding to the first order of *Legendre* decomposition ($I_s=0$) of phase function with the RTC/UPRAD (SO). For extracting the total atmospheric transmittance, we need to set $I_s=0$ and $\theta_v=-1$. μ_s is defined as $\cos(\theta_s)$.

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1	412.5 *nm*
U_{H2O}	0	
U_{O2}	0	
ESFT		N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	*see* Section 6.11.4.2
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A

Variable	*Value*	*Comments*
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	0	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	24, 1, 1	Use a loop for 24 θ_s.
θ_s	*Gaussian* angles	Computed with RTC/GAUSS
θ_v	-1	To get the total atmospheric transmittance
$\Delta\phi$	0	
pol	1	

Step-3: Compute the *Rayleigh* spherical albedo *Rayalb_LUT*[τ^R] as follows, knowing that μ=cos(θ_s),

$$Rayalb\_LUT[\tau^R] = 1 - 2 . \int_0^1 T_R[\tau^R, \mu] . w[\mu] . \mu . d\mu$$

Scientific content:

The *Rayleigh* spherical albedo *Rayalb_LUT* is used in the atmospheric correction algorithm over land, and is precomputed with a RTC for a set of *Rayleigh* optical thicknesses.

Resources:

Estimated CPU time: 17 *sec*
Output disk space: 17 × 4 bytes/fl = 68 bytes

Acceptance:

Comparison of these *Rayleigh* spherical albedos with those computed with another RTC.

6.11.9 ADS O2 Transmission around 778.75 nm

6.11.9.1 O2 transmittances around 778.75 nm (21 shifted filters)

Reference: TO2[λ', L_{779}, θ_s, θ_v, $\Delta\phi$], LUT099

[AD-8] Section 6.11.6, GADS field 1.

FUB/ACRI provided

Dependencies:

LUT085, LUT086, LUT087, LUT088, LUT095

Tool:

Neural Network

Procedure:

Inputs:	λ'	21 reference wavelengths [*nm*] corresponding to the 21 spectral shifts ($\Delta\lambda$) of $\pm 0.1\,nm$ applied on the MERIS O_2 filter centred at $778.5\,nm$, *see* Section 6.11.4.11, (LUT095)
	L_{779}	25 normalized radiances at $778.75\,nm$ [sr^{-1}], *see* Section 6.11.4.12, (LUT085)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.11.4.13, (LUT086)
	θ_v	Viewing zenith angle [*deg*], *see* Section 6.11.4.14, (LUT087)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.11.4.15, (LUT088)

Output: TO2[λ', L_{779}, θ_s, θ_v, $\Delta\phi$]
O_2 transmittances around 778.75 *nm*

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

TO2[λ', L_{779}, θ_s, θ_v, $\Delta\phi$] correspond to the residual O_2 absorption within the MERIS band #12 ($778.75\,nm$), accounting for the smile effect (21 shifted filters (λ')), the normalized radiance at $778.75\,nm$ (25 values of L_{779}) and whatever the illumination and viewing geometry (θ_s, θ_v, $\Delta\phi$). Note that the set of 25 values of L_{779} have been pre-computed with RTC/MOMO for a set of surface reflectances (ρ_s), a set of surface pressures (P_s), and a set of aerosol optical thicknesses (τ^{a1}).

Resources:

Estimated CPU time: -

Output disk space: $21 \times 25 \times 15 \times 10 \times 19 \times 4$ bytes/fl = 5985000 bytes

Acceptance:

Corresponds to the latest definition.

6.11.10 ADS Apparent Pressure Parameters

6.11.10.1 O2 Rayleigh transmittances around 778.75 nm (21 shifted filters)

Reference: TO2_ray[λ', θ_s, θ_v], LUT103

[AD-8] Section 6.11.10, GADS field 1.

FUB/ACRI provided

Dependencies:

LUT471, LUT472

Tool:

Neural Network

Procedure:

Inputs:

Inputs:	λ'	21 reference wavelengths [*nm*] corresponding to the 21 spectral shifts ($\Delta\lambda$) of $\pm 0.1\,nm$ applied on the MERIS O_2 filter centred around $761.7\,nm$, *see* Section 6.11.4.26, (LUT471)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.11.4.29, (LUT472)
	θ_v	Viewing zenith angle [*deg*], *see* Section 6.11.4.29, (LUT472)

Output: TO2_ray[λ', θ_s, θ_v]
O_2 Rayleigh transmittances around $778.75\,nm$

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

TO2_ray[λ', θ_s, θ_v] corresponds to the residual O_2 absorption within the MERIS band #12 ($778.75\,nm$) over a flat black surface, including the molecular scattering effects and accounting for the smile effect (21 shifted filters (λ')) whatever the illumination and viewing geometry (θ_s, θ_v).

Resources:

Estimated CPU time: -
Output disk space: 21 × 24 × 24 × 4 bytes/fl = 48384 bytes

Acceptance:

Corresponds to the latest definition.

6.11.10.2 O2 aerosol transmittances around 778.75 nm (21 shifted filters; Ha=2 km)

Reference: TO2_aer[λ', θ_s, θ_v], LUT104

[AD-8] Section 6.11.10, GADS field 2.

FUB/ACRI provided

Dependencies:

LUT471, LUT472

Tool:

Neural Network

Procedure:

Inputs:

λ'	21 reference wavelengths [*nm*] corresponding to the 21 spectral shifts ($\Delta\lambda$) of $\pm 0.1\,nm$ applied on the MERIS O_2 filter centred around 761.7 *nm*, *see* Section 6.11.4.26, (LUT471)
θ_s	Solar zenith angle [*deg*], *see* Section 6.11.4.29, (LUT472)
θ_v	Viewing zenith angle [*deg*], *see* Section 6.11.4.29, (LUT472)

Output: TO2_aer[λ', θ_s, θ_v]
O_2 aerosol transmittances around 778.75 *nm*

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

TO2_aer[λ', θ_s, θ_v] correspond to the residual O_2 absorption within the MERIS band #12 (778.75 *nm*) over a flat black surface, including the aerosol scattering effects and accounting for the smile effect (21 shifted filters (λ')) whatever the illumination and viewing geometry (θ_s, θ_v). An aerosol scale height (H_a) of 2 *km* has been selected to generate these transmittances.

Resources:

Estimated CPU time: -
Output disk space: 21 × 24 × 24 × 4 bytes/fl = 48384 bytes

Acceptance:

Corresponds to the latest definition.

6.11.10.3 O2 aerosol Fresnel transmittances around 778.75 nm (21 shifted filters; Ha=2 km)

Reference: TO2_aer_Fresnel[λ', θ_s, θ_v], LUT105

[AD-8] Section 6.11.10, GADS field 3.

FUB/ACRI provided

Dependencies:

LUT471, LUT472

Tool:

Neural Network

Procedure:

Inputs:
- λ' — 21 reference wavelengths [*nm*] corresponding to the 21 spectral shifts ($\Delta\lambda$) of $\pm 0.1\,nm$ applied on the MERIS O_2 filter centred around $761.7\,nm$, *see* Section 6.11.4.26, (LUT471)
- θ_s — Solar zenith angle [*deg*], *see* Section 6.11.4.29, (LUT472)
- θ_v — Viewing zenith angle [*deg*], *see* Section 6.11.4.29, (LUT472)

Output: TO2_aer_Fresnel[λ', θ_s, θ_v]
O_2 aerosol *Fresnel* transmittances around $778.75\,nm$

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

TO2_aer_Fresnel[λ', θ_s, θ_v] correspond to the residual O_2 absorption within the MERIS band #12 ($778.75\,nm$) of the *Fresnel* reflection contribution over a flat black surface, including the aerosol scattering effects and accounting for the smile effect (21 shifted filters (λ')) whatever the illumination and viewing geometry (θ_s, θ_v). An aerosol scale height (H_a) of $2\,km$ has been selected to generate these transmittances.

Resources:

Estimated CPU time: -
Output disk space: 21 × 24 × 24 × 4 bytes/fl = 48384 bytes

Acceptance:

Corresponds to the latest definition.

6.11.10.4 O2 atmospheric transmittances around 778.75 nm (21 shifted filters; 21 layers; Ha=2 km)

Reference: TO2_atm[λ', P_k, θ_s, θ_v], LUT107

[AD-8] Section 6.11.10, GADS field 4.

FUB/ACRI provided

Dependencies:

LUT471, LUT472, LUT473

Tool:

Neural Network

Procedure:

Inputs:

Inputs:	λ'	21 reference wavelengths [nm] corresponding to the 21 spectral shifts ($\Delta\lambda$) of $\pm 0.1\,nm$ applied on the MERIS O_2 filter centred around $761.7\,nm$, *see* Section 6.11.4.26, (LUT471)
	P_k	21 reference pressure levels [hPa], *see* Section 6.11.4.30, (LUT473)
	θ_s	Solar zenith angle [deg], *see* Section 6.11.4.29, (LUT472)
	θ_v	Viewing zenith angle [deg], *see* Section 6.11.4.29, (LUT472)

Output: TO2_atm[λ', P_k, θ_s, θ_v]
O_2 atmospheric transmittances around 778.75 nm

units: [dl]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

$TO2\_atm[\lambda', P_k, \theta_s, \theta_v]$ correspond to the residual O_2 absorption within the MERIS band #12 (778.75 nm) over a flat black surface, including the aerosol and *Rayleigh* scattering effects and accounting for the smile effect (21 shifted filters (λ')) whatever the illumination and viewing geometry (θ_s, θ_v) and the pressure level (21 values of P_k). An aerosol scale height (H_a) of 2 km has been selected to generate these transmittances.

Resources:

Estimated CPU time: -
Output disk space: 21 ×21 × 24 × 24 × 4 bytes/fl = 1016064 bytes

Acceptance:

Corresponds to the latest definition.

6.11.11 (Spare)

Reference:

[AD-8] Section 6.11.11

6.11.12 ADS Rayleigh Reflectance Over Ocean

This LUT can be generated with both the 2 RTCs (FUB & UdL). Consequently, two recipes are proposed hereafter to generate this LUT either with the RTC/FUB (without polarization) or with the RTC/UdL(SO) including the polarization processes (used for the current MERIS reprocessing).

6.11.12.1 Rayleigh reflectance over ocean

6.11.12.1.1 FUB Recipe

Reference: $\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]$, LUT110

[AD-8] Section 6.11.12, GADS fields 1, 2 & 3

Dependencies:

LUT076, LUT077, LUT078, LUT079, LUT92, LUT93, LUT410

Tools:

RTC/MOMO (FUB)
Multi-linear interpolation

Procedure:

Inputs: λ MERIS wavelength [nm], *see* Section 6.11.4.3, (LUT076)

w_s	Wind-speed [$m.s^{-1}$] above sea level, *see* Section 6.11.4.20, (LUT093)
θ_s	Solar zenith angle [*deg*], *see* Section 6.11.4.4, (LUT077).
θ_v	Viewing zenith angle [*deg*], *see* Section 6.11.4.5, (LUT078).
$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.11.4.6, (LUT079).
P_s	Surface pressure [*hPa*], *see* Section 6.11.4.19, (LUT092).
τ^R	*Rayleigh* optical thickness [*dl*], *see* Section 6.11.1.1, (LUT410)

Output: $\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$

Rayleigh reflectance over ocean as function of the MERIS wavelength (λ), the wind-speed above sea level (w_s), and the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Step-1: Generate TOA normalized *Rayleigh* radiance $L_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]$ for a pure *Rayleigh* atmosphere over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10 $m.s^{-1}$) with the RTC/MOMO.

Note: The sun glint (*i.e.*, direct to direct contribution) is accounted for in $L_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]$.

RTC/MOMO Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./up_out/uprad_out"	
i_branch	2	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.11.4.3
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	*see* Section 6.11.4.19
$\tau^R(\lambda)$	tauR	*see* Section 6.11.1.1
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
$\tau^{c1}(550)$	0	
cloud2	-	N/A
$\tau^{c2}(550)$	0	
cloud3	-	N/A

Variable	***Value***	***Comments***
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./sca_vert/vtp1_lut110"	Vertical profile with 12 atmospheric layers
I_s	70	
ρ_s	0	
E_o	1	
$\sigma^{w}_{a,\lambda}$	99	
w_s	1.5, 5.0 and 10	*see* Section 6.11.4.20
n_s , n_v , $n_{\Delta\phi}$	16, 10, 25	
$\theta_s^{'}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\theta_v^{'}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\Delta\phi$	*see* inputs	*see* Section 6.11.4.6

$$n(\lambda),\ w_s,\ \theta_s',\ \theta_v',\ \Delta\phi$$

$$\downarrow$$

$$\boxed{\begin{array}{l}\text{RTC/MOMO}\\ (\ i\_branch{=}2;\\ \ \tau^{a}=0\ ;\ \rho_s=0\ )\end{array}}$$

$$\downarrow$$

$$L_R(\lambda,\ w_s,\ \theta_s',\ \theta_v',\ \Delta\phi\ )$$

Step-2: Compute the *Rayleigh* reflectance $\rho_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]$ as follows,

$$\rho_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi] = \pi\ .\ \frac{L_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]}{\cos(\theta_s^{'})}$$

Step-3: Remove the sun glint reflectance at TOA (ρ_{G_TOA}) from the *Rayleigh* reflectance (only for the case where $w_s \neq 0$). This is achieved by following this procedure:

In the *Cox and Munk* surface representation (*see* [RD-7] for more details), the probability density function of facet slopes $p(\theta_s^{'},\theta_v^{'},\Delta\phi)$ for the illumination and viewing configurations $(\theta_s^{'},\theta_v^{'},\Delta\phi)$ is expressed as:

$$p(\theta_s^{'},\theta_v^{'},\Delta\phi) = \frac{1}{\pi\,\sigma^2}\,.\exp\left(\frac{-\tan^2\beta}{\sigma^2}\right)$$

where β, the angle between the local normal and the normal to the facet, is defined as,

$$\cos\beta = \frac{\cos\theta_s^{'} + \cos\theta_v^{'}}{2\,\cos\omega}$$

with $$\cos 2\omega = \cos\theta_s^{'}\,.\cos\theta_v^{'} - \sin\theta_s^{'}\,.\sin\theta_v^{'}\,.\cos\Delta\phi$$

and σ the root mean square of facet slopes (which are generated by the wind-speed w_s just above sea surface) is written as,

$$\sigma^2 = 0.003 + 5.12\;\;10^{-3}.\,w_s$$

The sunglint ρ_G (*i.e.*, the specular reflection of the sunlight over the ocean waves) just above sea level is then computed as:

$$\rho_G(w_s,\theta_s^{'},\theta_v^{'},\Delta\phi) = \rho_F(\omega)\,.\frac{\pi\,.\,p(\theta_s^{'},\theta_v^{'},\Delta\phi)}{4\,.\cos\theta_s^{'}\,\cos\theta_v^{'}\,\cos^4\beta}$$

where $\rho_F(\omega)$ is the *Fresnel* reflectance at the *air-sea* interface for an angle ω given by

$$\begin{cases} \rho_F(\omega) = \dfrac{1}{2}\cdot\left[\left(\dfrac{\sin(\omega-\vartheta_t)}{\sin(\omega+\vartheta_t)}\right)^2 + \left(\dfrac{\tan(\omega-\vartheta_t)}{\tan(\omega+\vartheta_t)}\right)^2\right] & \mathit{for}\ \omega \neq \vartheta_t \\ \rho_F(\omega) = \left(\dfrac{n_w - 1}{n_w + 1}\right)^2 & \mathit{for}\ \omega = \vartheta_t \end{cases}$$

with $\vartheta_t = \arcsin(\sin\omega / n_w)$, and n_w the water refractive index (n_w=1.34).

Finally, the sun glint reflectance at TOA (ρ_{G_TOA}) is expressed as:

$$\rho_{G\_TOA}(w_s,\theta_s^{'},\theta_v^{'},\Delta\phi) = \rho_G(w_s,\theta_s^{'},\theta_v^{'},\Delta\phi)\,.\,T(\theta_s^{'})\,.\,T(\theta_v^{'})$$

where T(θ) is the direct atmospheric transmittance for the zenith angle θ defined as,

$$T(\theta) = e^{-\tau/\cos(\theta)}$$

with τ the total optical thickness (*Rayleigh* + aerosols + O_3 + *etc.*).

Step-4: Apply a multi-linear interpolation to output the *Rayleigh* reflectance $\rho_R\,[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]$ into the input angular grid in (θ_s, θ_v):

$$\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi] = interpolation(\rho_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi\,])$$

and build the *Rayleigh* reflectance $\rho_R[\lambda,ws,\theta_s,\theta_v,\Delta\phi]$ for all parameters.

Scientific content:

$\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ describes the *Rayleigh* reflectances simulated at each of the 15 MERIS wavelengths over 3 wind-roughened black sea surfaces (w_s =1.5, 5.0 and 10 $m.s^{-1}$), for various illumination and viewing conditions, and a standard atmospheric pressure (1013.25 *hPa*). The boundary condition is a black (*Fresnel* reflecting) ocean. Note that the sun glint component at TOA has been removed from these *Rayleigh* reflectances.

Resources:

Estimated CPU time: 1024 *sec*
Output disk space: 23 × 3 × 15 × 13 × 25 × 4 bytes/fl = 1345500 bytes

Note that the storage of this table is completed using different records for each θ_s tabulated value (*see* [AD-8] for exact structure).

Acceptance:

Comparison with another RTC that does not account for the polarization processes.

6.11.12.1.2 UdL Recipe

Reference: $\rho_R[\lambda,\, w_s,\, \theta_s,\, \theta_v,\, \Delta\phi]$, LUT110

[AD-8] Section 6.11.12, GADS fields 1, 2 & 3

Dependencies:

LUT076, LUT077, LUT078, LUT079, LUT92, LUT93, LUT410

Tool:

RTC/UPRAD (SO)

Procedure:

Inputs:	λ	MERIS wavelength [*nm*], *see* Section 6.11.4.3, (LUT076)
	w_s	Wind-speed [$m.s^{-1}$] above sea level, *see* Section 6.11.4.20, (LUT093)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.11.4.4, (LUT077).

θ_v Viewing zenith angle [*deg*], *see* Section 6.11.4.5, (LUT078).
$\Delta\phi$ Relative azimuth angle [*deg*], *see* Section 6.11.4.6, (LUT079).
P_s Surface pressure [*hPa*], *see* Section 6.11.4.19, (LUT092).
τ^R *Rayleigh* optical thickness [*dl*], *see* Section 6.11.1.1, (LUT410)

Output: $\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$
Rayleigh reflectance over ocean as function of the MERIS wavelength (λ), the wind-speed above sea level (w_s), and the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Step-1: Generate TOA normalized *Rayleigh* radiance $L_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ for a pure *Rayleigh* atmosphere over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10$m.s^{-1}$) with the RTC/UPRAD (SO). The sun glint (*i.e.*, the direct to direct contribution) is not accounted for in $L_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$.

Note: An internal sun glint flag has been desactivated in the RTC/SO for excluding the direct to direct contribution in the computation of TOA normalized radiance.

RTC/UPRAD (SO) Inputs (OCEAN)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	2	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.11.4.3
U_{H2O}	0	
U_{O2}	0	
ESFT	-	
P_s	1013.25	*see* Section 6.11.4.19
$\tau^R(\lambda)$	tauR	*see* Section 6.11.1.1
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A

Variable	***Value***	***Comments***
spm	-	N/A
$\sigma_{e,\lambda}^{spm}$	-	N/A
$\omega_{o,\lambda}^{spm}$	-	N/A
$\sigma_{e,\lambda}^{ys}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	79	
ρ_s	0	
E_o	1	
$\sigma_{e,\lambda}^{w}$	-	N/A
$\omega_{o,\lambda}^{w}$	-	N/A
w_s	1.5, 5.0 and 10	*see* Section 6.11.4.20
n_s , n_v , $n_{\Delta\phi}$	16, 10, 25	
θ_s	*Gaussian* angles	Selected from a *Gauss* quadrature; *see* Section 6.11.4.4
θ_v	*Gaussian* angles	Selected from a *Gauss* quadrature; *see* Section 6.11.4.5
$\Delta\phi$	see inputs	*see* Section 6.11.4.6
pol	1	

$n(\lambda), w_s, \theta_s, \theta_v, \Delta\phi$

↓

RTC/UPRAD(SO)
(*i_branch*=2;
τ^a=0; ρ_s=0)

↓

$L_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]$

Step-2: Compute the *Rayleigh* reflectance $\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ as follows,

$$\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi] = \pi \,.\, \frac{L_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]}{\cos(\theta_s)}$$

Scientific content:

$\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ describes the *Rayleigh* reflectances simulated at each of the 15 MERIS wavelengths over 3 wind-roughened black sea surfaces (w_s =1.5, 5.0 and 10$m.s^{-1}$), for various illumination and viewing conditions, and a standard atmospheric pressure (1013.25hPa). The boundary condition is a black (*Fresnel* reflecting) ocean. Note that the sun glint component at TOA has been removed from these *Rayleigh* reflectances.

Resources:

Estimated CPU time: 259 *sec*
Output disk space: 23 × 3 × 15 × 13 × 25 × 4 bytes/fl = 1345500 bytes
Note that the storage of this table is completed using different records for each θ_s tabulated value (*see* [AD-8] for exact structure).

Acceptance:

Comparison with another RTC that does account for the polarization processes.

6.11.13 ADS Photosynthetically Active Radiation

6.11.13.1 Photosynthetically active radiation, $PAR(\alpha, U_{H2O}, U_{O3}, \tau^a)$

Reference: PAR[α, u_{O3}, τ^a, u_{H2O}], LUT111

[AD-8] Section 6.11.13, GADS field 1.

ACRI provided

Dependencies:

LUT94, LUT305, LUT306, LUT307

Tool:

None

Procedure:

Input:
- α — *Angstroem* exponent, *see* Section 6.11.4.22 (LUT305)
- u_{H2O} — water vapor amount [$g.cm^{-2}$], *see* Section 6.11.4.25, (LUT094)
- u_{O3} — ozone amount [*DU*], *see* Section 6.11.4.23, (LUT306)
- τ^a — aerosol optical thickness at 865 *nm* [*dl*], *see* Section 6.11.4.24, (LUT307)

Output: $PAR[\alpha, u_{O3}, \tau^a, u_{H2O}]$
Photosynthetically available radiation as function of the *Angström* exponent, the ozone amount, the aerosol optical thickness, and the water vapor content.
units: [$\mu Einstein/m^2/s$]

Step: User specified.

Resources:

Estimated CPU time: -
Output disk space: 20 × 20 × 20 × 20 × 4 bytes/fl = 640000 bytes

Acceptance:

Corresponds to the latest definition.

6.12 WATER-VAPOUR PARAMETERS

6.12.1 C.P.

None

6.12.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.12.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.12.4 GADS General

6.12.4.1 Solar zenith angles

Reference: SZA, LUT112

[AD-8] Section 6.12.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angle (27 values of θ_s)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 27 solar zenith angles (θ_s) regularly spaced

Current baseline: 27 θ_s values within [15;80] *deg*., with a step of 2.5 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 27 × 4 bytes/ul = 108 bytes

Acceptance:

Corresponds to the latest definitions

6.12.4.2 View zenith angles

Reference: VZA, LUT113

[AD-8] Section 6.12.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA* View zenith angle (18 values of θ_v)
units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 18 view zenith angles (θ_v) regularly spaced

Current baseline: 18 θ_v values within [0;42.5] *deg*., with a step of 2.5 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 18 × 4 bytes/ul = 72 bytes

Acceptance:

Corresponds to the latest definitions

6.12.4.3 Relative azimuth angles

Reference: RAA, LUT114

[AD-8] Section 6.12.4, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle (25 values of $\Delta\phi$)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 25 relative azimuth angle ($\Delta\phi$) regularly spaced

Current baseline: 25 $\Delta\phi$ values within [0;180] *deg*., with a step of 7.5 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 25 × 4 bytes/ul = 100 bytes

Acceptance:

Corresponds to the latest definitions

6.12.4.4 Threshold value on radiance at 885 nm for marking pixel as invalid for water vapour processing

Reference: inv_WV, LUT115

[AD-8] Section 6.12.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *inv_WV* Threshold value on the radiance at 885 nm ($L_{\mathrm{Thresh}}^{885}$) from which the water vapor content cannot be retrieved.

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

inv_WV represents the threshold value on the radiance at 885 nm ($L_{\mathrm{Thresh}}^{885}$) from which the water vapor content cannot be retrieved. In the water vapor retrieval algorithm, all the pixels, for which the radiance at 885 nm is lower than this threshold value, will be systematically discarded from the water vapor retrieval processing.

Current baseline: 310 $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

According to the MERIS sensor specifications.

6.12.4.5 Minimum threshold for out of range output value of water vapour content

Reference: out_Min, LUT116

[AD-8] Section 6.12.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *out_Min* Acceptable minimum value of water vapor content ($u_{\mathrm{H2O}}^{\min}$) retrieved from the algorithm

units: [$g.cm^{-2}$]

Step: User specified.

Scientific content:

out_Min corresponds to the lowest acceptable value of water vapor content ($u_{\mathrm{H2O}}^{\min}$) retrieved from the algorithm. Pixels for which the retrieved water vapor content is lower than this threshold, are set to *out_Min*.

Current baseline: 0.1 $g.cm^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.6 Maximum threshold for out of range output value of water vapour content

Reference: out_Max, LUT117

[AD-8] Section 6.12.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *out_max* Acceptable maximum value of water vapor content ($u_{\mathrm{H2O}}^{\max}$) retrieved from the algorithm

units: [$g.cm^{-2}$]

Step: User specified.

Scientific content:

out_ Max corresponds to the highest acceptable value of water vapor content ($u_{\mathrm{H2O}}^{\max}$) retrieved from the algorithm. Pixels for which the retrieved water vapor content is larger than this threshold, are set to *out_Min*.

Current baseline: 7 $g.cm^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.7 Sun irradiances at 778.75 nm, 865 nm, 885nm and 900 nm (consistent with cloud LUTs)

Reference: Eo_779, Eo_865, Eo_885, Eo_900 LUT118

[AD-8] Section 6.12.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Outputs: E_o^{779}, E_o^{865}, E_o^{885}, E_o^{900}

Extraterrestrial solar irradiances respectively at 778.75 nm (band#12), 865.00 nm (band#13), 885.00 nm (band#14) and 900.00 nm (band#15), not corrected for *Sun-Earth* distance (d).

units: $[W.m^{-2}.\mu m^{-1}]$

Step: User specified.

Scientific content:

Set of 4 extraterrestrial solar irradiances (E_o^{779}, E_o^{865}, E_o^{885}, E_o^{900}) in MERIS band#12 (778.755 nm), #13 (865.00 nm), #14 (885.00 nm) and 15 (900.00 nm) resepctively, are used in the water vapour retrieval algorithm to convert radiances into reflectances. Note that these solar irradiances are not corrected for the *Sun-Earth* distance (d).

Current baseline: {1193.696, 967.772, 926.348, 894.569} $W.m^{-2}.\mu m^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 4 × 4 bytes/fl = 16 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.8 Aerosol optical thicknesses at 885 nm

Reference: AOT885, LUT119

[AD-8] Section 6.12.4, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: τ_o^a Aerosol optical thickness at $885\,nm$ (20 values)

units: $[dl]$

Step: User specified.

Scientific content:

Set of 20 pre-selected aerosol optical thicknesses at $885\,nm$ (τ_o^a) used in the water vapour retrieval algorithm

Current baseline: [0.03;0.60] by step of 0.03

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 bytes/fl = 80 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.9 Surface albedos

Reference: Salb, LUT120

[AD-8] Section 6.12.4, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: S^{o}_{alb} Surface albedo (10 values)

units: [dl]

Step: User specified.

Scientific content:

Set of 10 pre-selected surface albedo (S^{o}_{alb}) used in the water vapour retrieval algorithm

Current baseline: [0;0.9] by step of 0.1

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/fl = 40 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.10 Cloud optical thicknesses at 550nm

Reference: COT550, LUT308

[AD-8] Section 6.12.4, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: τ_o^c Cloud optical thickness at $550nm$ (20 values)

units: $[dl]$

Step: User specified.

Scientific content:

Set of 20 pre-selected cloud optical thicknesses at $550nm$ (τ_o^c) used in the water vapour retrieval algorithm

Current baseline: [5;100] by step of 5

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 bytes/fl = 80 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.11 Wind-speeds for GADS polynomial coefficients for water vapour retrieval over ocean

Reference: ws, LUT433

[AD-8] Section 6.12.4, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: ws Wind-speed just above sea level (5 values of w_s)

units: $[m.s^{-1}]$

Step: User specified.

Scientific content:

Set of 5 pre-selected wind-speeds (w_s) used to account for the sea surface roughness in the water vapour retrieval algorithm

Current baseline: {2; 4; 6; 8; 10} $m.s^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 5 × 4 bytes/fl = 20 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.12 Latitudes for ADS surface albedo slope between 900 nm & 885 nm and ADS surface albedo at 885 nm

Reference: lat, LUT476

[AD-8] Section 6.12.4, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *lat* Latitudes (3600 values)

units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Set of 3600 latitudes (*lat*) used as the geographic grid for the albedo map used in the water vapour retrieval algorithm

Current baseline: [-89.975;89.975] *deg.* by step of 0.05 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 3600 × 4 bytes/sl = 14400 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.13 Longitudes for ADS surface albedo slope between 900 nm & 885 nm and ADS surface albedo at 885 nm

Reference: long, LUT477

[AD-8] Section 6.12.4, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *long* Longitudes (7200 values)
units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

The albedo map used in the water vapour retrieval algorithm is defined on a grid of 7200 longitudes.

Current baseline: [-179.975 ; 179.975] *deg.* by step of 0.05 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 7200 × 4 bytes/sl = 28800 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.14 Offset and scaling factor for surface albedo ratio between 900 nm & 885 nm

Reference: SalbRat_offset, SalbRat_scale, LUT478

[AD-8] Section 6.12.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SalbRat_offset*, *SalbRat_scale*
Offset and scaling factor for surface albedo ratio between 900 & 885 *nm* (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: {0.9, 7.8740175 10^{-4}}

Resources:

Estimated CPU time: -
Output disk space: 2×4 bytes/sl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.15 Scaling factor for surface albedo at 885 nm

Reference: Salb885_scale, LUT479

[AD-8] Section 6.12.4, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Salb885_scale*
Scaling factor for surface albedo at 885 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: 0.0039215689

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/sl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.16 Bad data value for surface albedo ratio between 900 nm & 885 nm

Reference: SalbRat_flag, LUT480

[AD-8] Section 6.12.4, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SalbRat_flag*

Flag to detect bad value of surface albedo ratio between 900 & 885 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: 255

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.12.4.17 Minimum valid values for neural network inputs

Reference: MinDataIn_NN, LUT481

[AD-8] Section 6.12.4, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MinDataIn_NN*

Minimum valid values for NN inputs

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: {0.342, 0.680, -0.733, 0.0041, 0.899, -0.863, 0.0054, -1.670, 759.0, 648.0}

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/fl = 40 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.18 Maximum valid values for neural network inputs

Reference: MaxDataIn_NN, LUT482

[AD-8] Section 6.12.4, GADS field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MaxDataIn_NN*
Maximum valid values for NN inputs

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: {0.948, 1.000, 0.733, 0.198, 1.070, 0.0356, 0.197, 9.070, 765.00, 1020.00}

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/fl = 40 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.19 Minimum valid value for neural network output

Reference: MinDataOut_NN, LUT483

[AD-8] Section 6.12.4, GADS field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MinDataOut_NN*
Minimum valid value for NN output

units: [$g.cm^{-2}$]

Step: User specified.

Scientific content:

Current baseline: 0.13 $g.cm^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.12.4.20 Maximum valid value for neural network output

Reference: MaxDataOut_NN, LUT484

[AD-8] Section 6.12.4, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *MaxDataOut_NN*
Maximum valid value for NN output

units: $[g.cm^{-2}]$

Step: User specified.

Scientific content:

Current baseline: 5.63 $g.cm^{-2}$

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.12.5 GADS Neural Network for Water-Vapour Retrieval over Land

6.12.5.1 Neural network (NN) parameters for water vapour retrieval over land

Reference: WV_Land, LUT121

[AD-8] Section 6.12.5, GADS field 1

FUB/ACRI provided

Dependencies:

None

Tool:

Neural Network

Procedure:

Input: none

Output: *WV_Land* NN parameters for water vapour retrieved over land

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

WV_Land provides the water vapor content (*WV*) retrieved over land with a NN tool and an huge amount of RTC/MOMO simulations in MERIS band#14 (885 *nm*) and #15 (900 *nm*). RTC computations were completed over various reflective land surfaces (S_{alb}), for various atmospheric profiles (VTP files) with different surface pressures (P_s), and for various illumination and viewing geometries (θ_s,θ_v,$\Delta\phi$). Simulations were corrected for the slope effect of the surface albedo between 900 and 885 *nm*.

Current baseline: 262144 values

Resources:

Estimated CPU time: -
Output disk space: 262144 × 1 byte/uc = 262144 bytes

The storage of this table is completed with only one record (*see* [AD-8], Annex-6) for the full description of the output structure).

Acceptance:

Corresponds to the latest definition (or last delivery by the FUB institute).

6.12.6 ADS Polynomial Coefficients for Water-Vapour Retrieval over Ocean (without Sun Glint)

6.12.6.1 Polynomial coefficients for water vapour retrieval over ocean (no glint)

Reference: WV_Ocean_NoGlint, LUT122

[AD-8] Section 6.12.6, GADS fields 1, 2 & 3

FUB/ACRI provided

Dependencies:

LUT112, LUT113, LUT114, LUT119, LUT433

Tool:

Neural Network

Procedure:

Inputs:	θ_s	Solar zenith angle [*deg*], *see* Section 6.12.4.1, (LUT112)
	θ_v	View zenith angle [*deg*], *see* Section 6.12.4.2, (LUT113)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.12.4.3, (LUT114)
	τ_o^a	AOT885 [*dl*] (20 values), *see* Section 6.12.4.8 (LUT119)
	w_s	Wind-speeds ASL [$m.s^{-1}$] (5 values), *see* Section 6.12.4.11 (LUT433)
	k	Polynomial coefficient orders [*dl*], k = [0;2]

Output: $WV\_Ocean\_NoGlint[\theta_s,k,\theta_v,\Delta\phi,\tau_o^a,w_s]$

Polynomial coefficients for water vapour retrieval over ocean (no glint)

units: [$g.cm^{-2}$]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

$WV\_Ocean\_NoGlint[\theta_s,k,\theta_v,\Delta\phi,\tau_o^a,w_s]$ describes the coefficients of the polynomial fit expressing the water vapor content (*WV*) over ocean (without sun glint) as function of the ratio of TOA normalized radiances at 900 and 885 *nm* ($R_{TOA\_15/14}[\tau_o^a,w_s,\theta_s,\theta_v,\Delta\phi]$) computed with RTC/MOMO, for each of 5 wind-speeds (w_s; LUT433), for each of 20 AOT885 (τ_o^a; LUT119), for each illumination and viewing geometry ($\theta_s,\theta_v,\Delta\phi$) and for many different vertical atmos-pheric profiles (VTP files). As previously (*see* Section 6.12.5.1), a NN tool is then used to determine these polynomial fits for retrieving the WV over ocean:

$$
\begin{aligned}
WV = \quad & WV\_Ocean\_NoGlint[\theta_s,0,\theta_v,\Delta\phi,\tau_0^a,w_s] \\
& + WV\_Ocean\_NoGlint[\theta_s,1,\theta_v,\Delta\phi,\tau_0^a,w_s]\ .\ \log\left(R_{TOA\_15/14}[\tau_0^a,w_s,\theta_s,\theta_v,\Delta\phi]\right) \\
& + WV\_Ocean\_NoGlint[\theta_s,2,\theta_v,\Delta\phi,\tau_0^a,w_s]\ .\ \log^2\left(R_{TOA\_15/14}[\tau_0^a,w_s,\theta_s,\theta_v,\Delta\phi]\right)
\end{aligned}
$$

Resources:

Estimated CPU time: -
Output disk space: 27 × 3 × 18 × 25 × 20 × 5 × 4 bytes/float = 14580000 bytes

The storage of this table is completed with different records for each θ_s tabulated value (*see* [AD-8] for the full description of the output structure).

Acceptance:

Corresponds to the latest definition (or last delivery by the FUB institute).

6.12.7 (Deleted)

Reference:

[AD-8] Section 6.12.7

6.12.8 ADS Polynomial Coefficients for Water-Vapour Retrieval over Clouds

6.12.8.1 Polynomial coefficients for water vapour retrieval over clouds

Reference: WV_Cloud, LUT123

[AD-8] Section 6.12.8, GADS fields 1, 2 & 3

FUB/ACRI provided

Dependencies:

LUT112, LUT113, LUT114, LUT120, LUT308

Tool:

Neural Network

Procedure:

Inputs:	θ_s	Solar zenith angle [*deg*], *see* Section 6.12.4.1, (LUT112)
	θ_v	View zenith angle [*deg*], *see* Section 6.12.4.2, (LUT113)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.12.4.3, (LUT114)

S^{o}_{alb}	Surface albedo [*dl*] (10 values), *see* Section 6.12.4.9 (LUT120)
τ^{c}_{o}	Cloud optical thickness at 550*nm* [*dl*] (20 values), *see* Section 6.12.4.10, (LUT308)
k	Polynomial coefficient orders [*dl*], $k = [0;2]$

Output: $WV\_Cloud[\theta_s,k,\theta_v,\Delta\phi,S^{o}_{alb},\tau^{c}_{o}]$

Polynomial coefficients for water vapour retrieval over clouds

units: $[g.cm^{-2}]$

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

$WV\_Cloud[\theta_s,k,\theta_v,\Delta\phi,S^{o}_{alb},\tau^{c}_{o}]$ describes the coefficients of the polynomial fit expressing the water vapor content (*WV*) over clouds as function of the ratio of TOA normalized radiances at 900 and 885 *nm* ($R_{TOA\_15/14}[\tau^{c}_{o},S^{o}_{alb},\theta_s,\theta_v,\Delta\phi]$) computed with RTC/MOMO, for each of 20 COT550 (τ^{c}_{o}; LUT308), for each of 10 surface albedo (S^{o}_{alb}; LUT120), for each illumination and viewing geometry ($\theta_s,\theta_v,\Delta\phi$) and for many different vertical atmospheric profiles (VTP files). As previously (*see* Section 6.12.5.1), a NN tool is then used to determine the polynomial fit to retrieve the WV over clouds:

$$\begin{aligned} WV = \; & WV\_Cloud[\theta_s,0,\theta_v,\Delta\phi,S^{o}_{alb},\tau^{c}_{o}] \\ & + WV\_Cloud[\theta_s,1,\theta_v,\Delta\phi,S^{o}_{alb},\tau^{c}_{o}] \,.\, \log(R_{TOA\_15/14}[\tau^{c},S^{o}_{alb},\theta_s,\theta_v,\Delta\phi]) \\ & + WV\_Cloud[\theta_s,2,\theta_v,\Delta\phi,S^{o}_{alb},\tau^{c}_{o}] \,.\, \log^2(R_{TOA\_15/14}[\tau^{c},S^{o}_{alb},\theta_s,\theta_v,\Delta\phi]) \end{aligned}$$

Resources:

Estimated CPU time: -
Output disk space: 27 × 3 × 18 × 25 × 10 × 20 × 4 bytes/float = 29160000 bytes

The storage of this table is completed with different records for each θ_s tabulated value (*see* [AD-8] for the full description of the output structure). Moreover, within each θ_s block the records corresponding to the second S^{o}_{alb} are duplicated in each of the last 8 S^{o}_{alb} values.

Acceptance:

Corresponds to the latest definition (or last delivery by the FUB institute).

6.12.9 ADS Surface Albedo Slope between 900 nm and 885 nm

6.12.9.1 Surface albedo slope between 900 nm and 885 nm

Reference: Salb_slope, LUT124

[AD-8] Section 6.12.9, GADS field 1

FUB/ACRI provided

Dependencies:

LUT476, LUT477

Tool:

None

Procedure:

Inputs:	*month*	Month (12 values) [*dl*]
	lat	Latitude (180 values) [*deg.*], *see* Section 6.12.4.12, (LUT476)
	long	Longitude (360 values) [*deg.*], *see* Section 6.12.4.13, (LUT477)

Output: *Salb_slope* [*month*, *lat*, *long*]
Monthly map of surface albedo slope between 900 and 885 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Salb_slope[*month*, *lat*, *long*] describes the monthly surface albedo slope between 900 *nm* (band#15) and 885 *nm* (band#14), for an angular grid of 0.05 *deg.* in latitude (*lat*) and in longitude (*long*).

These monthly maps are employed in the water vapour content retrieval algorithm in order to correct the ratio of TOA normalized between MERIS band#15 and #14 for the surface albedo slope effect.

Resources:

Estimated CPU time: -
Output disk space: 12 × 3600 × 7200 × 1 byte/uc = 311040000 bytes

Acceptance:

Corresponds to the latest definition (or last delivery by the FUB institute).

6.12.10 ADS Aerosol Corrections

6.12.10.1 Polynomial coefficients for aerosol corrections at 885 nm

Reference: Aerosol_wv_corr, LUT125

[AD-8] Section 6.12.10, GADS fields 1, 2 & 3

FUB/ACRI provided

Dependencies:

LUT112, LUT113, LUT114

Tool:

Neural Network

Procedure:

Inputs:	θ_s	Solar zenith angle [*deg*], *see* Section 6.12.4.1, (LUT112)
	θ_v	View zenith angle [*deg*], *see* Section 6.12.4.2, (LUT113)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.12.4.3, (LUT114)
	k	Polynomial coefficient orders [*dl*], $k = [0;2]$

Output: $Aerosol\_wv\_corr[\theta_s,\theta_v,\Delta\phi,k]$
Polynomial coefficients for aerosol corrections at 885 nm

units: [*dl*]

Step: User specified.
LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

$Aerosol\_wv\_corr[\theta_s,\theta_v,\Delta\phi, k]$ describes the coefficients of the polynomial fit expressing the corrected aerosol optical thicknesses (τ^a) at 885 nm (MERIS band #14) as function of the TOA normalized radiances $L_{TOA\_12}[\theta_s,\theta_v,\Delta\phi]$ and $L_{TOA\_13}[\theta_s,\theta_v,\Delta\phi]$ computed with the MERIS bands #12 and 13, respectively. These regression coefficients ($k=[0;2]$) depends on the illumination and viewing geometries ($\theta_s,\theta_v,\Delta\phi$). The latters are useful for the aerosol corrections of the retrieved aerosol optical thicknesses (τ^a) at 885 nm.

Note: Due to the fact that the MERIS bands #12 and 13 are the nearest ones of the water vapor absorption bands, the total aerosol optical thicknesses (τ^a) at 885 nm will can be retrieved from the polynomial fit with an absolute accuracy of 0.03.

As previously (*see* Section 6.12.5.1), a NN tool is then used to determine the polynomial fit to to retrieve the corrected aerosol optical thicknesses (τ^a) at 885 nm:

$$\tau^a = \quad Aerosol\_wv\_LUT[\theta_s,\theta_v,\Delta\phi,0] + Aerosol\_wv\_LUT[\theta_s,\theta_v,\Delta\phi,1] \,.\, L^*_{TOA\_12}[\theta_s,\theta_v,\Delta\phi] + Aerosol\_wv\_LUT[\theta_s,\theta_v,\Delta\phi,2] \,.\, L^*_{TOA\_13}[\theta_s,\theta_v,\Delta\phi]$$

where $L_{TOA\_12}[P_s,\theta_s,\theta_v,\Delta\phi]$, $L_{TOA\_13}[P_s,\theta_s,\theta_v,\Delta\phi]$ and $L_{TOA\_14}[P_s,\theta_s,\theta_v,\Delta\phi]$ are respectively the TOA normalized radiances within the MERIS bands #12, 13 and 14.

Resources:

Estimated CPU time: -
Output disk space: $27 \times 3 \times 18 \times 25 \times 4$ bytes/fl = 145800 bytes

The storage of this table is completed with different records for each θ_s tabulated value (*see* [AD-8] for the full description of the output structure).

Acceptance:

Corresponds to the latest definition (or last delivery by the FUB institute).

6.12.11 ADS Surface Albedo at 885 nm

6.12.11.1 Surface albedo map at 885 nm

Reference: Salb885, LUT126

[AD-8] Section 6.12.11, GADS field 1

FUB/ACRI provided

Dependencies:

LUT476, LUT477

Tool:

None

Procedure:

Inputs: *month* Month (12 values) [*dl*]
lat Latitude (180 values) [*deg.*], *see* Section 6.12.4.12, (LUT476)
long Longitude (360 values) [*deg.*], *see* Section 6.12.4.13, (LUT477)

Output: *Salb885*[*month*, *lat*, *long*]
Monthly map of surface albedo at 885 *nm*

units: [*dl*]

Scientific content:

Salb885[*month*, *lat*, *long*] describes the monthly surface albedo at 885 *nm* (band#14), for an angular grid of 0.05 *deg.* in latitude (*lat*) and in longitude (*long*).

These monthly maps are employed in the water vapour content retrieval algorithm.

Resources:

Estimated CPU time: -
Output disk space: 12 × 3600 × 7200 × 1 byte/uc = 311040000 bytes

Acceptance:

Corresponds to the latest definition (or last delivery by the FUB institute).

6.13 OCEAN-AEROSOL PARAMETERS

All the LUTs from this MERIS ADF can be generated with both the tools from FUB & UdL. Consequently, two different recipes are systematically proposed to generate all these LUTs either with the tools from FUB or with the tools from UdL.

6.13.1 C.P.

6.13.1.1 C.P. AOT at 550 nm (boundary layer) for all ocean-aerosol assemblages, $\tau^{a1}(iaer,itau)$

Reference: tauA1 LUT136

PARBLEU provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *tauA1* Aerosol optical thickness at 550 nm for boundary aerosol layer (7 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 7 AOT550 (tauA1) used in the boundary layer of the 34 aerosol assemblages. Note that the first null tauA1 value is not employed in the LUTs computations but defined to make easy the use of output LUTs in the MERIS processor (IPF).

Current baseline: 34 x 7 values (*see* table in Section 6.13.5.1)

Resources:

Estimated CPU time: -
Output disk space: 34 × 7 × 4 bytes/fl = 952 bytes

Acceptance:

Corresponds to the latest definition.

6.13.1.2 C.P. AOT at 550 nm (dust layer) for all ocean-aerosol assemblages, $\tau^{a2}(iaer,itau)$

Reference: tauA2 LUT137

PARBLEU provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *tauA2* Aerosol optical thickness at 550 nm for dust aerosol layer (7 values)

units: [dl]

Step: User specified.

Scientific content:

Set of 7 AOT550 (tauA2), the first null value being 0, used in the dust layer of the 34 aerosol assemblages. Note that the first null tauA2 value is not employed in the LUTs computations but defined to make easy the use of output LUTs in the MERIS processor (IPF).

Current baseline: 34 x 7 values (*see* table in Section 6.13.5.1)

Resources:

Estimated CPU time: -
Output disk space: 34 × 7 × 4 bytes/fl = 952 bytes

Acceptance:

Corresponds to the latest definition.

6.13.1.3 C.P. AOT at 550 nm (troposphere layer) for all ocean-aerosol assemblages, $\tau^{a3}(iaer,itau)$

Reference: tauA3 LUT409

PARBLEU provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *tauA3* Aerosol optical thickness at 550 nm for tropospheric layer (7 values)

units: [dl]

Step: User specified.

Scientific content:

Set of 7 AOT550 (tauA3), the first null value being 0, used in the tropospheric layer of the 34 aerosol assemblages. Note that the first null tauA3 value is not employed in the LUTs computations but defined to make easy the use of output LUTs in the MERIS processor (IPF).

Current baseline: 34 x 7 values (*see* table in Section 6.13.5.1)

Resources:

Estimated CPU time: -
Output disk space: $34 \times 7 \times 4$ bytes/fl = 952 bytes

Acceptance:

Corresponds to the latest definition.

6.13.1.4 C.P. FUB-scattering phase matrices and IOPs for all the aerosol models

Reference: Q_{sca}, Q_{ext} & SSA[$model,\lambda$] LUT399

Dependencies:

LUT130

Tool:

OTC/MIE (FUB)

Procedure:

Inputs: *model* Aerosol model# [*dl*] (selected amoung a set of 23 models)
λ MERIS wavelength [*nm*], *see* Section 6.13.4.1 (LUT130)

Output: $Q_{sca}[model,\lambda]$, $Q_{ext}[model,\lambda]$ & $SSA[model,\lambda]$
Scattering (Q_{sca}) and extinction (Q_{ext}) coefficients, and single scattering albedo (*SSA*) (referred also as to σ_s, σ_e, ω_0) for each of the 23 aerosol models (*model*) used in the 34 assemblages and each of the 15 MERIS spectral bands (λ).

units: [μm^{-1}, μm^{-1}, *dl*]

Step-1: For each of the 23 aerosol model (*model*) used in the ocean-aerosol assemblages, launch the *Mie*'s computations at each of the 15 MERIS wavelengths (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/ *sc_mar**xx**_b**yy***, *sc_coa**xx**_b**yy***, *sc_rur**xx**_b**yy***, *sc_dbds**z**_b**yy***, *sc_dbdw**z**_b**yy***, *sc_IOP**ww**_b**yy***, *sc_conti_b**yy***, *sc_H2SO4_b**yy***

*with **xx** = {50, 70, 90, 99} (i.e., relative humidity), **yy** = {01,..,15} (i.e., MERIS bands #), **z** = {1, 2, 3} (i.e.,3 scale heights), **ww** = {01, 02, 03} (i.e., 3 Log-normal distributions)*

Note: These output *Mie* files will be used as inputs for generating the LUT138 & LUT139, and the LUT142 & LUT143 with the RTC/FUB (MOMO).

Step-2: For each of the 23 aerosol model (*model*) and for each wavelength (λ), extract from the output *Mie*'s file the IOPs, *i.e.*, the normalized extinction coefficient, $Q_{ext,norm}(model,\lambda)$ (labelled as *"ex_norm"*), the single scattering albedo, *SSA* or $\omega_0(model,\lambda)$ (labelled as *"w_o"*) and the extinction coefficient $Q_{ext,550}(model)$ at the 550*nm* reference wavelength (labelled as *"ex_ref"*), and compute the extinction coefficient $Q_{ext}(model,\lambda)$ and the scattering coefficient $Q_{sca}(model,\lambda)$ as follows:

$$Q_{ext}[\text{model},\lambda] = Q_{ext,550}[\text{model}] \cdot Q_{ext,norm}[\text{model},\lambda]$$

$$Q_{sca}[\text{model},\lambda] = \omega_0[\text{model},\lambda] \cdot Q_{ext}[\text{model},\lambda]$$

Step-3: Build the output LUT399 with $Q_{sca}(model,\lambda)$, $Q_{ext}(model,\lambda)$ and $\omega_0(model,\lambda)$ respectively for each of the 23 aerosol models (*model*) and each of the 15 MERIS bands (λ).

Scientific content:

Scattering phase function and IOPs (scattering coefficient, extinction coefficient and single scattering albedo) of the 23 models used in the 34 ocean-aerosol assemblages.

Current baseline: 23 x 15 x 3 values

Resources:

Estimated CPU time: $23 \times 15 \times (\sim 52\ sec) = 18197\ sec$
Output disk space: $23 \times 15 \times 3 \times 4$ bytes/fl = 4140 bytes

Acceptance:

Corresponds to the latest definition.

6.13.1.5 C.P. UdL-scattering phase matrices and IOPs for all the aerosol models

Reference: Q_{sca}, Q_{ext} & SSA[*model*,λ] LUT419

Dependencies:

LUT130

Tool:

OTC/SCAMAT (UdL)

Procedure:

Inputs: *model* Aerosol model# [*dl*] (selected amoung a set of 23 models)
λ MERIS wavelength [*nm*], *see* Section 6.13.4.1 (LUT130)

Output: $Q_{sca}[model,\lambda]$, $Q_{ext}[model,\lambda]$ & $SSA[model,\lambda]$
Scattering (Q_{sca}) and extinction (Q_{ext}) coefficients, and single scattering albedo (*SSA*) for each of the 17 aerosol models (*model*) used in the 16 SAMs and each of the 15 MERIS spectral bands (λ).

units: [μm^{-1}, μm^{-1}, *dl*]

Step-1: For each of the 17 aerosol model (*model*) used in the 16 SAMs, launch the *Mie*'s computations at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/ *sc_mar***xx***_b***yy**, *sc_coa***xx***_b***yy**, *sc_rur***xx***_b***yy**, *sc_IOP***ww***_b***yy**, *sc_conti_b***yy**, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Note: These output *Scamat* files will be used as inputs for generating the LUT138 & LUT139, and the LUT143 with the RTC/UdL (SO).

Step-2: For each of the 17 aerosol model (*model*) and for each wavelength (λ), extract from the output *Mie*'s file the IOPs, *i.e.*, the normalized extinction coefficient, $Q_{ext,norm}(model,\lambda)$ (labelled as *"Qext(λ)/Qext(λ_ref)"*), the single scattering albedo, *SSA* or $\omega_0(model,\lambda)$ (labelled as *"wo(λ)"*) and the extinction coefficient $Q_{ext,550}(model)$ at the reference wavelength ($550nm$) (labelled as $Qext(\lambda\_ref)$), and compute the extinction coefficient $Q_{ext}(model,\lambda)$ and the scattering coefficient $Q_{sca}(model,\lambda)$ as follows:

$$Q_{ext}[\text{model},\lambda] = Q_{ext,550}[\text{model}] \cdot Q_{ext,norm}[\text{model},\lambda]$$

$$Q_{sca}[\text{model},\lambda] = \omega_{o}[\text{model},\lambda] \cdot Q_{ext}[\text{model},\lambda]$$

Step-3: Build the output LUT419 with $Q_{sca}(model,\lambda)$, $Q_{ext}(model,\lambda)$ and $\omega_0(model,\lambda)$ respectively for each of the 17 aerosol models (*model*) and each of the 15 MERIS bands (λ).

Scientific content:

Scattering phase function and IOPs (scattering coefficient, extinction coefficient and single scattering albedo) of the 17 models used in the 16 SAMs (MAR, COA, RUR, BLU-IOP).

Current baseline: 17 x 15 x 3 values

Resources:

Estimated CPU time: $17 \times 15 \times (\sim 52\ sec) = 13260\ sec$
Output disk space: $17 \times 15 \times 3 \times 4$ bytes/fl = 3060 bytes

6.13.1.6 C.P. TOA normalized radiances, $L_{TOA}(\lambda, \theta_s, \theta_v, \Delta\phi)$

Reference: (no variable used) LUT401

Intermediate results stored in LUTs.

LUT dimension: $N_{SZA} \times N_{VZA} \times N_{RAA} = 23 \times 13 \times 25$.

Number of intermediate LUTs:

- with RTC/FUB: $N_{wvl} \times N_{model} \times N_{aot550} \times N_{ws} = 15 \times 34 \times 6 \times 3$
- with RTC/UdL: $N_{wvl} \times N_{model} \times N_{aot550} \times N_{ws} = 15 \times 16 \times 6 \times 3$

Resources:

Estimated CPU time: -

Output disk space:

- with RTC/FUB: $15 \times 23 \times 13 \times 25 \times 34 \times 6 \times 3 \times 4$ bytes/fl = 274482000 bytes
- with RTC/UdL: $15 \times 23 \times 13 \times 25 \times 16 \times 6 \times 3 \times 4$ bytes/fl = 129168000 bytes

6.13.1.7 C.P. FUB total and Rayleigh optical thicknesses, $\tau(iaer,type,itau,iband)$

Reference: (no variable used) LUT405

Intermediate results stored in a LUT

LUT dimension: $N_{model} \times N_{type} \times N_{aot550} \times N_{wvl} = 34 \times 2 \times 6 \times 15$.

with type being the index used to refer to the total and the *Rayleigh* optical thickness.

Resources:

Estimated CPU time: -
Output disk space: $34 \times 2 \times 6 \times 15 \times 4$ bytes/fl = 24480 bytes

6.13.1.8 C.P. Spectral dependence of the AOT (without normalization at reference wavelength), *f(iaer,λ,itau)*

Reference: (no variable used) LUT408

Intermediate results stored in a LUT: τ_a_bl865 (LUT139) × *specdep* (LUT138)

LUT dimension: $N_{model} \times N_{wvl} \times N_{aot550} = 34 \times 15 \times 7$.

Resources:

Estimated CPU time: -
Output disk space: $34 \times 15 \times 7 \times 4$ bytes/fl = 14280 bytes

6.13.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.13.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.13.4 GADS General

6.13.4.1 Nominal wavelengths of the 15 MERIS spectral bands

Reference: Wvl, LUT130

[AD-8] Section 6.13.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl* Nominal wavelengths of MERIS spectral bands (15 values)

units: [*nm*]

Step: User specified.

Scientific content:

Nominal wavelenghts of the 15 MERIS spectral bands

Current baseline: {412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75, 753.75, 761.875, 778.75, 865.0, 885.0, 900.0} *nm*

Resources:

Estimated CPU time: -
Output disk space: 15×4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.13.4.2 (Spare)

Reference:

[AD-8] Section 6.13.4, GADS field 2

6.13.4.3 Solar zenith angles

Reference: SZA, LUT132

[AD-8] Section 6.13.4, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angle (23 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

The set of solar zenith angles (SZA) derives from the *Gauss* quadrature used in the RTC/SO (UdL) [RD-1] ***Fell, F., and J. Fischer, 2001.*** "Numerical simulation of the light field in the atmosphere-ocean system using the matrix-operator method", *Journal of Quantitative Spectroscopy & Radiative Transfer: 69* (3), 351-388.
[RD-2]. The values are listed hereafter:

Current baseline: 23 SZA values (θ_s) selected as the first 23 angles from the *Gauss* quadrature (24 discrete directions including the zenith direction).

θ_s [*deg.*]
0.000000
2.840906
6.521063
10.222955
13.929756
17.638419

θ_s [*deg.*]
21.347983
25.058051
28.768427
32.479006
36.189726
39.900547

θ_s [*deg.*]
43.611442
47.322394
51.033390
54.744420
58.455477
62.166556

θ_s [*deg.*]
65.877652
69.588762
73.299882
77.011011
80.722147

Resources:

Estimated CPU time: -
Output disk space: 23 × 4 bytes/ul = 92 bytes

Acceptance:

Corresponds to the latest definition.

6.13.4.4 View zenith angles

Reference: VZA, LUT133

[AD-8] Section 6.13.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA* View zenith angle (13 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

The set of view zenith angles (VZA) derives from the *Gauss* quadrature used in the RTC/SO (UdL) [RD-1] ***Fell, F., and J. Fischer, 2001.*** "Numerical simulation of the light field in the atmosphere-ocean system using the matrix-operator method", *Journal of Quantitative Spectroscopy & Radiative Transfer: 69* (3), 351-388.
[RD-2]. The values are listed hereafter:

Current baseline: 13 VZA values (θ_v) selected as the first 13 angles from the *Gauss* quadrature (24 discrete directions including the zenith direction).

θ_v [*deg.*]
0.000000
2.840906
6.521063
10.222955
13.929756
17.638419
21.347983

θ_v [*deg.*]
25.058051
28.768427
32.479006
36.189726
39.900547
43.611442

Resources:

Estimated CPU time: -
Output disk space: 13 × 4 bytes/ul = 52 bytes

Acceptance:

Corresponds to the latest definition.

6.13.4.5 Relative azimuth angles

Reference: RAA, LUT134

[AD-8] Section 6.13.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle (25 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

The set of the relative azimuth angles ($\Delta\phi$) between illumination and viewing directions is regularly spaced and listed hereafter:

Current baseline: 25 RAA values ($\Delta\phi$) within [0;180] *deg*., with a step of 7.5 *deg*.

$\Delta\phi$[deg.]
0.00
7.50
15.00
22.50
30.00

$\Delta\phi$[deg.]
37.50
45.00
52.50
60.00
67.50

$\Delta\phi$[deg.]
75.00
82.50
90.00
97.50
105.00

$\Delta\phi$[deg.]
112.50
120.00
127.50
135.00
142.50

$\Delta\phi$[deg.]
150.00
157.50
165.00
172.50
180.00

Resources:

Estimated CPU time: -
Output disk space: 25×4 bytes/ul = 100 bytes

Acceptance:

Corresponds to the latest definition.

6.13.4.6 Wind-speeds

Reference: ws, LUT135

[AD-8] Section 6.13.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None.

Procedure:

Input: none

Output: *ws* Wind-speed just above sea level (3 values)

units: $[m.s^{-1}]$

Step: User specified.

Scientific content:

Above water surfaces, the wind-speed (w_s) is responsible for the surface roughness. The effect of the *air-sea* interface shape on the *Fresnel* reflection and refraction is then modelled according to the statistical description of the wave facet distribution derived by *Cox and Munk* [RD-7]. This surface model assumes an isotropic distribution of the facet slopes independently of the wind orientation, and the surface reflectance only depends on the wind-speed (shadowing effects are not accounted for in the total upwelling radiances). Thus, within the sun glint area this reflectance will be much higher than the one originated from the water body itself.

Since the sun glint area depends on the wave slope distribution, 3 wind-speeds (w_s) have been then selected in the algorithm for generating LUT143

Current baseline: {1.5, 5.0, 10} $m.s^{-1}$

Resources:

Estimated CPU time: -

Output disk space: 3 x 4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.13.4.7 Vicarious adjustement gains

Reference: Vic_Gain[b], LUT131

[AD-8] Section 6.13.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None.

Procedure:

Input: *b* MERIS spectral band# (15 values) *see* Section 6.13.4.1,(LUT130)

Output: *Vic_Gain[b]* Vicarious adjustement gain (15 values)

units: [*dl*]

Step: User specified.

Scientific content:

15 vicarious gain values given for the 15 MERIS spectral bands

Current baseline: {0.9868575931, 0.9924236536, 0.9990998507, 1.0003386736, 1.0045168400, 1.0082343817, 1.0074515343, 1.0063384771, 1.0000000000, 1.0033472776, 1.0000000000, 1.0000000000, 0.9864488244, 0.9829149246, 1.0000000000}

Resources:

Estimated CPU time: -
Output disk space: 15 x 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.13.4.8 (spare)

Reference:

[AD-8] Section 6.13.4, GADS field 8

6.13.5 GADS Spectral Optical Thickness

6.13.5.1 Spectral dependence factor of the total AOT (with normalization at reference wavelength)

6.13.5.1.1 FUB Recipe

Reference: specdep, LUT138

[AD-8] Section 6.13.5, GADS field 1

Dependencies:

LUT130, LUT136, LUT137, LUT409

Tool:

OTC/MIE

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

Procedure:

Inputs:	*iaer*	Aerosol model # [*dl*] (among the 34 aerosol assemblages)
	λ	MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)
	τ^a	Total aerosol optical thickness at 550*nm* [*dl*] (7 values, but only the last 6 ones have to be considered), *see* table below, Section 6.13.1.1 (LUT136), Section 6.13.1.2 (LUT137) and Section 6.13.1.3 (LUT409)

Output: $Specdep[iaer,\lambda,\tau^a]$, referred also as $f[iaer,\lambda,\tau^a]$

Spectral dependence of the aerosol optical thickness for each of the 34 aerosol assemblages (*iaer*), for each of the 15 MERIS wavelengths, and for each of the 7 total aerosol optical thicknesses (τ^a) at 550*nm*.

units: [*dl*]

Note: The *Mie*'s computations for the different aerosol models have to be performed with the input cards placed in ***/FUB/sca_in***. All the input parameters for these calculations are described and defined in [AD-6] and [AD-7], respectively.

Here is an example of an input card for the *Mie*'s computations with OTC/MIE (FUB)

'sca_out: '	sc_conti_b01.s
'wavelength: '	412.50
'ref. wavelength: '	550.00
'number of angles (n2): '	171
'number of size distributions (N): '	3
'real, imag. refrac. index (m_i,k_i) #1:'	1.530 0.5000000E-02
'ref. refrative index (m_r_i,k_r_i) #1:'	1.530 0.6000000E-02
'min,max,step of particles (r0,rf,dr) #1:'	4.7173841954562E-06 0.48141415860349 0.0001
'size distrib. parameters (ind,a,b) #1:'	2 0.0050 2.99
'volume percentage (n_i/n) #1:'	0.93876773E+00
'real, imag. refrac. index (m_i,k_i) #2:'	1.530 0.8000000E-02
'ref. refrative index (m_r_i,k_r_i) #2:'	1.530 0.8000000E-02
'min,max,step of particles (r0,rf,dr) #2:'	4.7173841954562E-04 48.14141586034900 0.0100
'size distrib. parameters (ind,a,b) #2:'	2 0.5000 2.99
'volume percentage (n_i/n) #2:'	0.00000227E+00
'real, imag. refrac. index (m_i,k_i) #3:'	1.750 0.4586364E+00
'ref. refrative index (m_r_i,k_r_i) #3:'	1.750 0.4387952E+00
'min,max,step of particles (r0,rf,dr) #3:'	1.8955848629255E-04 0.28027805069842 0.0001
'size distrib. parameters (ind,a,b) #3:'	2 0.0118 2.00
'volume percentage (n_i/n) #3:'	0.06123000E+00
'volume (1) and particle (2) ratio : '	2

31 aerosol assemblages have been defined and given in the table hereafter. The latters result from different mixtures in aerosol components (*i.e.*, desert dust particles, dust-like particles, oceanic particles, rural aerosol mixtures, soot-like particles, water soluble particles, and H_2SO_4) for each of the 3 aerosol layers (boundary, troposphere and stratosphere), which yield to 6 different kinds of aerosol assemblages (*i.e.*, maritime, coastal, rural, dust-BDS, dust-BDW).

3 blue aerosols have been determined with an approach combining the micro-physical properties of these small particles with their inherent optical properties (IOP's) derived from CIMEL measurements acquired over ocean sites [RD-15].

Aerosols Assemblage			***Boundary Layer***	***Tropospheric Layer***			***Stratosph. Layer***
iaer	***Assemblage***	***RH(%)***	***[0-2km]***	***[2-5km]***	***[5-7km]***	***[7-12km]***	***[12-50km]***
0	MAR-99	99	*Maritime*	-	-	-	-
1	MAR-50	50	*Maritime*	*Continental*	*Continental*	*Continental*	*H2SO4*
2	MAR-70	70	*Maritime*	*Continental*	*Continental*	*Continental*	*H2SO4*
3	MAR-90	90	*Maritime*	*Continental*	*Continental*	*Continental*	*H2SO4*
4	MAR-99	99	*Maritime*	*Continental*	*Continental*	*Continental*	*H2SO4*
5	COA-50	50	*Coastal*	*Continental*	*Continental*	*Continental*	*H2SO4*
6	COA-70	70	*Coastal*	*Continental*	*Continental*	*Continental*	*H2SO4*
7	COA-90	90	*Coastal*	*Continental*	*Continental*	*Continental*	*H2SO4*
8	COA-99	99	*Coastal*	*Continental*	*Continental*	*Continental*	*H2SO4*
9	RUR-50	50	*Rural*	*Continental*	*Continental*	*Continental*	*H2SO4*
10	RUR-70	70	*Rural*	*Continental*	*Continental*	*Continental*	*H2SO4*
11	RUR-90	90	*Rural*	*Continental*	*Continental*	*Continental*	*H2SO4*
12	RUR-99	99	*Rural*	*Continental*	*Continental*	*Continental*	*H2SO4*

Aerosols Assemblage			*Boundary Layer*	*Tropospheric Layer*			*Stratosph. Layer*
iaer	***Assemblage***	***RH(%)***	***[0-2km]***	***[2-5km]***	***[5-7km]***	***[7-12km]***	***[12-50km]***
13	MAR-BDS1-1	90	*Maritime* *Dust - BDS1*	*Continental* *-*	*Continental* *-*	*Continental* *-*	*H2SO4*
14	MAR-BDS1-2	90	*Maritime* *Dust - BDS1*	*Continental* *Dust - BDS1*	*Continental* *-*	*Continental* *-*	*H2SO4*
15	MAR-BDS1-3	90	*Maritime* *Dust - BDS1*	*Continental* *Dust - BDS1*	*Continental* *Dust - BDS1*	*Continental* *-*	*H2SO4*
16	MAR-BDS2-1	90	*Maritime* *Dust - BDS2*	*Continental* *-*	*Continental* *-*	*Continental* *-*	*H2SO4*
17	MAR-BDS2-2	90	*Maritime* *Dust - BDS2*	*Continental* *Dust - BDS2*	*Continental* *-*	*Continental* *-*	*H2SO4*
18	MAR-BDS2-3	90	*Maritime* *Dust - BDS2*	*Continental* *Dust - BDS2*	*Continental* *Dust - BDS2*	*Continental* *-*	*H2SO4*
19	MAR-BDS3-1	90	*Maritime* *Dust - BDS3*	*Continental* *-*	*Continental* *-*	*Continental* *-*	*H2SO4*
20	MAR-BDS3-2	90	*Maritime* *Dust - BDS3*	*Continental* *Dust - BDS3*	*Continental* *-*	*Continental* *-*	*H2SO4*
21	MAR-BDS3-3	90	*Maritime* *Dust - BDS3*	*Continental* *Dust - BDS3*	*Continental* *Dust - BDS3*	*Continental* *-*	*H2SO4*
22	MAR-BDW1-1	90	*Maritime* *Dust - BDW1*	*Continental* *-*	*Continental* *-*	*Continental* *-*	*H2SO4*
23	MAR-BDW1-2	90	*Maritime* *Dust - BDW1*	*Continental* *Dust - BDW1*	*Continental* *-*	*Continental* *-*	*H2SO4*
24	MAR-BDW1-3	90	*Maritime* *Dust - BDW1*	*Continental* *Dust - BDW1*	*Continental* *Dust - BDW1*	*Continental* *-*	*H2SO4*
25	MAR-BDW2-1	90	*Maritime* *Dust - BDW2*	*Continental* *-*	*Continental* *-*	*Continental* *-*	*H2SO4*
26	MAR-BDW2-2	90	*Maritime* *Dust - BDW2*	*Continental* *Dust - BDW2*	*Continental* *-*	*Continental* *-*	*H2SO4*
27	MAR-BDW2-3	90	*Maritime* *Dust - BDW2*	*Continental* *Dust - BDW2*	*Continental* *Dust - BDW2*	*Continental* *-*	*H2SO4*
28	MAR-BDW3-1	90	*Maritime* *Dust - BDW3*	*Continental* *-*	*Continental* *-*	*Continental* *-*	*H2SO4*
29	MAR-BDW3-2	90	*Maritime* *Dust - BDW3*	*Continental* *Dust - BDW3*	*Continental* *-*	*Continental* *-*	*H2SO4*
30	MAR-BDW3-3	90	*Maritime* *Dust - BDW3*	*Continental* *Dust - BDW3*	*Continental* *Dust - BDW3*	*Continental* *-*	*H2SO4*
31	BLU-IOP01	-	*Blue IOP01*	*Blue IOP01*	*Blue IOP01*	*Blue IOP01*	*Blue IOP01*
32	BLU-IOP02	-	*Blue IOP02*	*Blue IOP02*	*Blue IOP02*	*Blue IOP02*	*Blue IOP02*
33	BLU-IOP03	-	*Blue IOP03*	*Blue IOP03*	*Blue IOP03*	*Blue IOP03*	*Blue IOP03*

Description of the 34 aerosol assemblages (iaer): 4 maritime aerosol assemblages, 4 coastal aerosol assemblages, and 4 rural aerosol assemblages with 4 relative humidity (RH) values, and 18 dust aerosol assemblages with 3 scale heights, and 3 blue IOP aerosol assemblages.

All *Mie*'s input parameters (spectral refractive indices, particle size distribution, minimum/maximum radii and size increment, mixing ratio) for each aerosol component used in the aerosol models for the 34 assemblages, are fully described in the reference model document [AD-6].

Optical properties (aerosol optical thickness at 550*nm*) of each aerosol layers (boundary, dust, troposphere, and stratosphere) are summarized in the table below:

Aerosols Assemblage			*Boundary Layer*	*Dust Layer*	*Tropospheric Layer*	*Stratospheric Layer*
iaer	*Assemblage*	*RH(%)*	$\tau^a_{550,bound}$	$\tau^a_{550,dust}$	$\tau^a_{550,tropo}$	$\tau^a_{550,strato}$
0	MAR-99	99	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0*	*0*
1	MAR-50	50	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
2	MAR-70	70	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
3	MAR-90	90	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
4	MAR-99	99	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
5	COA-50	50	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
6	COA-70	70	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
7	COA-90	90	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
8	COA-99	99	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
9	RUR-50	50	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
10	RUR-70	70	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
11	RUR-90	90	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
12	RUR-99	99	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
13	MAR-BDS1-1	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
14	MAR-BDS1-2	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
15	MAR-BDS1-3	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
16	MAR-BDS2-1	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
17	MAR-BDS2-2	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
18	MAR-BDS2-3	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
19	MAR-BDS3-1	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
20	MAR-BDS3-2	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
21	MAR-BDS3-3	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
22	MAR-BDW1-1	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
23	MAR-BDW1-2	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
24	MAR-BDW1-3	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
25	MAR-BDW2-1	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
26	MAR-BDW2-2	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
27	MAR-BDW2-3	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
28	MAR-BDW3-1	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
29	MAR-BDW3-2	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
30	MAR-BDW3-3	90	*0.05;0.05;0.05;0.05;0.05;0.05*	*0.01; 0.05; 0.2; 0.5; 0.8; 2*	*0.025*	*0.005*
31	BLU-IOP01	-	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
32	BLU-IOP02	-	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*
33	BLU-IOP03	-	*0.01, 0.03, 0.1, 0.3, 0.5, 0.8*	*0*	*0.025*	*0.005*

Aerosol optical thickness at 550 nm for each of the 4 aerosol layers (i.e., boundary, dust, troposphere, and stratosphere) and for each of the 34 aerosol assemblages (iaer). Note that the first null value of AOT-550 for boundary layer is not reported in this table.

Using the spectral dependence in the *Mie*'s inputs (*i.e.*, spectral characteristics of the aerosols) and the aerosol optical thicknesses at 550 nm, $f[iaer,\lambda,\tau^a]$ is then estimated with the following steps:

Step-1: Select each aerosol model among the 23 models used in the 34 ocean-aerosol assemblages, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/*sc_mar***xx***_b***yy*, *sc_coa***xx***_b***yy*, *sc_rur***xx***_b***yy*, *sc_dbds***z***_b***yy*, *sc_dbdw***z***_b***yy**, *sc_IOP***ww***_b***yy*, *sc_conti_b***yy*, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **z** *= {1, 2, 3} (i.e.,3 scale heights),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Determine the extinction coefficient at 865 nm ($\sigma_{e,865}^{layer}$) from OTC/MIE for each of the 4 aerosol layers (*layer*= boundary, dust, troposphere, or stratosphere).

Step-3: Extract the extinction coefficients $\sigma_{e,\lambda}^{layer}$ for each of the 4 aerosol layers (*layer*) and for each of the 15 MERIS wavelengths (λ).

Step-4: Compute the spectral dependence factor of the total aerosol optical thickness τ^a, $f[iaer,\lambda,\tau^a]$, as follows,

$$f[iaer,\lambda,\tau^a] = \frac{\sum_{layer=1}^{4} \tau_{550,layer}^{a}[iaer,\tau^a]\,.\,\dfrac{\sigma_{e,\lambda}^{layer}}{\sigma_{e,550}^{layer}}}{\sum_{layer=1}^{4} \tau_{550,layer}^{a}[iaer,\tau^a]\,.\,\dfrac{\sigma_{e,865}^{layer}}{\sigma_{e,550}^{layer}}} \quad , \quad with \quad \tau^a = \sum_{layer=1}^{4} \tau_{550,layer}^{a}$$

$\tau_{550,layer}^{a}$ is the aerosol optical thickness at 550 nm for the aerosol layer *layer*, and σ_e^{layer} its associated extinction coefficient at the wavelength λ or 550 nm or 865 nm. Note that the *layer* values of 1, 2, 3 and 4 correspond respectively to the boundary layer (*layer #1* referred also as *'bound'*), the dust aerosol layer (*layer #2* referred also as *'dust'*), the tropospheric aerosol layer (*layer #3* referred also as *'tropo'*) and the stratospheric aerosol layer (*layer #4* referred also as *'strato'*).

Warning: Only the last 6 $\tau_{550,layer}^{a}$ values from LUT136 (Section 6.13.1.1), from LUT137 (Section 6.13.1.2) and from LUT409 (Section 6.13.1.3) are considered for the f table computation. The fields corresponding to the first AOT value (*i.e.*, $\tau_{550,layer}^{a}$ =0) in the f table are filled with 0 values.

The extinction coefficients for the 4 aerosol layers (*'bound'*, *'dust'*, *'tropo'* and *'strato'*) are computed with the OTC/MIE and are already normalized at a reference wavelength (here, 550 nm), thus $\sigma_{e,550}^{layer}$ =1.

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Scientific content:

$f[iaer,\lambda,\tau^a]$ describes the spectral dependence of the total aerosol optical thickness, for each of the 34 aerosol assemblages ($iaer$), for each of the 15 MERIS wavelengths (λ), and for each of the 6 (non-null) pre-selected total aerosol optical thicknesses (τ^a) at 550 nm. Values of $f[iaer,\lambda,\tau^a]$ are normalized to the reference wavelength at 865 nm.

The aerosol assemblages are defined as homogeneous mixtures of basic constituents which are assumed to be spherical particles characterized by their complex refractive index at all the wavelengths and their particle size distribution with the microphysical characteristics (*see* [AD-6] for more details). The extinction (absorption + scattering) coefficients are then computed via the *Mie*'s theory, as a function of the aerosol size distribution and the complex refractive index.

The choice of a set of 6 (non-null) pre-selected nominal τ^a values at 550 nm relies on a better comparison between the aerosol models which also differ with respect to their spectral characteristics. The spectral change in optical thickness of a given assemblage is therefore dependent on the optical thickness specified at 550 nm.

Resources:

Estimated CPU time:	3 *sec* (if LUT399 already generated, otherwise 18200 *sec*)
Output disk space:	$34 \times 15 \times 7 \times 4$ bytes/fl = 14280 bytes

Acceptance:

Comparison with another OTC from the LOV institute.

6.13.5.1.2 UdL Recipe

Reference: specdep, LUT138

[AD-8] Section 6.13.5, GADS field 1

Dependencies:

LUT130, LUT136, LUT409

Tool:

OTC/SCAMAT

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (16 SAMs [iaer#0 + MAR+ COA + RUR + BLU-IOP])

λ MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)

τ^a Total aerosol optical thickness at 550*nm* [*dl*] (7 values, but only the last 6 ones has to be considered), *see* table below, Section 6.13.1.1 (LUT136) and Section 6.13.1.3 (LUT409)

Output: $Specdep[iaer,\lambda,\tau^a]$, referred also as $f[iaer,\lambda,\tau^a]$

Spectral dependence of the aerosol optical thickness for each of the 16 SAMs (*iaer*), for each of the 15 MERIS wavelengths, and for each of the 7 total aerosol optical thicknesses (τ^a) at 550*nm*.

units: [*dl*]

Note: The *Mie*'s computations for the different aerosol models have to be performed with the input cards placed in ***/UdL/INPUT/sca_in***. All the input parameters for these calculations are described and defined in [AD-6] and [AD-7], respectively.

Here is an example of an input card for the *Mie*'s computations with OTC/SCAMAT (UdL)

sc_conti_b01.s	*Output filename*
412.50	*Nominal wavelength (nm)*
550.00	*Reference wavelength (nm)*
83	*Number of scattering angles (fixed to 83)*
3	*Number of size distribution (3 max.)*
1.530 0.5000000E-02	*Refractive index (Re,Im) at nominal wavelength for particle size distribution #1*
1.530 0.6000000E-02	*Refractive index (Re,Im) at reference wavelength for particle size distribution #1*
4.7173841954562E-06 0.48141415860349 0.0001	*Minimum, maximum radii and size increment (µm) for particle size distribution #1*
2 0.0050 2.99	*Index of selected particle size distribution and its 2 parameters, for particle size distribution #1*
0.93876773E+00	*Component mixing ratio for particle size distribution #1*
1.530 0.8000000E-02	*Refractive index (Re,Im) at nominal wavelength for particle size distribution #2*
1.530 0.8000000E-02	*Refractive index (Re,Im) at reference wavelength for particle size distribution #2*
4.7173841954562E-04 48.14141586034900 0.0100	*Minimum, maximum radii and size increment (µm) for particle size distribution #2*
2 0.5000 2.99	*Index of selected particle size distribution and its 2 parameters, for particle size distribution #2*
0.00000227E+00	*Component mixing ratio for particle size distribution #2*
1.750 0.4586364E+00	*Refractive index (Re,Im) at nominal wavelength for particle size distribution #3*
1.750 0.4387952E+00	*Refractive index (Re,Im) at reference wavelength for particle size distribution #3*
1.8955848629255E-04 0.28027805069842 0.0001	*Minimum, maximum radii and size increment (µm) for particle size distribution #3*
2 0.0118 2.00	*Index of selected particle size distribution and its 2 parameters, for particle size distribution #3*
0.06123000E+00	*Component mixing ratio for particle size distribution #3*

The 16 SAMs consist in the maritime (MAR), coastal (COA), rural (RUR) and blue-IOP (BLU) assemblages given in Section 6.13.5.1.1. The latters are referred by *iaer* from #0 to #12 and #31, #32 and #33.

Using the spectral dependence in the *Mie*'s inputs (*i.e.*, spectral characteristics of the aerosols) and the aerosol optical thicknesses at $550nm$ tabulated in the previous section, $f[iaer,\lambda,\tau^a]$ is then estimated with the following steps:

Step-1: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar***xx***_b***yy*, *sc_coa***xx***_b***yy**, *sc_rur***xx***_b***yy**, *sc_IOP***ww***_b***yy**, *sc_conti_b***yy**, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Determine the extinction coefficient at $865nm$ ($\sigma_{e,865}^{layer}$) from OTC/SCAMAT for each of the 3 aerosol layers (*layer*= boundary, troposphere, or stratosphere).

Step-3: Extract the extinction coefficients $\sigma_{e,\lambda}^{layer}$ for each of the 3 aerosol layers (*layer*) and for each of the 15 MERIS wavelengths (λ).

Step-4: Compute the spectral dependence factor of the total aerosol optical thickness τ^a, $f[iaer,\lambda,\tau^a]$, as follows,

$$f[iaer,\lambda,\tau^a]=\frac{\sum_{layer=1}^{3}\tau_{550,layer}^{a}[iaer,\tau^a].\dfrac{\sigma_{e,\lambda}^{layer}}{\sigma_{e,550}^{layer}}}{\sum_{layer=1}^{3}\tau_{550,layer}^{a}[iaer,\tau^a].\dfrac{\sigma_{e,865}^{layer}}{\sigma_{e,550}^{layer}}}\quad,\quad with\quad \tau^a=\sum_{layer=1}^{3}\tau_{550,layer}^{a}$$

$\tau_{550,layer}^{a}$ is the aerosol optical thickness at $550nm$ for the aerosol layer *layer*, and σ_e^{layer} its associated extinction coefficient at the wavelength λ or $550nm$ or $865nm$. Note that the *layer* values of 1, 2 and 3 correspond respectively to the boundary layer (*layer #1* referred also as *'bound'*), the tropospheric aerosol layer (*layer #2* referred also as *'tropo'*) and the stratospheric aerosol layer (*layer #3* referred also as *'strato'*).

Warning: Only the last 6 $\tau_{550,layer}^{a}$ values from LUT136 (Section 6.13.1.1) and from LUT409 (Section 6.13.1.3) are considered for the *f* table computation. The fields corresponding to the first AOT value (*i.e.*, $\tau_{550,layer}^{a}$ =0) in the *f* table are filled with 0 values.

The extinction coefficients for the 3 aerosol layers (*'bound'*, *'tropo'* and *'strato'*) are computed with the OTC/SCAMAT and are already normalized at a reference wavelength (here, $550nm$), thus $\sigma_{e,550}^{layer}=1$.

Note: In order to keep the size of the output LUT as defined in the previous FUB recipe above, the $f[iaer,\lambda,\tau^a]$ LUT is completed with null values for *iaer* from #13 to #30.

Scientific content:

$f[iaer,\lambda,\tau^a]$ describes the spectral dependence of the total aerosol optical thickness, for each of the 16 SAMs (*iaer*), for each of the 15 MERIS wavelengths (λ), and for each of the 6 (non-null) pre-selected total aerosol optical thicknesses (τ^a) at 550 nm. Values of $f[iaer,\lambda,\tau^a]$ are normalized to the reference wavelength at 865 nm.

Resources:

Estimated CPU time:	3 *sec* (if LUT419 already generated, otherwise 13263 *sec*)
Output disk space:	34 × 15 × 7 × 4 bytes/fl = 14280 bytes

Acceptance:

Comparison with another OTC from the LOV institute.

6.13.6 GADS Aerosol Optical Thickness at 865 nm

6.13.6.1 Aerosol optical thickness at 865 nm, $\tau^a_{865}(iaer,\tau^a)$

6.13.6.1.1 FUB Recipe

Reference: τ_a_bl865, LUT139

[AD-8] Section 6.13.6, GADS field 1

Dependencies:

LUT136, LUT137, LUT409

Tool:

OTC/MIE

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

Procedure:

Inputs:	*iaer*	Aerosol assemblage # [*dl*] (among the 34 aerosol assemblages)
	τ^{a1}	Aerosol optical thickness at 550 nm [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)

τ^{a2} Aerosol optical thickness at 550 nm [dl] for the dust layer (aerosol layer #2), *see* Section 6.13.1.2 (LUT137)

τ^{a3} Aerosol optical thickness at 550 nm [dl] for the tropospheric layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)

τ^{a4} Aerosol optical thickness at 550 nm [dl] for the stratospheric layer (aerosol layer #4) fixed to 0.005 whatever the wavelength and the assemblage except for the first one (*iaer#0*, τ^{a4} = 0)

Output: τ_a_bl865[$iaer,\tau^a$], referred also as τ^a_{865} [$iaer,\tau^a$]

Aerosol optical thickness at 865 nm for each of the 34 aerosol assemblages (*iaer*) and for each aerosol optical thickness (τ^a) at 550 nm.

units: [dl]

τ^a_{865} [$iaer,\tau^a$] is computed as the sum of the products between the aerosol optical thickness $\tau^a_{550,layer}[iaer,\tau^a]$ at 550 nm and the extinction coefficients ratio $(\sigma^{layer}_{e,865}/\sigma^{layer}_{e,550})$, describing the spectral dependence of the aerosol model, for each of the 4 aerosol layers (*layer*) (*i.e.*, boundary, dust, troposphere and stratosphere). This calculation is achived with the following steps:

Step-1: Select each aerosol model among the 23 models used in the 34 ocean-aerosol assemblages, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/*sc_mar***xx***_b***yy*, *sc_coa***xx***_b***yy*, *sc_rur***xx***_b***yy*, *sc_dbdsz***_b***yy*, *sc_dbdwz***_b***yy*, *sc_IOP***ww***_b***yy*, *sc_conti_b***yy*, *sc_H2SO4_b***yy**

with ***xx*** *= {50, 70, 90, 99} (i.e., relative humidity),* ***yy*** *= {01,..,15} (i.e., MERIS bands #),* ***z*** *= {1, 2, 3} (i.e.,3 scale heights),* ***ww*** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Extract the extinction coefficients at 865 nm ($\sigma^{model}_{e,865}$) and 550 nm ($\sigma^{model}_{e,550}$) from the 4 aerosol models, and compute τ^a_{865} [$iaer,\tau^a$], the total optical thickness at 865 nm, as follows,

$$\tau^a_{865}[iaer,\tau^a] = \sum_{layer=1}^{4} \tau^a_{550,layer}[iaer,\tau^a_{550}] \cdot \frac{\sigma^{layer}_{e,865}}{\sigma^{layer}_{e,550}}$$

with $\tau^a = \sum_{layer=1}^{4} \tau^a_{550,layer} = \tau^a_{550,bound} + \tau^a_{550,dust} + \tau^a_{550,tropo} + \tau^a_{550,strato}$

where $\tau^a_{550,bound}, \tau^a_{550,dust}, \tau^a_{550,tropo}, \tau^a_{550,strato}$ correspond to τ^{a1}, τ^{a2}, τ^{a3}, τ^{a4}, respectively.

Warning: Only the last 6 $\tau^a_{550,layer}$ values from LUT136 (Section 6.13.1.1), from LUT137 (Section 6.13.1.2) and from LUT409 (Section 6.13.1.3) are considered for the τ^a_{865} table computation. The fields corresponding to the first AOT value (*i.e.*, $\tau^a_{550,layer}$ =0) in the τ^a_{865} table are filled with 0 values.

Scientific content:

τ^a_{865} $[iaer, \tau^a]$ describes the aerosol optical thickness at $865\,nm$ for the whole atmosphere (0–50 km), for each of the 34 aerosol assemblages (*iaer*) and for each of the 6 (non null) total aerosol optical thicknesses (τ^a) at $550\,nm$, from which depends the aerosol *mixing ratio*. This reference table is required due to the fact that the AOTs are normalized to the $865\,nm$ wavelength.

Resources:

Estimated CPU time: 1 *sec* (if LUT399 already generated, otherwise 18198 *sec*)
Output disk space: 34 × 7 × 4 bytes/fl = 952 bytes

Acceptance:

Comparison with another OTC from the LOV institute.

6.13.6.1.2 UdL Recipe

Reference: τ_a_bl865, LUT139

[AD-8] Section 6.13.6, GADS field 1

Dependencies:

LUT136, LUT409

Tool:

OTC/SCAMAT

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

Procedure:

Inputs:	*iaer*	Aerosol assemblage # [*dl*] (16 SAMs [iaer#0+MAR+COA+RUR+BLU-IOP])
	τ^{a1}	Aerosol optical thickness at $550\,nm$ [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)
	τ^{a2}	Aerosol optical thickness at $550\,nm$ [*dl*] for the tropospheric layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)
	τ^{a3}	Aerosol optical thickness at $550\,nm$ [*dl*] for the stratospheric layer (aerosol layer #4) fixed to 0.005 whatever the wavelength and the assemblage except for the first one (*iaer#0*, $\tau^{a4} = 0$)

Output: τ_a_bl865[$iaer,\tau^a$], referred also as τ^a_{865} [$iaer,\tau^a$]

Aerosol optical thickness at 865 nm for each of the 16 SAMs ($iaer$) and for each aerosol optical thickness (τ^a) at 550 nm.

units: [dl]

τ^a_{865} [$iaer,\tau^a$] is computed as the sum of the products between the aerosol optical thickness $\tau^a_{550,layer}[iaer,\tau^a]$ at 550 nm and the extinction coefficients ratio $(\sigma^{layer}_{e,865}/\sigma^{layer}_{e,550})$, describing the spectral dependence of the aerosol model, for each of the 3 aerosol layers ($layer$) ($i.e.$, boundary, troposphere and stratosphere). This calculation is achived with the following steps:

Step-1: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar****xx****_b****yy***, *sc_coa****xx****_b****yy***, *sc_rur****xx****_b****yy***, *sc_IOP****ww****_b****yy***, *sc_conti_b****yy***, *sc_H2SO4_b****yy***

with ***xx*** *= {50, 70, 90, 99} (i.e., relative humidity),* ***yy*** *= {01,..,15} (i.e., MERIS bands #),* ***ww*** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Extract the extinction coefficients at 865 nm ($\sigma^{model}_{e,865}$) and 550 nm ($\sigma^{model}_{e,550}$) for each of the 3 aerosol layers ($layer$), and compute τ^a_{865} [$iaer,\tau^a$], the total optical thickness at 865 nm, as follows,

$$\tau^a_{865}[iaer,\tau^a] = \sum_{layer=1}^{3} \tau^a_{550,layer}[iaer,\tau^a_{550}] \cdot \frac{\sigma^{layer}_{e,865}}{\sigma^{layer}_{e,550}}$$

with $\tau^a = \sum_{layer=1}^{3} \tau^a_{550,layer} = \tau^a_{550,bound} + \tau^a_{550,tropo} + \tau^a_{550,strato}$

where $\tau^a_{550,bound}, \tau^a_{550,tropo}, \tau^a_{550,strato}$ correspond to τ^{a1}, τ^{a2}, τ^{a3}, respectively.

Warning: Only the last 6 $\tau^a_{550,layer}$ values from LUT136 (Section 6.13.1.1) and from LUT409 (Section 6.13.1.3) are considered for the τ^a_{865} table computation. The fields corresponding to the first AOT value ($i.e.$, $\tau^a_{550,layer}$ =0) in the τ^a_{865} table are filled with 0 values.

Note: In order to keep the size of the output LUT as defined in the previous FUB recipe above, the τ^a_{865} [$iaer,\tau^a$] LUT is completed with null values for $iaer$ from #13 to #30.

Scientific content:

τ^a_{865} [$iaer,\tau^a$] describes the aerosol optical thickness at 865 nm for the whole atmosphere (0 - 50 km), for each of the 16 SAMs ($iaer$) and for each of the 6 (non null) total aerosol optical thicknesses (τ^a) at

550 *nm*, from which depends the aerosol *mixing ratio*. This reference table is required due to the fact that the aerosol optical properties are normalized to the 865 *nm* wavelength.

Resources:

Estimated CPU time: 1 *sec* (if LUT419 already generated, otherwise 13261 *sec*)
Output disk space: 34 × 7 × 4 bytes/fl = 952 bytes

Acceptance:

Comparison with another OTC from the LOV institute.

6.13.7 GADS Aerosol Single Scattering Albedo

6.13.7.1 Aerosol single scattering albedo, $\omega_o^a(iaer,\lambda)$

6.13.7.1.1 FUB Recipe

Reference: $\omega_a$tab_LUT, LUT140

[AD-8] Section 6.13.7, GADS field 1

Dependencies:

LUT130

Tool:

OTC/MIE

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (among the 34 aerosol assemblages)
λ MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)

Output: $\omega_a tab\_LUT[iaer,\lambda]$, referred also as $\omega_o^a[iaer,\lambda]$
Aerosol single scattering albedo for each of the 34 aerosol assemblages (*iaer*) and for each of the 15 MERIS wavelengths (λ).

units: [*dl*]

Note: The *Mie*'s computations for the different aerosol models have to be performed with the input cards placed in ***/FUB/sca_in***. All the input parameters for these calculations are described and defined in [AD-6] and [AD-7], respectively.

Step-1: Select each aerosol model among the 23 models used in the 34 ocean-aerosol assemblages, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/*sc_mar***xx***_b***yy*, *sc_coa***xx***_b***yy*, *sc_rur***xx***_b***yy*, *sc_dbds***z***_b***yy*, *sc_dbdw***z***_b***yy*, *sc_IOP***ww***_b***yy*, *sc_conti_b***yy*, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **z** *= {1, 2, 3} (i.e.,3 scale heights),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Determine the single scattering albedo $\omega_o^a[iaer,\lambda]$ for each of the 34 aerosol assemblages (*iaer*) and for each of the 15 MERIS wavelengths (λ), by combining the different aerosol components in each of the 4 aerosol layers (as defined according to WCRP or *Shettle and Fenn* (*1979*) [RD-8], *see* also [AD-6] for more details) and their optical properties (*i.e.*, extinction / scattering coefficients and single scattering albedo) for the boundary, dust, tropospheric and stratospheric layers.

The single scattering albedo (ω_o) is defined as the ratio between the scattering (b) and the extinction (c) coefficient. $\omega_o^a[iaer,\lambda]$ will then be computed as the ratio of a weighted average on the scattering to a weighted average on the extinction. The weighting factor is defined by the optical thickness. As an example, for an aerosol assemblage composed with the aerosol models a_1 (boundary layer), a_2 (dust layer), a_3 (troposphere) and a_4 (stratosphere) for which the optical thicknesses are respectively τ^{a1}, τ^{a2}, τ^{a3} and τ^{a4} the scattering coefficients b_1, b_2, b_3 and b_4 and the extinction coefficients c_1, c_2, c_3 and c_4, the resulting single scattering albedo ω_o will be:

$$\omega_o = \frac{\sum_{k=1}^{4} b_k \cdot \tau^{a_k}}{\sum_{k=1}^{4} c_k \cdot \tau^{a_k}}$$

For the computation, τ^{a1} and τ^{a2} will be selected as the 5th value in the set of 7 AOT550 respectively for the boundary and the dust layer (LUT136 & LUT137).

Note that the ω_o values have to be positive and lower or equal to 1.

Scientific content:

$\omega_o^a[iaer,\lambda]$ describes the aerosol single scattering albedo for the whole atmosphere (0 - 50km), for each of the 34 aerosol assemblages (*iaer*) and for each of the 15 MERIS wavelengths (λ). This table is required for the atmospheric correction algorithm over ocean.

Resources:

Estimated CPU time: 1 *sec* (if LUT399 already generated, otherwise 18198 *sec*)
Output disk space: 34 × 15 × 4 bytes/fl = 2040 bytes

Acceptance:

Comparison with another OTC from the LOV institute.

6.13.7.1.2 UdL Recipe

Reference: $\omega_a$tab_LUT, LUT140

[AD-8] Section 6.13.7, GADS field 1

Dependencies:

LUT130

Tool:

OTC/SCAMAT

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (16 SAMs [iaer#0 + MAR+ COA + RUR + BLU-IOP])
λ MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)

Output: ω_a*tab_LUT*[*iaer*,λ], referred also as $\omega_0^a[iaer,\lambda]$
Aerosol single scattering albedo for each of the 16 SAMs (*iaer*) and for each of the 15 MERIS wavelengths (λ).

units: [*dl*]

Step-1: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar***xx***_b***yy**, *sc_coa***xx***_b***yy**, *sc_rur***xx***_b***yy**, *sc_IOP***ww***_b***yy**, *sc_conti_b***yy**, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

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Step-2: Determine the single scattering albedo $\omega_o^a[iaer,\lambda]$ for each of the 16 SAMs (*iaer*) and for each of the 15 MERIS wavelengths (λ), by combining the different aerosol components in each of the 3 aerosol layers and their optical properties (*i.e.*, extinction / scattering coefficients and single scattering albedo) for the boundary, dust, tropospheric and stratospheric layers.

$\omega_o^a[iaer,\lambda]$ is then computed as the ratio of a weighted average on the scattering to a weighted average on the extinction. For an aerosol assemblage composed with the aerosol models a_1 (boundary layer), a_2 (troposphere) and a_3 (stratosphere) for which the optical thicknesses are respectively τ^{a1}, τ^{a2} and τ^{a3}, the scattering coefficients b_1, b_2 and b_3 and the extinction coefficients c_1, c_2 and c_3, the resulting single scattering albedo ω_o is computed as:

$$\omega_o = \frac{\sum_{k=1}^{3} b_k \cdot \tau^{a_k}}{\sum_{k=1}^{3} c_k \cdot \tau^{a_k}}$$

For the computation, τ^{a1} will be selected as the 5th value in the set of 7 AOT550 for the boundary layer (LUT136).

Note that the ω_o values have to be positive and lower or equal to 1.

Note: In order to keep the size of the output LUT as defined in the previous FUB recipe above, the ω_o^a $[iaer,\lambda]$ LUT is completed with null values for *iaer* from #13 to #30.

Scientific content:

$\omega_o^a[iaer,\lambda]$ describes the aerosol single scattering albedo for the whole atmosphere (0 - 50km), for each of the 16 SAMs (*iaer*) and for each of the 15 MERIS wavelengths (λ). This table is required for the atmospheric correction algorithm over ocean.

Resources:

Estimated CPU time: 1 *sec* (if LUT419 already generated, otherwise 13261 *sec*)
Output disk space: 34 × 15 × 4 bytes/fl = 2040 bytes

Acceptance:

Comparison with another OTC from the LOV institute.

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6.13.8 GADS Aerosol Forward Scattering Proportion

6.13.8.1 Aerosol forward scattering proportion, $fp^a(iaer,\lambda)$

6.13.8.1.1 FUB Recipe

Reference: $f_a$tab_LUT, LUT141

[AD-8] Section 6.13.8, GADS field 1

Dependencies:

LUT130

Tools:

OTC/MIE
OTC/SCFP_2

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

The OTC/SCFP_2 allows one to compute the aerosol forward scattering proportion using aerosol optical properties generated with the OTC/MIE.

Procedure:

Inputs: *iaer* Aerosol model # [*dl*](among the 34 aerosol assemblages)
λ MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)

Output: $f_a tab\_LUT[iaer,\lambda]$, referred also as $f_a[iaer,\lambda]$
aerosol forward scattering proportion for each of the 34 aerosol assemblages (*iaer*) and for each of the 15 MERIS wavelengths (λ).

units: [*dl*]

Note: The *Mie*'s computations for the different aerosol models have to be performed with the input cards placed in ***/FUB/sca_in***. All the input parameters for these calculations are described and defined in [AD-6] and [AD-7], respectively.

Step-1: Select each aerosol model among the 23 models used in the 34 ocean-aerosol assemblages, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/*sc_mar***xx***_b***yy***, *sc_coa***xx***_b***yy***, *sc_rur***xx***_b***yy***, *sc_dbds***z***_b***yy***, *sc_dbdw***z***_b***yy***, *sc_IOP***ww***_b***yy***, *sc_conti_b***yy***, *sc_H2SO4_b***yy***

with ***xx*** *= {50, 70, 90, 99} (i.e., relative humidity),* ***yy*** *= {01,..,15} (i.e., MERIS bands #),* ***z*** *= {1, 2, 3} (i.e.,3 scale heights),* ***ww*** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Build the *'scpf.ein'* file with the list of aerosol models, launch the computations of the aerosol forward scattering proportion for each aerosol models with the OTC/SCFP_2, and save results in an output file namely *'ae_fp.d'*.

Step-3: Determine the forward scattering proportion $f_a[iaer,\lambda]$ for each of the 34 aerosol assemblages ($iaer$) and for each of the 15 MERIS wavelengths (λ), by combining the different aerosol components in each of the 4 aerosol layers (as defined according to WCRP or *Shettle and Fenn* (*1979*) [RD-8], *see* also [AD-6] for more details).

The forward scattering proportion (f_a) is defined as the sum of the individual forward scattering probabilities of the aerosol models in the 4 aerosol layers weighted by their associated optical thicknesses. As an example, for an aerosol assemblage composed with the aerosol models a_1 (boundary layer), a_2 (dust layer), a_3 (troposphere) and a_4 (stratosphere) for which the optical thicknesses are respectively τ^{a1}, τ^{a2}, τ^{a3} & τ^{a4} and the forward scattering probabilities $f_{a_1}, f_{a_2}, f_{a_3}$ & f_{a_4}, the resulting forward scattering proportion f_a will be:

$$f_a = \frac{\sum_{k=1}^{4} f_{a_k} \cdot \tau^{a_k}}{\sum_{k=1}^{4} \tau^{a_k}}$$

For the computation, τ^{a1} and τ^{a2} will be selected as the 5th value in the set of 7 AOT550 respectively for the boundary and the dust layer (LUT136 & LUT137).

Note that the f_a values have to be positive and lower or equal to 1.

Scientific content:

$f_a[iaer,\lambda]$ describes the aerosol forward scattering proportion for the whole atmosphere (0 - 50 km), for each of the 34 aerosol assemblages ($iaer$) and for each of the 15 MERIS wavelengths (λ). This table is required for the atmospheric correction algorithm over ocean.

Resources:

Estimated CPU time: 2 *sec* (if LUT399 already generated, otherwise 64808 *sec*)
Output disk space: 34 × 15 × 4 bytes/fl = 2040 bytes

Acceptance:

Comparison with another computations should have be done.

6.13.8.1.2 UdL Recipe

Reference: $f_a$tab_LUT, LUT141

[AD-8] Section 6.13.8, GADS field 1

Dependencies:

LUT130

Tools:

OTC/SCAMAT
OTC/COMPUTE_FSP

Note: The optical properties (*i.e.*, phase function, extinction and scattering coefficients, and single scattering albedo) for the aerosol models have to be computed with the *Mie's* theory (*see* [AD-7] for more details).

The OTC/COMPUTE_FSP allows one to compute the aerosol forward scattering proportion using aerosol optical properties generated with the OTC/SCAMAT.

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (16 SAMs [iaer#0 + MAR+ COA + RUR + BLU-IOP])

λ MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)

Output: f_a*tab_LUT*[*iaer*,λ], referred also as f_a[*iaer*,λ]
Aerosol forward scattering proportion for each of the 16 SAMs (*iaer*) and for each of the 15 MERIS wavelengths (λ).

units: [*dl*]

Step-1: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar***xx***_b***yy*, *sc_coa***xx***_b***yy*, *sc_rur***xx***_b***yy*, *sc_IOP***ww***_b***yy*, *sc_conti_b***yy**, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Compute the aerosol forward scattering proportion for each of all the aerosol models with OTC/COMPUTE_FSP by using as input the *Scamat* ouput files from step-1.

Step-3: For each of the 16 SAMs (*iaer*) and each of the 15 MERIS wavelengths (λ), extract from the output files generated with OTC/COMPUTE_FSP the aerosol forward scattering proportion $f_a[k,\lambda]$ (value at θ=0 *deg.*) for each of the 3 models (*k*) used in the boundary, tropospheric and stratospheric layers, then compute the forward scattering proportion f_a[*iaer*,λ] as:

$$f_a = \frac{\sum_{k=1}^{3} f_{a_k} \cdot \tau^{a_k}}{\sum_{k=1}^{3} \tau^{a_k}}$$

where τ^{a_k} is the associated optical thicknesses with the aerosol model (k).

$$f_a = \frac{\sum_{k=1}^{3} f_{a_k} \cdot \tau^{a_k}}{\sum_{k=1}^{3} \tau^{a_k}}$$

For the computation, τ^{a1} will be selected as the 5th value in the set of 7 AOT550 for the boundary layer (LUT136).

Note that the f_a values have to be positive and lower or equal to 1.

Note: In order to keep the size of the output LUT as defined in the previous FUB recipe above, the f_a*tab_LUT*[*iaer*,λ] LUT is completed with null values for *iaer* from #13 to #30.

Scientific content:

f_a[*iaer*,λ] describes the aerosol forward scattering proportion for the whole atmosphere (0–50 *km*), for each of the 16 SAMs (*iaer*) and for each of the 15 MERIS wavelengths (λ). This table is required for the atmospheric correction algorithm over ocean.

Resources:

Estimated CPU time:	2 *sec* (if LUT419 already generated, otherwise 45902 *sec*)
Output disk space:	34 × 15 × 4 bytes/fl = 2040 bytes

Acceptance:

Comparison with another computations should have be done.

6.13.9 GADS Blue TOA Reflectance Threshold - ROGC

6.13.9.1 Threshold on the glint corrected blue TOA reflectance ρ_{GC}(412.5)

Reference: $\rho_{GCthresh}$_LUT, LUT142

[AD-8] Section 6.13.9, ADSR field 1

Dependencies:

LUT130, LUT132, LUT133, LUT134, LUT136, LUT137, LUT409, LUT410

Tools:

RTC/UPRAD (MOMO)
Multi-linear interpolation

Procedure:

Inputs:	*iaer*	Aerosol assemblage #27 ('*MAR-BDW2-3*')
	λ	MERIS band #1 (412.5*nm*), *see* Section 6.13.4.1, (LUT130)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.13.4.3, (LUT132)
	θ_v	View zenith angle [*deg*], *see* Section 6.13.4.4, (LUT133)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.13.4.5, (LUT134)
	k	Polynomial coefficient order [*dl*], $k = [0;2]$
	τ^{a1}	Aerosol optical thickness at 550*nm* [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)
	τ^{a2}	Aerosol optical thickness at 550*nm* [*dl*] for the dust layer (aerosol layer #2), *see* Section 6.13.1.2 (LUT137)
	τ^{a3}	Aerosol optical thickness at 550*nm* [*dl*] for the troposphere layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)
	τ^{a4}	Aerosol optical thickness at 550*nm* [*dl*] for the stratospheric layer, fixed to 0.005 whatever wavelength and assemblage except for the first one (*iaer#0*, τ^{a4} = 0).
	τ^R	*Rayleigh* optical thickness [*dl*] (15 values), *see* Section 6.11.1.1, (LUT410)

Output: $\rho_{GCthresh}\_LUT[\theta_s,\theta_v,\Delta\phi]$

TOA reflectance thresholds at 412.5*nm* as function of the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Step-0: Select each aerosol model used in the ocean-aerosol assemblage #27 ('*MAR-BDW2-3*'), and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at the 412.5*nm* MERIS wavelength (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/*sc_mar***90***_b***01***, *sc_dbdw***2***_b***01***, *sc_conti_b***01***, *sc_H2SO4_b***01**

Step-1: Generate TOA normalized radiance $L_{TOA\_l}[\theta_s^{'},\theta_v^{'},\Delta\phi]$ at 412.5*nm* (MERIS band #1) for a maritime atmosphere (using aerosol assemblage #27, '*MAR-BDW2-3*') over a flat black sea surface, for all illumination and viewing configurations ($\theta_s^{'},\theta_v^{'},\Delta\phi$), with the RTC/MOMO (FUB). Note that the first cloud layer is used as an aerosol layer for stratosphere.

RTC/MOMO Inputs (OCEAN)

Variable	***Value***	***Comments***

Variable	***Value***	***Comments***
out_file	"./up_out/uprad_out"	
i_branch	3	For including the 4 aerosol layers in the radiative transfer computation
$n(\lambda)$	1	Selected from Section 6.13.4.1 (412.5 *nm*)
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Selected from Section 6.11.1.1
aerosol1	"./sca_out/sc_mar90_b01.s"	Boundary layer (assemblage #27)
$\tau^{a1}(550)$	0.05	Selected from Section 6.13.1.1
aerosol2	"./sca_out/sc_dbdw2_b01.s"	Dust layer [0-7 *km*] (assemblage#27)
$\tau^{a2}(550)$	2.0	Selected from Section 6.13.1.2
aerosol3	"./sca_out/sc_conti_b01.s"	Troposphere layer (assemblage #27)
$\tau^{a3}(550)$	0.025	Selected from Section 6.13.1.3
cloud1	"./sca_out/sc_H2SO4_b01.s"	Stratosphere layer (assemblage #27)
$\tau^{c1}(550)$	0.005	
cloud2	-	N/A
$\tau^{c2}(550)$	0	
cloud3	-	N/A
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./sca_vert/vtp1_lut143_0_7km"	Vertical profile with 12 atmospheric layers: boundary layer [0;2 *km*]; dust layer [0;7 *km*]; troposphere [2;12 *km*]; stratosphere [>12 *km*]
I_s	70	
ρ_s	0	
E_o	1	
$\sigma^{w}_{a,\lambda}$	99	
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	16, 10, 25	

Variable	Value	Comments
$\theta_s^{'}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\theta_v^{'}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5

$$n(1), \theta_s', \theta_v', \Delta\phi$$

$$\downarrow$$

$$\boxed{\begin{array}{c}\text{RTC/MOMO} \\ (i\_branch=3;\ iaer=27, \\ \tau^a=2.13;\ \tau^R=0.315;\ \rho_s=0)\end{array}}$$

$$\downarrow$$

$$L_{TOA\_1}[\theta_s', \theta_v', \Delta\phi]$$

Step-2: Apply a multi-linear interpolation to output the TOA normalized *Rayleigh* radiance $L_{TOA\_1}[\theta_s^{'}, \theta_v^{'}, \Delta\phi]$ into the input angular grid in (θ_s, θ_v):

$$L_{TOA\_1}[\theta_s, \theta_v, \Delta\phi] = interpolation(L_{TOA\_1}[\theta_s^{'}, \theta_v^{'}, \Delta\phi])$$

Step-3: Compute blue TOA reflectance thresholds at 412.5 *nm* ($\rho_{GCthresh}\_LUT[\theta_s, \theta_v, \Delta\phi]$) as,

$$\rho_{GCthresh\_LUT}[\theta_s, \theta_v, \Delta\phi] = \pi \,.\, \frac{L_{TOA\_1}[\theta_s, \theta_v, \Delta\phi]}{\cos(\theta_s)}$$

Scientific content:

These blue TOA reflectance thresholds define the maximum reflectance as observed at 412.5 *nm* over flat sea surfaces (*i.e.*, oceanic surfaces corrected for the sun glint).

Resources:

Estimated CPU time: 31 *sec*
Output disk space: 23 × 13 × 25 × 4 bytes/fl = 29900 bytes

Acceptance:

Comparison with another RTC.

6.13.10 ADS Coefficients of ρ_T/ρ_R to τ_a Relation

6.13.10.1 Polynomial coefficients for (ρ_T/ρ_R) to total AOT relationship

6.13.10.1.1 FUB Recipe

Reference: XCtab_LUT, LUT143

[AD-8] Section 6.13.10, ADSR field 1, 2 & 3

Dependencies:

LUT130, LUT132, LUT133, LUT134, LUT135, LUT136, LUT137, LUT409, LUT410

Tools:

RTC/MOMO (FUB)
Multi-linear interpolation
Polynomial fit

Procedure:

Inputs:

iaer	Aerosol assemblage # [*dl*] (among the 34 aerosol assemblages)
λ	MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)
w_s	Wind-speed [$m.s^{-1}$] (3 values), *see* Section 6.13.4.6, (LUT135)
θ_s	Solar zenith angle [*deg*], *see* Section 6.13.4.3, (LUT132)
θ_v	View zenith angle [*deg*], *see* Section 6.13.4.4, (LUT133)
$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.13.4.5, (LUT134)
k	Polynomial coefficient order [*dl*], $k = [0;2]$
τ^{a1}	Aerosol optical thickness at 550 *nm* [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)
τ^{a2}	Aerosol optical thickness at 550 *nm* [*dl*] for the dust layer (aerosol layer #2), *see* Section 6.13.1.2 (LUT137)
τ^{a3}	Aerosol optical thickness at 550 *nm* [*dl*] for the troposphere layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)
τ^{a4}	Aerosol optical thickness at 550 *nm* [*dl*] for the stratospheric layer, fixed to 0.005 whatever wavelength and assemblage except for the first one ($iaer\#0, \tau^{a4}$= 0).
τ^R	*Rayleigh* optical thickness [*dl*] (15 values), *see* Section 6.11.1.1, (LUT410)

Output: $XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$

polynomial coefficients for the relation between the normalized radiance ratio (ρ_T/ρ_R) to the total aerosol optical thickness (τ^a) at 550 *nm*, as function of the aerosol assemblage (*iaer*), the MERIS wavelength (λ), the wind-speed above sea level (w_s), and the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Note: The total aerosol optical thicknesses (τ^a) at 550*nm* is the sum of the 4 aerosol optical thicknesses (*resp.*, τ^{a1},τ^{a2} ,τ^{a3} and τ^{a4}) at 550*nm* for the 4 aerosol layers (*resp.*, boundary, dust, troposphere, and stratosphere), *see* table from Section 6.13.5.1.

Warning: The process for generating this *XCtab_LUT* table is very time-consuming. To avoid loosing data in case of a power failure during the processing, temporary binary files are created after *Step3* and *Step7* described below: *Rayleigh_Wy.LUT401* and *Mxx_Wy_Tz.LUT401 (where xx stands for the identification of the aerosol assemblage [00 .. 33], y for the identification of the wind-speed [0,1], and z for the identification of the total aerosol optical thickness at 550nm).* This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

See Section 6.13.1.7 (LUT401) for the description of these intermediate tables.

Moreover the total aerosol thickness (τ_λ^a) for each RTC/MOMO run is saved in the intermediate binary file (LUT405), see Section 6.13.1.7.

Step-1: Generate TOA normalized *Rayleigh* radiance $L_R[\lambda,w_s,\theta_s^{'},\theta_v^{'}, \Delta\phi]$ for a pure *Rayleigh* atmosphere over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10$m.s^{-1}$), for each MERIS wavelength (λ), and for all illumination and viewing configurations ($\theta_s^{'},\theta_v^{'},\Delta\phi$), with the RTC/MOMO (FUB). Note that the first cloud layer is used as an aerosol layer for stratosphere.

Note: The sun glint (*i.e.*, the direct to direct contribution) is accounted for in $L_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]$.

RTC/MOMO Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./up_out/uprad_out"	
i_branch	3	For using 4 aerosol layers in RTC
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.13.4.1
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	*See* Section 6.11.1.1
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	

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Variable	***Value***	***Comments***
cloud1	-	N/A
$\tau^{c1}(550)$	0	
cloud2	-	N/A
$\tau^{c2}(550)$	0	
cloud3	-	N/A
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./sca_vert/vtp1_lut143_0_2km"	Vertical profile with 12 atmospheric layers
I_s	70	
ρ_s	0	
E_o	1	
$\sigma^{w}_{a,\lambda}$	99	
w_s	1.5, 5.0 and 10	*See* Section 6.13.4.6
n_s , n_v , $n_{\Delta\phi}$	16, 10, 25	
$\theta_s^{'}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\theta_v^{'}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5

$n(\lambda), w_s, \theta_s', \theta_v', \Delta\phi$

↓

RTC/MOMO
(*i_branch=3;*
$\tau^a=0; \rho_s=0$)

↓

$L_R[\lambda, w_s, \theta_s', \theta_v', \Delta\phi]$

Step-2: Compute the *Rayleigh* reflectance $\rho_R[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi]$ as follows,

$$\rho_R[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi] = \pi \, . \, \frac{L_R[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi]}{\cos(\theta_s^{'})}$$

Remove the sun glint reflectance at TOA (ρ_{G_TOA}) from the *Rayleigh* reflectance (only for the case where $w_s \neq 0$). This is achieved with the procedure described in Section 6.11.12.1.

Step-3: Apply a multi-linear interpolation to output the *Rayleigh* reflectance $\rho_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi]$ into the input angular grid in (θ_s, θ_v):

$$\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi] = interpolation(\rho_R[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi])$$

Step-4: Select each aerosol model among the 23 models used in the 34 ocean-aerosol assemblages, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/MIE (FUB) and the associated input *Mie* card:

/FUB/sca_in/*sc_mar****xx****_b****yy****, sc_coa****xx****_b****yy****, sc_rur****xx****_b****yy****, sc_dbds****z****_b****yy****, sc_dbdw****z****_b****yy****, sc_IOP****ww****_b****yy****, sc_conti_b****yy****, sc_H2SO4_b****yy***

with ***xx*** *= {50, 70, 90, 99} (i.e., relative humidity),* ***yy*** *= {01,..,15} (i.e., MERIS bands #),* ***z*** *= {1, 2, 3} (i.e.,3 scale heights),* ***ww*** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-5: Generate TOA normalized radiances $L_T[\lambda,w_s,\theta_s^{'},\theta_v^{'}, \Delta\phi,\tau^a,iaer]$ for a maritime atmosphere (*Rayleigh* + aerosols) over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10$m.s^{-1}$), for each selected aerosol assemblage (τ^a, *iaer*), for each MERIS wavelength (λ), and for all illumination and viewing configurations ($\theta_s^{'},\theta_v^{'},\Delta\phi$), with the RTC/MOMO (FUB). Note that the first cloud layer is used as an aerosol layer for stratosphere.

Note: The sun glint (*i.e.*, the direct to direct contribution) is accounted for in $L_T[\lambda,w_s,\theta_s^{'},\theta_v^{'},\Delta\phi,\tau^a,iaer]$.

RTC/MOMO Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./up_out/uprad_out"	
i_branch	3	For using 4 aerosol layers in RTC
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.13.4.1
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$		*See* Section 6.11.1.1
aerosol1	"./sca_out/sc_mar*xx*_b*yy*.s" "./sca_out/sc_coa*xx*_b*yy*.s" "./sca_out/sc_rur*xx*_b*yy*.s" "./sca_out/sc_blue*w*_b*yy*.s"	For maritime, coastal and rural aerosols, *xx* depends on RH and *yy* on $n(\lambda)$. For blue aerosols, *w* depends on the *Ang-ström* exponent and *yy* on $n(\lambda)$.

Variable	***Value***	***Comments***
$\tau^{a1}(550)$	tauA1	*See* Section 6.13.1.1 (last 6 values only) or table in Section 6.13.5.1
aerosol2	"./sca_out/sc_dbdsz_b*yy*.s" "./sca_out/sc_dbdwz_b*yy*.s"	*yy* depends on $n(\lambda)$ and *z* on the height of the top of aerosol layer
$\tau^{a2}(550)$	tauA2	*See* Section 6.13.1.2 (last 6 values only) or table in Section 6.13.5.1
aerosol3	"./sca_out/sc_conti_b*yy*.s"	*yy* depends on $n(\lambda)$
$\tau^{a3}(550)$	tauA3	*See* Section 6.13.1.3 (last 6 values only) or table in Section 6.13.5.1
cloud1	"./sca_out/sc_H2SO4_b*yy*.s"	*yy* depends on $n(\lambda)$
$\tau^{c1}(550)$	0 0.005	For the first assemblage (*iaer#0*) For the other assemblages (*iaer*)
cloud2	-	N/A
$\tau^{c2}(550)$	0	
cloud3	-	N/A
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./sca_vert/vtp1_lut143_0_7km" "./sca_vert/vtp1_lut143_0_5km" "./sca_vert/vtp1_lut143_0_2km"	For assemblages: *iaer* #15, 18, 21, 24, 27, 30 For assemblages: *iaer* #14, 17, 20, 23, 26, 29 For the other assemblages
I_s	70	
ρ_s	0	
E_o	1	
$\sigma^{w}_{a,\lambda}$	99	
w_s	1.5, 5.0 and 10	*See* Section 6.13.4.6
n_s , n_v , $n_{\Delta\phi}$	16, 10, 25	
$\theta_s^{`}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\theta_v^{`}$	*Gaussian* angles	From *Gauss-Lobatto* quadrature (in RTC/FUB)
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5

$$n(\lambda), w_s, \theta_s', \theta_v', \Delta\phi, \tau^a, iaer$$

$$\downarrow$$

RTC/MOMO
($i\_branch=3$;
$\rho_s=0$)

$$\downarrow$$

$$L_T[\lambda, w_s, \theta_s', \theta_v', \Delta\phi, \tau^a, iaer]$$

Step-6: Compute the total TOA reflectance (*Rayleigh* + aerosols) $\rho_T[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi, \tau^a, iaer]$ as follows,

$$\rho_T[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi, \tau^a, iaer] = \pi \,.\, \frac{L_T[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi, \tau^a, iaer]}{\cos(\theta_s^{'})}$$

Remove the sun glint reflectance at TOA (ρ_{G_TOA}) from the *Rayleigh* reflectance (only for the case where $w_s \neq 0$). This is achieved with the procedure described in Section 6.11.12.1.

Note: For each RTC/MOMO run, the total aerosol optical thickness (τ_λ^a) is extracted from the output MOMO file (in the *'/FUB/mom_out/'* directory) and saved in an intermediate binary file (LUT405), *see* Section 6.13.1.7.

Step-7: Apply a multi-linear interpolation to output the total TOA reflectance $\rho_T[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi, \tau^a, iaer]$ into the input angular grid in (θ_s, θ_v):

$$\rho_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer] = interpolation(\rho_T[\lambda, w_s, \theta_s^{'}, \theta_v^{'}, \Delta\phi, \tau^a, iaer])$$

Step-8: Compute the TOA reflectance ratio $\rho_T/\rho_R\,[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]$,

$$\rho_T / \rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer] = \frac{\rho_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]}{\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]}$$

Step-9: Apply a 2nd order polynomial fit on the TOA reflectance ratio $\rho_T/\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]$ as function of the total aerosol optical thickness τ_λ^a, for retrieving polynomial coefficients $XCtab\_LUT[iaer, \lambda, w_s, \theta_s, \theta_v, \Delta\phi, k]$,

$$\begin{aligned}\rho_T/\rho_R\,[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer] = \; & XCtab\_LUT[iaer, \lambda, w_s, \theta_s, \theta_v, \Delta\phi, 0] \\ & + XCtab\_LUT[iaer, \lambda, w_s, \theta_s, \theta_v, \Delta\phi, 1] \,.\, \tau_\lambda^a \\ & + XCtab\_LUT[iaer, \lambda, w_s, \theta_s, \theta_v, \Delta\phi, 2] \,.\, [\tau_\lambda^a]^2\end{aligned}$$

Note that these coefficients will be determined by fitting 7 points to a 2nd order polynomial for which 6 of these points derive from the MOMO simulations (*i.e.*, 6 total AOTs (τ^a)), and the 7th one is simply (0,1) corresponding to a TOA reflectance ratio of 1 for an aerosol-free atmosphere. More a quality test is applied to the 2nd order polynomial fits in order to check the unique solution in the total AOT (τ_λ^a) retrieval (*i.e.*, to avoid the τ_λ^a value corresponding to the extremum of the 2nd order polynomial fit within the range of AOTs used as input for this fitting). The approach consists to establish the fit by decreasing the number of points (while keeping an acceptable range in τ^a defined by the first 2 non-null input τ^a values) as long as the quality test is not valid.

Step-10: Build the $XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$ table.

Scientific content:

$XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$ describes the coefficients of a polynomial fit which expresses the TOA reflectance ratio $\rho_T/\rho_R\,[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ (in other words, the relative increase in the path reflectance from an aerosol-free atmosphere to an atmosphere with an aerosol loading) as function of the total aerosol optical thickness τ_λ^a. These regression coefficients (k = [0;2]) depends on the aerosol assemblage (*iaer*), the MERIS wavelength (λ), the wind-speed above sea level (w_s), and the illumination and viewing geometries ($\theta_s,\theta_v,\Delta\phi$).

This table is useful for the aerosol correction algorithm over wind-roughened oceanic surface, and allows one to compute the total path to *Rayleigh* reflectances ratio ($\rho_T/\rho_R[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,\tau^a]$) knowing the total aerosol optical thickness τ_λ^a at wavelength λ.

Note that the values of these coefficients will be extracted from this table by using multiple linear interpolations.

The current baseline is:

N_w_s which corresponds to 3 predefined wind-speeds of 1.5, 5.0 and 10$m.s^{-1}$
N_θ_s which corresponds to 23 predefined values (*see* Section 6.13.4.3)
N_θ_v which corresponds to 13 predefined values (*see* Section 6.13.4.4)
$N\_\Delta\phi$ which corresponds to 25 preselected values (*see* Section 6.13.4.5)

Resources:

Estimated CPU time: 101663 *sec* (if LUT399 already generated, otherwise 166469 *sec*)
Output disk space: 34 × 15 × 3 × 23 × 13 × 25 × 3 × 4 bytes/fl = 137241000 bytes

Acceptance:

Some comparisons with another RTC, such as the RTC/UPRAD (SO) from UdL have been done, as well as a quality check with tables generated by the LOV institute.

6.13.10.1.2 UdL Recipe

Reference: XCtab_LUT, LUT143

[AD-8] Section 6.13.10, ADSR field 1, 2 & 3

Dependencies:

LUT130, LUT132, LUT133, LUT134, LUT135, LUT136, LUT409, LUT410

Tools:

RTC/UPRAD (SO)
Polynomial fit

Procedure:

Inputs:	*iaer*	Aerosol assemblage # [*dl*] (16 SAMs [iaer#0+MAR+COA+RUR+BLU-IOP])
	λ	MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)
	w_s	Wind-speed [$m.s^{-1}$] (3 values), *see* Section 6.13.4.6, (LUT135)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.13.4.3, (LUT132)
	θ_v	View zenith angle [*deg*], *see* Section 6.13.4.4, (LUT133)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.13.4.5, (LUT134)
	k	Polynomial coefficient order [*dl*], $k = [0;2]$
	τ^{a1}	Aerosol optical thickness at 550 *nm* [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)
	τ^{a2}	Aerosol optical thickness at 550 *nm* [*dl*] for the tropospheric layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)
	τ^{a3}	Aerosol optical thickness at 550 *nm* [*dl*] for the stratospheric layer (aerosol layer #4) fixed to 0.005 whatever the wavelength and the assemblage except for the first one (*iaer#0*, $\tau^{a4} = 0$)
	τ^{R}	*Rayleigh* optical thickness [*dl*] (15 values), *see* Section 6.11.1.1, (LUT410)

Output: *XCtab_LUT*[$iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k$]

Polynomial coefficients for the relation between the normalized radiance ratio (ρ_T/ρ_R) to the total aerosol optical thickness (τ^a) at 550 *nm*, as function of the aerosol assemblage (*iaer*), the MERIS wavelength (λ), the wind-speed above sea level (w_s), and the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Note: Because the RTC/SO (UdL) composes with 3 aerosol layers only, then the 18 dust assemblages are discarded. The total aerosol optical thicknesses (τ^a) at 550 *nm* is then the sum of the 3 aerosol optical thicknesses (*resp.*, τ^{a1},τ^{a2} and τ^{a3}) at 550 *nm* for the 3 aerosol layers (*resp.*, boundary, troposphere and stratosphere), *see* table from Section 6.13.5.1.

Warning: The process for generating this *XCtab_LUT* table is very time-consuming. To avoid loosing data in case of a power failure during the processing, temporary binary files are created after *Step2* and *Step5* described below: *Rayleigh_Wy.LUT401* and *Mxx_Wy_Tz.LUT401 (where xx* *stands for the identification of the aerosol assemblage [00 .. 16], y for the identification of the wind-speed [0,1,2], and z for the identification of the total aerosol optical thickness at 550 nm)*. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

See Section 6.13.1.7 (LUT401) for the description of these intermediate tables.

Moreover the total aerosol thickness (τ_λ^a) for each RTC/SO run is saved in the intermediate binary file (LUT405), *see* Section 6.13.1.7. Because the size of this LUT remains unchanged then it will be completed with null values.

Step-1: Generate TOA normalized *Rayleigh* radiance $L_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ for a pure *Rayleigh* atmosphere over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10$m.s^{-1}$), for each MERIS wavelength (λ), and for all illumination and viewing configurations ($\theta_s,\theta_v,\Delta\phi$), with the RTC/UPRAD (SO). The sun glint (*i.e.*, the direct to direct contribution) is not accounted for in $L_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$.

Note: An internal sun glint flag has been desactivated in the RTC/SO for excluding the direct to direct contribution in the computation of TOA normalized radiance.

RTC/UPRAD (SO) Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	2	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.13.4.1
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	*See* Section 6.11.1.1
aerosol1	-	
$\tau^{a1}(550)$	0	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma_{e,\lambda}^p$	-	N/A

Variable	*Value*	*Comments*
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_R=8 *km*)
I_s	79	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	1.5, 5.0 and 10	*See* Section 6.13.4.6
n_s , n_v , $n_{\Delta\phi}$	23, 13, 25	
θ_s	*Gaussian* angles	First 23 angles selected from *Gauss* quadrature; *See* Section 6.13.4.3
θ_v	*Gaussian* angles	First 13 angles selected from *Gauss* quadrature; *See* Section 6.13.4.4
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5
pol	1	

$n(\lambda), w_s, \theta_s, \theta_v, \Delta\phi$

↓

RTC/UPRAD (SO)
(*i_branch=2;*
$\tau^a=0; \rho_s=0$)

↓

$L_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]$

Step-2: Compute the *Rayleigh* reflectance $\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]$ as follows,

$$\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi] = \pi \, . \, \frac{L_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]}{\cos(\theta_s)}$$

Step-3: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar****xx****_b****yy**, *sc_coa***xx***_b***yy**, *sc_rur***xx***_b***yy**, *sc_IOP***ww***_b***yy**, *sc_conti_b***yy**, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-4: Generate TOA normalized radiances $L_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]$ for a maritime atmosphere (*Rayleigh* + aerosols) over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10$m.s^{-1}$), for each selected aerosol assemblage (τ^a, *iaer*), for each MERIS wavelength (λ), and for all illumination and viewing configurations ($\theta_s, \theta_v, \Delta\phi$), with the RTC/UPRAD (SO).

Note: An internal sun glint flag has been desactivated in the RTC/SO for excluding the direct to direct contribution in the computation of TOA normalized radiance.

RTC/UPRAD (SO) Inputs (OCEAN)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	2	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.13.4.1
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	*See* Section 6.11.1.1
aerosol1	"./INPUT/sca_out/sc_mar*xx*_b*yy*" "./INPUT/sca_out/sc_coa*xx*_b*yy*" "./INPUT/sca_out/sc_rur*xx*_b*yy*" "./INPUT/sca_out/sc_blue*w*_b*yy*"	For maritime, coastal and rural aerosols, *xx* depends on RH and *yy* on $n(\lambda)$. For blue aerosols, *w* depends on the *Ang-ström* exponent and *yy* on $n(\lambda)$.
$\tau^{a1}(550)$	tauA1	*See* Section 6.13.1.1 (last 6 values only) or table in Section 6.13.5.1
aerosol2	"./INPUT/sca_out/sc_conti_b*yy*"	*yy* depends on $n(\lambda)$
$\tau^{a2}(550)$	tauA2	*See* Section 6.13.1.3 (last 6 values only) or table in Section 6.13.5.1
aerosol3	"./INPUT/sca_out/sc_H2SO4_b*yy*"	*yy* depends on $n(\lambda)$
$\tau^{a3}(550)$	0 0.005	For the first assemblage (*iaer#0*) For the other assemblages (*iaer*)
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A

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spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (optically homogeneous layers)
I_s	79	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	1.5, 5.0 and 10	*See* Section 6.13.4.6
n_s , n_v , $n_{\Delta\phi}$	23, 13, 25	
θ_s	*Gaussian* angles	First 23 angles selected from *Gauss* quadrature; *See* Section 6.13.4.3
θ_v	*Gaussian* angles	First 23 angles selected from *Gauss* quadrature; *See* Section 6.13.4.4
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5
pol	1	

$$n(\lambda), w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer$$

$$\downarrow$$

$$\boxed{\begin{array}{c}\text{RTC/UPRAD (SO)}\\ (i\_branch=2;\\ \rho_s=0)\end{array}}$$

$$\downarrow$$

$$L_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]$$

Step-5: Compute the total TOA reflectance (*Rayleigh* + aerosols) $\rho_T[\lambda,w_s,\theta_s,\theta_v,\Delta\phi,\tau^a,iaer]$ as follows,

$$\rho_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer] = \pi \cdot \frac{L_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]}{\cos(\theta_s)}$$

Note: For each RTC/UPRAD (SO) run, the total aerosol optical thickness (τ^a_λ) is extracted from the output file ('./OUTPUT/uprad_out') and saved in an intermediate binary file (LUT405), *see* Section 6.13.1.7.

Step-6: Compute the TOA reflectance ratio $\rho_T/\rho_R\,[\lambda,w_s,\theta_s,\theta_v,\Delta\phi,\tau^a,iaer]$,

$$\rho_T / \rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer] = \frac{\rho_T[\lambda, w_s, \theta_s, \theta_v, \Delta\phi, \tau^a, iaer]}{\rho_R[\lambda, w_s, \theta_s, \theta_v, \Delta\phi]}$$

Step-7: Apply a 2nd order polynomial fit on the TOA reflectance ratio $\rho_T/\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi,\tau^a,iaer]$ as function of the total aerosol optical thickness τ_λ^a, for retrieving polynomial coefficients $XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$,

$$\begin{aligned}\rho_T/\rho_R[\lambda,w_s,\theta_s,\theta_v,\Delta\phi,\tau^a,iaer] = \; & XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,0] \\ & + XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,1] \,.\, \tau_\lambda^a \\ & + XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,2] \,.\, [\tau_\lambda^a]^2\end{aligned}$$

Note that these coefficients will be determined by fitting 7 points to a 2nd order polynomial for which 6 of these points derive from the MOMO simulations (*i.e.*, 6 total AOTs (τ^a)), and the 7th one is simply (0,1) corresponding to a TOA reflectance ratio of 1 for an aerosol-free atmosphere. More a quality test is applied to the 2nd order polynomial fits in order to check the unique solution in the total AOT (τ_λ^a) retrieval (*i.e.*, to avoid the τ_λ^a value corresponding to the extremum of the 2nd order polynomial fit within the range of AOTs used as input for this fitting). The approach consists to establish the fit by decreasing the number of points (while keeping an acceptable range in τ^a defined by the first 2 non-null input τ^a values) as long as the quality test is not valid.

Step-8: Build the $XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$ table for the 16 SAMs (iaer#0, 4 MAR, 4 COA, 4 RUR, 3 BLU-IOP).

Note: In order to keep the same LUT size as the one defined in the previous FUB recipe above then this $XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$ LUT will be completed with null values for *iaer* from #13 to #30.

Scientific content:

$XCtab\_LUT[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,k]$ describes the coefficients of a polynomial fit which expresses the TOA reflectance ratio $\rho_T/\rho_R[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi]$ (in other words, the relative increase in the path reflectance from an aerosol-free atmosphere to an atmosphere with an aerosol loading) as function of the total aerosol optical thickness τ_λ^a. These regression coefficients (k = [0;2]) depends on the aerosol assemblage (*iaer*), the MERIS wavelength (λ), the wind-speed above sea level (w_s), and the illumination and viewing geometries ($\theta_s,\theta_v,\Delta\phi$).

This table is useful for the aerosol correction algorithm over wind-roughened oceanic surface, and allows one to compute the total path to *Rayleigh* reflectances ratio ($\rho_T/\rho_R[iaer,\lambda,w_s,\theta_s,\theta_v,\Delta\phi,\tau^a]$) knowing the total aerosol optical thickness τ_λ^a at wavelength λ.

Note that the values of these coefficients will be extracted from this table by using multiple linear interpolations.

The current baseline is:

N_w_s	which corresponds to 3 predefined wind-speeds of 1.5, 5.0 and 10 $m.s^{-1}$
N_θ_s	which corresponds to 23 predefined values (*see* Section 6.13.4.3)
N_θ_v	which corresponds to 13 predefined values (*see* Section 6.13.4.4)
$N\_\Delta\phi$	which corresponds to 25 preselected values (*see* Section 6.13.4.5)

Resources:

Estimated CPU time: 47841 *sec* (if LUT419 already generated, otherwise 93741 *sec*)
Output disk space: 34 × 15 × 3 × 23 × 13 × 25 × 3 × 4 bytes/fl = 137241000 bytes

Acceptance:

Some comparisons with another RTC, such as the RTC/MOMO from FUB have been done, as well as a quality check with tables generated by the LOV institute.

6.13.11 ADS Transmittances

6.13.11.1 Total downward transmittance (direct+diffuse)

NOTE: The recipe of this LUT is presently not included in the MERISAT tool. This LUT is currently generated with an input user specified file.

Reference: Tdown_LUT, LUT485

[AD-8] Section 6.13.11, ADSR field 1, 2 & 3

Dependencies:

LUT130, LUT132, LUT135, LUT136, LUT409, LUT410

Tools:

RTC/UPRAD (SO)

Procedure:

Inputs:	*iaer*	Arosol assemblage # [*dl*] (16 SAMs [iaer#0+MAR+COA+RUR+BLU-IOP])
	λ	MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)
	w_s	Wnd-speed [$m.s^{-1}$] (3 values), *see* Section 6.13.4.6, (LUT135)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.13.4.3, (LUT132)
	τ^{a1}	Aerosol optical thickness at 550 *nm* [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)
	τ^{a2}	Aerosol optical thickness at 550 *nm* [*dl*] for the tropospheric layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)

τ^{a3} Aerosol optical thickness at 550 *nm* [*dl*] for the stratospheric layer (aerosol layer #4) fixed to 0.005 whatever the wavelength and the assemblage except for the first one (*iaer#0*, $\tau^{a4} = 0$)

τ^{R} *Rayleigh* optical thickness [*dl*] (15 values), *see* Section 6.11.1.1, (LUT410)

Output: $Tdown\_LUT[iaer,w_s,\lambda,,\theta_s,\tau^a]$

Total downward (diffuse+direct) transmittance, as function of the aerosol assemblage (*iaer*), the wind-speed above sea level (w_s), the MERIS wavelength (λ), the solar zenith angle (θ_s), and the total AOT550 (τ^a)

units: [*dl*]

Note: Because the RTC/SO (UdL) composes with 3 aerosol layers only, then the 18 dust assemblages are discarded. The total aerosol optical thicknesses (τ^a) at 550 *nm* is then the sum of the 3 aerosol optical thicknesses (*resp.*, τ^{a1},τ^{a2} and τ^{a3}) at 550 *nm* for the 3 aerosol layers (*resp.*, boundary, troposphere and stratosphere), *see* table from Section 6.13.5.1.

Step-1: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar***xx***_b***yy*, *sc_coa***xx***_b***yy**, *sc_rur***xx***_b***yy**, *sc_IOP***ww***_b***yy**, *sc_conti_b***yy**, *sc_H2SO4_b***yy**

with **xx** *= {50, 70, 90, 99} (i.e., relative humidity),* **yy** *= {01,..,15} (i.e., MERIS bands #),* **ww** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Generate total downwelling atmospheric transmittance $T_{down}[iaer,w_s,\lambda,,\theta_s,\tau^a]$ for a pure *Rayleigh* atmosphere and a maritime atmosphere (*Rayleigh* + aerosols) over 3 wind-roughened black sea surfaces (w_s=1.5, 5.0 and 10 $m.s^{-1}$), for each selected aerosol assemblage (τ^a, *iaer*), for each MERIS wavelength (λ), and for all illumination configurations (θ_s), with the RTC/UPRAD (SO).

Note: An internal sun glint flag has been desactivated in the RTC/SO for excluding the direct to direct contribution in the computation of total downwelling atmospheric transmittance.

RTC/UPRAD (SO) Inputs (OCEAN)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	2	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.13.4.1
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A

P_s	1013.25	
$\tau^R(\lambda)$	tauR	*See* Section 6.11.1.1
aerosol1	"./INPUT/sca_out/sc_mar*xx*_b*yy*" "./INPUT/sca_out/sc_coa*xx*_b*yy*" "./INPUT/sca_out/sc_rur*xx*_b*yy*" "./INPUT/sca_out/sc_blue*w*_b*yy*"	For maritime, coastal and rural aerosols, *xx* depends on RH and *yy* on $n(\lambda)$. For blue aerosols, *w* depends on the *Ang-ström* exponent and *yy* on $n(\lambda)$.
$\tau^{a1}(550)$	tauA1	*See* Section 6.13.1.1 (7 values)
aerosol2	"./INPUT/sca_out/sc_conti_b*yy*"	*yy* depends on $n(\lambda)$
$\tau^{a2}(550)$	tauA2	*See* Section 6.13.1.3 (7 values)
aerosol3	"./INPUT/sca_out/sc_H2SO4_b*yy*"	*yy* depends on $n(\lambda)$
$\tau^{a3}(550)$	0 0.005	For the first assemblage (*iaer#0*) For the other assemblages (*iaer*)
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (optically homogeneous layers)
I_s	0	First *Fourier* term only
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	1.5, 5.0 and 10	*See* Section 6.13.4.6
n_s , n_v , $n_{\Delta\phi}$	23, 13, 25	
θ_s	*Gaussian* angles	First 23 angles selected from *Gauss* quadrature; *See* Section 6.13.4.3
θ_v	*Gaussian* angles	First 13 angles selected from *Gauss* quadrature; *See* Section 6.13.4.4
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5
pol	1	

$n(\lambda), w_s, \theta_s, \tau^a$, *iaer*

↓

RTC/UPRAD (SO)
($i\_branch=2;$
$\rho_s=0;\ I_s=0$)

↓

$T_{down}(iaer, w_s, \lambda, \theta_s, \tau^a)$

Step-3: For each RTC/UPRAD (SO) run, extract the total downwelling transmittance in the output file ('./OUTPUT/uprad_out') and build the $Tdown\_LUT[iaer, w_s, \lambda, \theta_s, \tau^a]$ table for the 16 SAMs (iaer#0, 4 MAR, 4 COA, 4 RUR, 3 BLU-IOP).

Note: This $Tdown\_LUT[iaer, w_s, \lambda,, \theta_s, \tau^a]$ LUT will be completed with null values for *iaer* from #13 to #30.

Scientific content:

$Tdown\_LUT[iaer, w_s, \lambda,, \theta_s, \tau^a]$ describes the total downwelling atmospheric transmittance.

This table is useful for the aerosol correction algorithm over wind-roughened oceanic surface.

Note that the values of these coefficients will be extracted from this table by using multiple linear interpolations.

The current baseline is:

N_w_s	which corresponds to 3 predefined wind-speeds of 1.5, 5.0 and 10 $m.s^{-1}$
N_θ_s	which corresponds to 23 predefined values (*see* Section 6.13.4.3)
N_τ^a	which corresponds to 7 predefined values (including the pure *Rayleigh* case)

Resources:

Estimated CPU time:	21600 *sec* (if LUT419 already generated, otherwise 34860 *sec*)
Output disk space:	34 × 15 × 3 × 23 × 7 × 4 bytes/fl = 985320 bytes

Acceptance:

Some comparisonswith *Gordon and Wrang* (1994) approximation and with another RTC, such as the RTC/MOMO from FUB have been done, as well as a quality check with tables generated by the LOV institute.

6.13.11.2 Total upward transmittance (direct+diffuse)

NOTE: The recipe of this LUT is presently not included in the MERISAT tool. This LUT is currently generated with an input user specified file.

Reference: Tup_LUT, LUT486

[AD-8] Section 6.13.12, ADSR field 1

Dependencies:

LUT130, LUT133, LUT136, LUT409, LUT410

Tools:

RTC/UPRAD (SO)

Procedure:

Inputs:

Inputs:	*iaer*	Aerosol assemblage # [*dl*] (16 SAMs [iaer#0 + MAR+ COA + RUR + BLU-IOP])
	λ	MERIS wavelength [*nm*] (15 values), *see* Section 6.13.4.1, (LUT130)
	w_s	Wind-speed [$m.s^{-1}$] (3 values), *see* Section 6.13.4.6, (LUT135)
	θ_v	View zenith angle [*deg*], *see* Section 6.13.4.4, (LUT133)
	τ^{a1}	Aerosol optical thickness at 550*nm* [*dl*] for the boundary layer (aerosol layer #1), *see* Section 6.13.1.1 (LUT136)
	τ^{a2}	Aerosol optical thickness at 550*nm* [*dl*] for the tropospheric layer (aerosol layer #3), *see* Section 6.13.1.3 (LUT409)
	τ^{a3}	Aerosol optical thickness at 550*nm* [*dl*] for the stratospheric layer (aerosol layer #4) fixed to 0.005 whatever the wavelength and the assemblage except for the first one (*iaer#0*, $\tau^{a4} = 0$)
	τ^R	*Rayleigh* optical thickness [*dl*] (15 values), *see* Section 6.11.1.1, (LUT410)

Output: *Tup_LUT*[$iaer, \lambda,, \theta_v, \tau^a$]

Total downward (diffuse+direct) transmittance, as function of the aerosol assemblage (*iaer*), the MERIS wavelength (λ), the view zenith angle (θ_v), and the total AOT550 (τ^a)

units: [*dl*]

Notes: Because the RTC/SO (UdL) composes with 3 aerosol layers only, then the 18 dust assemblages are discarded. The total aerosol optical thicknesses (τ^a) at 550*nm* is then the sum of the 3 aerosol optical thicknesses (*resp.*, τ^{a1},τ^{a2} and τ^{a3}) at 550*nm* for the 3 aerosol layers (*resp.*, boundary, troposphere and stratosphere), *see* table from Section 6.13.5.1.

Using the principle of reciprocity, the upwelling atmospheric transmittance over a wind-roughned black sea surface corresponds to the downwelling atmospheric transmittance over a black land surface.

Step-1: Select each aerosol model among the 17 models used in the 16 SAMs, and compute the scattering phase matrix and the IOPs (extinction & scattering coefficients, and single scattering albedo) at each of the 15 MERIS wavelengths (λ) with the OTC/SCAMAT (UdL) and the associated input *Scamat* card:

/UdL/INPUT/sca_in/*sc_mar****xx****_b****yy***, *sc_coa****xx****_b****yy***, *sc_rur****xx****_b****yy***, *sc_IOP****ww****_b****yy***, *sc_conti_b****yy***, *sc_H2SO4_b****yy***

with ***xx*** *= {50, 70, 90, 99} (i.e., relative humidity),* ***yy*** *= {01,..,15} (i.e., MERIS bands #),* ***ww*** *= {01, 02, 03} (i.e., 3 Log-normal distributions)*

Step-2: Generate total upwelling atmospheric transmittance $T_{up}[iaer,\lambda,,\theta_v,\tau^a]$ for a pure *Rayleigh* atmosphere and a maritime atmosphere (*Rayleigh* + aerosols) over a black land, for each selected aerosol assemblage (τ^a, *iaer*), for each MERIS wavelength (λ), and for all illumination configurations (θ_s), with the RTC/UPRAD (SO).

RTC/UPRAD (SO) Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, *see* Section 6.13.4.1
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	*See* Section 6.11.1.1
aerosol1	"./INPUT/sca_out/sc_mar*xx*_b*yy*" "./INPUT/sca_out/sc_coa*xx*_b*yy*" "./INPUT/sca_out/sc_rur*xx*_b*yy*" "./INPUT/sca_out/sc_blue*w*_b*yy*"	For maritime, coastal and rural aerosols, *xx* depends on RH and *yy* on $n(\lambda)$. For blue aerosols, *w* depends on the *Ang-ström* exponent and *yy* on $n(\lambda)$.
$\tau^{a1}(550)$	tauA1	*See* Section 6.13.1.1 (7 values)
aerosol2	"./INPUT/sca_out/sc_conti_b*yy*"	*yy* depends on $n(\lambda)$
$\tau^{a2}(550)$	tauA2	*See* Section 6.13.1.3 (7 values)
aerosol3	"./INPUT/sca_out/sc_H2SO4_b*yy*"	*yy* depends on $n(\lambda)$
$\tau^{a3}(550)$	0 0.005	For the first assemblage (*iaer#0*) For the other assemblages (*iaer*)
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A

spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (optically homogeneous layers)
I_s	0	First *Fourier* term only
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	23, 13, 25	
θ_s	*Gaussian* angles	First 23 angles selected from *Gauss* quadrature; *See* Section 6.13.4.3
θ_v	*Gaussian* angles	First 13 angles selected from *Gauss* quadrature; *See* Section 6.13.4.4
$\Delta\phi$	*see* inputs	*See* Section 6.13.4.5
pol	1	

$n(\lambda), \theta_v, \tau^a$, *iaer*

↓

RTC/UPRAD (SO)
(*i_branch=1;*
ρ_s*=0;* I_s*=0*)

↓

$T_{up}(iaer, \lambda, \theta_v, \tau^a)$

Step-3: For each RTC/UPRAD (SO) run, extract from the total downwelling transmittance in the output file ('./OUTPUT/uprad_out') and build the *Tup_LUT*[$iaer, \lambda,, \theta_v, \tau^a$] table for the 16 SAMs (iaer#0, 4 MAR, 4 COA, 4 RUR, 3 BLU-IOP).

Note: This *Tup_LUT*[$iaer, \lambda,, \theta_v, \tau^a$] LUT will be completed with null values for *iaer* from #13 to #30.

Scientific content:

Tup_LUT[$iaer, \lambda,, \theta_v, \tau^a$] describes the total upwelling atmospheric transmittance.

This table is useful for the aerosol correction algorithm over wind-roughened oceanic surface.

Note that the values of these coefficients will be extracted from this table by using multiple linear interpolations.

The current baseline is:

N_θ_v which corresponds to 13 predefined values (*see* Section 6.13.4.4)
N_τ^a which corresponds to 7 predefined values (including the pure *Rayleigh* case)

Resources:

Estimated CPU time: 7200 *sec* (if LUT419 already generated, otherwise 20460 *sec*)
Output disk space: 34 × 15 × 13 × 7 × 4 bytes/fl = 185640 bytes

Acceptance:

Some comparisonswith *Gordon and Wrang* (1994) approximation and with another RTC, such as the RTC/MOMO from FUB have been done, as well as a quality check with tables generated by the LOV institute.

6.14 LAND-AEROSOL PARAMETERS

6.14.1 C.P.

6.14.1.1 C.P. Imaginary parts of refractive indices for land-aerosol models

Reference: ni, LUT144

[AD-6]

PARBLEU provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ni* Imaginary parts of refractive indices for land-aerosol models (78 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 78 n_i values corresponding to the imaginary parts of refractive indices of particles included in the 78 land-aerosol models

Current baseline: vector with 78 null values [*dl*]

Resources:

Estimated CPU time: -
Output disk space: 78 × 4 bytes/fl = 312 bytes

Acceptance:

Corresponds to the latest definition.

6.14.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.14.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.14.4 GADS General

6.14.4.1 Zenith angles

Reference: ZA, LUT147

[AD-8] Section 6.14.4, GADS field 1.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ZA* Zenith angles (12 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 12 zenith angles (θ) selected from the *Gauss* quadrature generated for 24 discrete directions with the RTC/Gauss tool (UdL)

Current baseline: 12 *Gaussian* angles (*see* Section 6.2.13.1)

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/ul = 60 bytes

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Acceptance:

Corresponds to the latest definition.

6.14.4.2 Stored indices for (θ_s x θ_v) combinations

Reference: SVZA_index, LUT148

[AD-8] Section 6.14.4, GADS field 2.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SVZA_index* Stored indices for (θ_sxθ_v) combinations (78 values)

units: [*dl*]

Step: User specified.

Scientific content:

Current baseline: 78 angular combinations (SZA x VZA) (*see* Section 6.10.7.14)

Note: Due to the fact that the matrix is symmetrical in the ($\theta_s \times \theta_v$) directions, we can then store only a half triangular matrix, *i.e.*, N(N+1)/2 instead of N^2 elements (78 instead of 144).

Resources:

Estimated CPU time: -
Output disk space: 78 × 2 × 1 byte/uc = 156 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.3 Relative azimuth angles

Reference: RAA, LUT149

[AD-8] Section 6.14.4, GADS field 3.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle (18 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

The set of the relative azimuth angles ($\Delta\phi$) between illumination and viewing directions is regularly spaced and listed hereafter:

Current baseline: 18 RAA values ($\Delta\phi$) within [0;180] *deg*., with a step of 10 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definitions

6.14.4.4 Cosine of scattering angles

Reference: Cos_Theta_Sca, LUT150

[AD-8] Section 6.14.4, GADS field 4.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Cos_Theta_Sca*
Cosine of scattering angle

units: [*dl*]

Step: User specified.

Scientific content:

Set of 83 scattering angles (Θ) computed with angles deriving from the *Gauss* quadrature for 40 discrete directions (+ nadir/zenith) with the RTC/Gauss tool (UdL)

Current baseline: 83 values of cos(Θ)

i	$\cos(\Theta_i)$	i	$\cos(\Theta_i)$	i	$\cos(\Theta_i)$	i	$\cos(\Theta_i)$
1	-1.0000000000	22	-0.6896376010	43	0.0195113830	64	0.7440002561
2	-0.9995538000	23	-0.6608598830	44	0.0585044362	65	0.7695024014
3	-0.9976498480	24	-0.6310757400	45	0.0974083543	66	0.7938326597
4	-0.9942275290	25	-0.6003305910	46	0.1361640096	67	0.8169541359
5	-0.9892912510	26	-0.5686712270	47	0.1747122407	68	0.8388314247
6	-0.9828485250	27	-0.5361458660	48	0.2129944563	69	0.8594313860
7	-0.9749091270	28	-0.5028041010	49	0.2509523034	70	0.8787225485
8	-0.9654850360	29	-0.4686965940	50	0.2885280252	71	0.8966755271
9	-0.9545907380	30	-0.4338753220	51	0.3256643414	72	0.9132630825
10	-0.9422427420	31	-0.3983933930	52	0.3623047471	73	0.9284598231
11	-0.9284598230	32	-0.3623047470	53	0.3983933926	74	0.9422427416
12	-0.9132630830	33	-0.3256643410	54	0.4338753223	75	0.9545907378
13	-0.8966755270	34	-0.2885280250	55	0.4686965942	76	0.9654850364
14	-0.8787225480	35	-0.2509523030	56	0.5028041005	77	0.9749091268
15	-0.8594313860	36	-0.2129944560	57	0.5361458659	78	0.9828485250
16	-0.8388314250	37	-0.1747122410	58	0.5686712265	79	0.9892912507
17	-0.8169541360	38	-0.1361640100	59	0.6003305912	80	0.9942275286
18	-0.7938326600	39	-0.0974083540	60	0.6310757399	81	0.9976498485

i	$\cos(\Theta_i)$	i	$\cos(\Theta_i)$	i	$\cos(\Theta_i)$	i	$\cos(\Theta_i)$
19	-0.7695024010	40	-0.0585044360	61	0.6608598828	82	0.9995537996
20	-0.7440002560	41	-0.0195113830	62	0.6896376014	83	1.0000000000
21	-0.7173651460	42	0.0000000000	63	0.7173651457		

Resources:

Estimated CPU time: -
Output disk space: 83 × 4 bytes/fl = 332 bytes

Acceptance:

Corresponds to the latest definitions

6.14.4.5 Indices of band numbers (starting from 1) for in-land waters and islands screening

Reference: (No variable used), LUT151

[AD-8] Section 6.14.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Indices of band numbers for in-land waters and islands screening (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

2 MERIS bands selected for in-land waters and islands screening

Current baseline: {7, 13}

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definitions

6.14.4.6 Threshold for in-land waters screening spectral slope test

Reference: (No variable used), LUT152

[AD-8] Section 6.14.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold for in-land waters screening spectral slope test

units: [*dl*]

Step: User specified.

Scientific content:

Threshold used for in-land waters screening spectral slope test

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definitions

6.14.4.7 Threshold for islands screening spectral slope test

Reference: (No variable used), LUT153

[AD-8] Section 6.14.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold for islands screening spectral slope test

units: [*dl*]

Step: User specified.

Scientific content:

Threshold used for islands screening spectral slope test

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definitions

6.14.4.8 Aerosol optical properties (real part of refractive index, Angstroem exponent) for land-aerosol models

Reference: Aerosol_angstrom, LUT154
& Aerosol_refindex

[AD-8] Section 6.14.4, GADS field 8.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs:	*iaer*	Aerosol model # [*dl*] (among the 78 aerosol models)	
	k	Output index [*dl*] (for selecting the aerosol property)	
Outputs:	*Aerosol_refindex*[*iaer*]	*k*=1	refractive index (real part)
	Aerosol_angstrom[*iaer*]	*k*=2	*Angström* coefficient (α)

units: [*dl*]

Step: User specified.

Scientific content:

The first parameter is the *Angström* exponent (α) which describes the wavelength dependence of the aerosol optical thickness $\tau^a(\lambda)$,

$$\frac{\tau^a(\lambda)}{\tau^a(\lambda')} = \left(\frac{\lambda}{\lambda'}\right)^{\alpha}$$

The latter is employed in the definition of the *Junge* size distribution $n(r)$ which is a power-law well known as the simplest but realistic description.

$$n(r) \approx r^{\alpha-3}$$

The second parameter is the real part of the refractive index m (referred as $Re(m)$) which is related to the aerosol optical characteristic. The aerosol absorption is accounted for with the imaginary part of the refractive index ($Im(m)$).

78 aerosol models have been defined to be used in the atmospheric correction algorithm over land. The latters results from different values for the *Angström* exponent (α) and the refractive index (m) which is considered as independent on the wavelength.

Current baseline: 78 x 2 values

iaer	*Re(m)* [k=1]	α [k=2]	*Im(m)*
1	1.33	0.0	0
2	1.33	0.1	0
3	1.33	0.2	0
4	1.33	0.3	0
5	1.33	0.4	0
6	1.33	0.5	0
7	1.33	0.6	0
8	1.33	0.7	0
9	1.33	0.8	0
10	1.33	0.9	0
11	1.33	1.0	0
12	1.33	1.1	0
13	1.33	1.2	0
14	1.33	1.3	0
15	1.33	1.4	0
16	1.33	1.5	0
17	1.33	1.6	0
18	1.33	1.7	0
19	1.33	1.8	0
20	1.33	1.9	0
21	1.33	2.0	0
22	1.33	2.1	0
23	1.33	2.2	0
24	1.33	2.3	0
25	1.33	2.4	0
26	1.33	2.5	0

iaer	*Re(m)* [k=1]	α [k=2]	*Im(m)*
27	1.44	0.0	0
28	1.44	0.1	0
29	1.44	0.2	0
30	1.44	0.3	0
31	1.44	0.4	0
32	1.44	0.5	0
33	1.44	0.6	0
34	1.44	0.7	0
35	1.44	0.8	0
36	1.44	0.9	0
37	1.44	1.0	0
38	1.44	1.1	0
39	1.44	1.2	0
40	1.44	1.3	0
41	1.44	1.4	0
42	1.44	1.5	0
43	1.44	1.6	0
44	1.44	1.7	0
45	1.44	1.8	0
46	1.44	1.9	0
47	1.44	2.0	0
48	1.44	2.1	0
49	1.44	2.2	0
50	1.44	2.3	0
51	1.44	2.4	0
52	1.44	2.5	0

iaer	*Re(m)* [k=1]	α [k=2]	*Im(m)*
53	1.55	0.0	0
54	1.55	0.1	0
55	1.55	0.2	0
56	1.55	0.3	0
57	1.55	0.4	0
58	1.55	0.5	0
59	1.55	0.6	0
60	1.55	0.7	0
61	1.55	0.8	0
62	1.55	0.9	0
63	1.55	1.0	0
64	1.55	1.1	0
65	1.55	1.2	0
66	1.55	1.3	0
67	1.55	1.4	0
68	1.55	1.5	0
69	1.55	1.6	0
70	1.55	1.7	0
71	1.55	1.8	0
72	1.55	1.9	0
73	1.55	2.0	0
74	1.55	2.1	0
75	1.55	2.2	0
76	1.55	2.3	0
77	1.55	2.4	0
78	1.55	2.5	0

Angström exponent (α) and real and imaginary part of refractive index (m) for each of the 78 aerosol models used in the atmospheric correction algorithm.

Resources:

Estimated CPU time: -
Output disk space: $78 \times 2 \times 4$ bytes/fl = 624 bytes

Acceptance:

Corresponds to the latest definitions

6.14.4.9 Aerosol optical thicknesses at 550 nm

Reference: AOT550, LUT155

[AD-8] Section 6.14.4, GADS field 9.

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *tauA* Aerosol optical thickness (16 values of τ_a)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 16 aerosol optical thicknesses at $550 nm$ (τ_a) used for the aerosol climatology over land

Current baseline: 16 τ_a values from 0 to 1.5 by step of 0.1.

Resources:

Estimated CPU time: -
Output disk space: 16 × 4 bytes/fl = 64 bytes

Acceptance:

Corresponds to the latest definitions.

6.14.4.10 Gamma coefficient for ARVI computation

Reference: Gamma, LUT156

[AD-8] Section 6.14.4, ADSR field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *Gamma* Gamma coefficient for ARVI computation (γ)

units: [*dl*]

Step: User specified.

Scientific content:

This γ coefficient is required for the ARVI (Atmospherically Resistant Vegetation Index) computation. The latter has been introduced by *Kauffman and Tanré* (*1992*) [RD-9] to decrease the atmospheric effects by adding a blue band to the NDVI (Normalized Difference Vegetation Index). Using the MERIS bands, ARVI is expressed as:

$$ARVI = \frac{\rho_{aG}(865) - \rho_{RB}}{\rho_{aG}(865) + \rho_{RB}}$$

where $\rho_{aG}(865)$ is the *Rayleigh*-corrected TOA reflectance at the 865 *nm* MERIS wavelength and ρ_{RB} is a linear combinaison of *Rayleigh*-corrected TOA reflectances in the blue and red bands. For the MERIS wavelengths, the latter is defined as:

$$\rho_{RB} = \rho_{aG}(665) - \gamma \cdot [\rho_{aG}(442.5) - \rho_{aG}(665)]$$

From a practical point of view, an optimal value for the γ coefficient could be derived from RTC simulations for a selected DDV (Dense Dark Vegetation) model, several aerosol models and different illumination and viewing geometries. This sensitivity study on the simulated ARVI versus the γ value should allow then to deduce the optimized γ value of DDV remote sensing for which the ARVI is less sensitive to the aerosol loading and models.

Kauffman and Tanré (*1992*) stressed that this optimal γ value may be set up to 1.3 for DDVs over forest covers [RD-9].

Current baseline: 1.3

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Numerous studies have already stressed that the γ optimal value for DDV was equal to 1.3.

6.14.4.11 Aerosol optical thickness increment for iterative procedure

Reference: dtauA, LUT157

[AD-8] Section 6.14.4, ADSR field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *dtauA* Aerosol optical thickness increment ($\Delta\tau_a$)

units: [*dl*]

Step: User specified.

Scientific content:

This increment in aerosol optical thickness ($\Delta\tau_a$) is used in the iterative procedure.

Current baseline: 0.1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.12 Dense dark vegetation, DDV(biome,month)

Reference: DDV, LUT309

[AD-8] Section 6.14.4, ADSR field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs:	*Bi*	Biome # [*dl*], type of vegetation (11 values)
	month	Period [*month*] (12 values)
Outputs:	*DDV*	Dense dark vegetation
units:	[*dl*]	

Step: User specified.

Scientific content:

This increment in aerosol optical thickness ($\Delta\tau_a$) is used in the iterative procedure.

Current baseline: 11 x 12 values

Jan	*Feb*	*Mar*	*Apr*	*May*	*June*	*July*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*
9	9	9	9	9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10	10	10	10	10
0	0	11	11	11	11	11	11	0	0	0	0
1	1	12	12	12	12	12	12	12	12	1	1
2	2	13	13	13	13	13	13	2	2	2	2
3	3	14	14	14	14	14	14	3	3	3	3
4	4	15	15	15	15	15	15	4	4	4	4
5	5	16	16	16	16	16	16	5	5	5	5
6	6	17	17	17	17	17	17	6	6	6	6
7	7	18	18	18	18	18	18	7	7	7	7
8	8	19	19	19	19	19	19	8	8	8	8

Resources:

Estimated CPU time: -
Output disk space: $11 \times 12 \times 1$ byte/uc = 132 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.13 Latitudes for DDV climatology

Reference: lat, LUT310

[AD-8] Section 6.14.4, ADSR field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *lat* Latitude (180 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 180 latitudes (*lat*) used as the geographic grid for the DDV climatology

Current baseline: [-89.5;89.5] *deg.* by step of 1 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 180 × 4 bytes/sl = 720 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.14 Longitudes for DDV climatology

Reference: Long, LUT311

[AD-8] Section 6.14.4, ADSR field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *long* Longtitude (360 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 360 longitudes (*long*) used as the geographic grid for the DDV climatology

Current baseline: [-179.5;179.5] *deg.* by step of 1 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 360 × 4 bytes/sl = 1440 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.15 Effective radius values

Reference: Strato_rad, LUT312

[AD-8] Section 6.14.4, ADSR field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *Strato_rad* Effective radius for stratospheric aerosols (18 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 18 effective radii for the 18 stratospheric aerosol models

Current baseline: {0, 1, 2, 0, 1, 2, 0, 1, 2, 0, 1, 2, 0, 1, 2, 0, 1, 2}

Resources:

Estimated CPU time: -
Output disk space: 18 × 1 byte/uc = 18 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.16 Record numbers of GADS multiplicative function to account for volcanic aerosol multiple scattering effects

Reference: Strato_multi, LUT313

[AD-8] Section 6.14.4, ADSR field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *Strato_multi* Record numbers of GADS multiplicative function to account for volcanic aerosol multiple scattering effects (18 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 18 record numbers for the 18 stratospheric aerosol models

Current baseline: {12, 13, 14, 12, 13, 14, 12, 13, 14, 12, 13, 14, 12, 13, 14, 12, 13, 14}

Resources:

Estimated CPU time: -
Output disk space: 18 × 1 byte/uc = 18 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.17 Volcanic aerosol optical thicknesses, $\tau^{va}(iaer)$

Reference: Strato_tau, LUT314

[AD-8] Section 6.14.4, ADSR field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *Strato_tau* Volcanic aerosol optical thickness (18 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 18 volcanic aerosol optical thicknesses (τ^{va}) for the 18 stratospheric aerosol models

Current baseline: {0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1, 0.1}

Resources:

Estimated CPU time: -
Output disk space: 18 × 4 bytes/fl = 72 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.18 Reflectance threshold at 865 nm for DDV screening

Reference: (No variable used), LUT439

[AD-8] Section 6.14.4, ADSR field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *(no variable)* Reflectance threshold at 865 nm for DDV screening

units: [dl]

Step: User specified.

Scientific content:

Threshold on reflectance at 865 nm for screening the DDV pixels

Current baseline: 0.2

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.19 Ground reflectance threshold at 665 nm for iterative aerosol identification

Reference: (No variable used), LUT487

[AD-8] Section 6.14.4, ADSR field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *(no variable)* Ground reflectance threshold at 665 nm for iterative aerosol identification
units: [dl]

Step: User specified.

Scientific content:

Threshold on ground reflectance at 665 nm for iterative aerosol identification

Current baseline: 0.2

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.14.4.20 List of band indices (starting from 1) to be used for land aerosols remote sensing

Reference: (No variable used), LUT488

[AD-8] Section 6.14.4, ADSR field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *(no variable)* List of band indices (starting from 1) to be used for land aerosols remote sensing (3 values)

units: [*dl*]

Step: User specified.

Scientific content:

4 MERIS bands are available for the land-aerosol remote sensing algorithm (band#1 [412.5 *nm*], band#2 [442.5 *nm*], band#3 [490 *nm*], band#7 [665 *nm*]). 2 or 3 bands can be then selected. If only 2 bands are used then the last index will be set to 1.

For the current MERIS processing, only 2 bands are used for the land-aerosols remote sensing algorithm (band#2 and #7)).

Current baseline: {2, 7, -1}

Resources:

Estimated CPU time: -
Output disk space: 3×2 bytes/us = 6 bytes

Acceptance:

Corresponds to the latest definition.

6.14.5 GADS Reflectance Thresholds for Inland Waters and Islands Screening

6.14.5.1 α - Constant applied to threshold for inland waters screening

Reference: $\alpha_{7thresh}$, LUT158

[AD-8] Section 6.14.5, ADSR field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: $\alpha_{7thresh}$ α - constant applied to threshold for inland waters screening

units: $[dl]$

Step: User specified.

Scientific content:

This multiplicative factor ($\alpha_{7thresh}$) is applied to the TOA reflectance thresholds at 665 nm for inland waters screening processing identification to take the environment and the bathymetric effects into account.

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.14.5.2 TOA reflectance thresholds at 665 nm for inland waters screening, $\rho_{T,665}(\theta_s \times \theta_v, \Delta\phi)$

Reference: $\rho_{7thresh}$_LUT, LUT159

[AD-8] Section 6.14.5, ADSR field 2

Dependencies:

LUT144, LUT147, LUT148, LUT149, LUT154

Tools:

OTC/SCAMAT
OTC/RAYLEIGH
RTC/UPRAD (SO)

Procedure:

Inputs:

- *iaer* — Aerosol model # [*dl*] (among the 78 *Junge*'s models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).
- θ — Zenith angle [*deg*]; tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
- $\theta_s \times \theta_v$ — Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.14.4.2, (LUT148)
- $\Delta\phi$ — Relative azimuth angle [*deg*], *see* Section 6.14.4.3, (LUT149)

Output: $\rho_{7thresh}\_LUT[\theta_s \times \theta_v, \Delta\phi]$
TOA reflectance thresholds at 665 *nm* as function of the illumination and viewing configuration ($\theta_s, \theta_v, \Delta\phi$)

units: [*dl*]

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

Step-1: Generate TOA normalized radiance $L_{TOA\_7}[iaer, \theta_s \times \theta_v, \Delta\phi]$ at 665 *nm* (MERIS band #7) for a continental atmosphere over a land reflective surface, for each of the 78 land aerosol models (*iaer*) and all illumination and viewing configurations ($\theta_s, \theta_v, \Delta\phi$), with the RTC/UPRAD (SO).

RTC/UPRAD (SO) Inputs (LAND)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	7	665 *nm*
U_{H2O}	0	
U_{O2}	0	

Variable	*Value*	*Comments*
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./INPUT/sca_out/sc_land*yy*_b05"	*yy* depends on the selected *Junge*'s model (*iaer*=1 to 78)
$\tau^{a1}(550)$	1.5	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*; H_R=8 *km*)
I_s	79	
ρ_s	0.02	
E_o	1	
$\sigma^w_{e,\lambda}$	-	N/A
$\omega^w_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	Use a loop for 78 θ_sxθ_v combinations.
θ_s	*see* inputs	*See* Section 6.14.4.1 and Section 6.14.4.2
θ_v	*see* inputs	*See* Section 6.14.4.1 and Section 6.14.4.2
$\Delta\phi$	*see* inputs	*See* Section 6.14.4.3
pol	1	

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$n(7), iaer, \theta_s \text{x} \theta_v, \Delta\phi$

↓

RTC/UPRAD(SO)
($i\_branch=1$)

↓

$L_{TOA\_7}[iaer, \theta_s \text{x} \theta_v, \Delta\phi]$

Step-2: Select among all the aerosol models the one which yields to the highest number of maximum values of L_{TOA_7} for all $\theta_s \times \theta_v$ and $\Delta\phi$ combinations, and use this L_{TOA_7} value to compute the TOA reflectance threshold at $665\,nm$ ($\rho_{7thresh}\_LUT[\theta_s \times \theta_v, \Delta\phi]$) as,

$$\rho_{7thresh\_LUT}[\theta_s \times \theta_v, \Delta\phi] = \pi \,.\, \frac{L_{TOA\_7}[\theta_s \times \theta_v, \Delta\phi]}{\cos(\theta_s)}$$

Scientific content:

These TOA reflectance thresholds define the maximum reflectances as observed at $665\,nm$ over water surfaces. The latters are useful for the inland waters discrimination in the pixels classification algorithm.

Resources:

Estimated CPU time: 7078 *sec*
Output disk space: 78 × 19 × 4 bytes/fl = 5928 bytes

Acceptance:

Comparison with another RTC.

6.14.5.3 α - Constant applied to threshold for islands screening

Reference: $\alpha_{13thresh}$, LUT437

[AD-8] Section 6.14.5, ADSR field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: $\alpha_{13thresh}$ α - constant applied to threshold for islands screening

units: [*dl*]

Step: User specified.

Scientific content:

This multiplicative factor ($\alpha_{13thresh}$) is applied to the TOA reflectance thresholds at 865*nm* for islands screening processing identification.

Current baseline: 0.375

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.14.5.4 TOA reflectance thresholds at 865 nm for islands screening, $\rho_{T,865}(\theta_s \times \theta_v, \Delta\phi)$

Reference: $\rho_{13thresh}$_LUT, LUT438

[AD-8] Section 6.14.5, ADSR field 4

Dependencies:

LUT144, LUT147, LUT148, LUT149, LUT154

Tools:

OTC/SCAMAT
OTC/RAYLEIGH
RTC/UPRAD (SO)

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (among the 78 *Junge*'s models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).

θ Zenith angle [*deg*]; tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)

$\theta_s \times \theta_v$ Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.14.4.2, (LUT148)

$\Delta\phi$ Relative azimuth angle [*deg*], *see* Section 6.14.4.3, (LUT149)

Output: $\rho_{13thresh}\_LUT[\theta_s{\times}\theta_v,\Delta\phi]$

TOA reflectance thresholds at 865 *nm* as function of the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

Step-1: Generate TOA normalized radiance $L_{TOA\_13}[iaer,\theta_s{\times}\theta_v,\Delta\phi]$ at 865 *nm* (MERIS band #13) for a continental atmosphere over a land reflective surface, for each of the 78 continental aerosol models (*iaer*) and all illumination and viewing configurations ($\theta_s,\theta_v,\Delta\phi$), with the RTC/UPRAD (SO).

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	13	865 *nm*
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./INPUT/sca_out/sc_land*yy*_b05"	*yy* depends on the *Junge*'s model (*iaer*=1 to 78)
$\tau^{a1}(550)$	1.5	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A

Variable	***Value***	***Comments***
spm	-	N/A
$\sigma_{e,\lambda}^{spm}$	-	N/A
$\omega_{o,\lambda}^{spm}$	-	N/A
$\sigma_{e,\lambda}^{ys}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2km; H_R=8km)
I_s	79	
ρ_s	0.02	
E_o	1	
$\sigma_{e,\lambda}^{w}$	-	N/A
$\omega_{o,\lambda}^{w}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	Use a loop for 78 θ_sxθ_v combinations.
θ_s	*see* inputs	*See* Section 6.14.4.1 and Section 6.14.4.2
θ_v	*see* inputs	*See* Section 6.14.4.1 and Section 6.14.4.2
$\Delta\phi$	*see* inputs	*See* Section 6.14.4.3
pol	1	

$n(13)$,$iaer$,θ_sxθ_v,$\Delta\phi$

↓

RTC/UPRAD(SO)
($i\_branch=1$)

↓

$L_{TOA\_13}[iaer,\theta_s x\theta_v,\Delta\phi]$

Step-2: Select among all the aerosol models the one which yields to the highest number of maximum values of L_{TOA_13} for all $\theta_s\times\theta_v$ and $\Delta\phi$ combinations, and use this L_{TOA_13} value to compute the TOA reflectance threshold at 865nm ($\rho_{13thresh}\_LUT[\theta_s\times\theta_v,\Delta\phi]$) as,

$$\rho_{13thresh\_LUT}[\theta_s\times\theta_v,\Delta\phi]=\pi\ .\ \frac{L_{TOA\_13}[\theta_s\times\theta_v,\Delta\phi]}{\cos(\theta_s)}$$

Scientific content:

These TOA reflectance thresholds define the maximum reflectances as observed at 865nm over water surfaces. The latters are useful for the islands discrimination in the pixels classification algorithm.

Resources:

Estimated CPU time: 7078 *sec*
Output disk space: 78 × 19 × 4 bytes/fl = 5928 bytes

Acceptance:

Comparison with another RTC.

6.14.5.5 Altitude threshold above which in-land waters screening is disabled

Reference: Alt_thresh, LUT489

[AD-8] Section 6.14.5, ADSR field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *Alt_thresh* Altitude threshold above which in-land waters screening is disabled
units: [*m*]

Step: User specified.

Scientific content:

Altitude threshold above which in-land waters screening is disabled.

Current baseline: 0 *m*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.14.6 ADS ARVI Thresholds for DDV models

6.14.6.1 ARVI thresholds used for DDV models, $ARVI\_thresh(iddv,\theta_s{\times}\theta_v,\Delta\phi)$

Reference: ARVI_thresh, LUT160

[AD-8] Section 6.14.6, ADSR field 1

Dependencies:

LUT147, LUT148, LUT149, LUT156

Tool:

RTC/UPRAD (SO)

Warning: Take care with the azimuth angle (ϕ) convention. The CESBIO files and the MERIS sensor used the same azimuth (relative azimuth angle) convention ($\Delta\phi$) while the RTCs works in the opposite convention (π-$\Delta\phi$).

Procedure:

Inputs:

θ	Zenith angle [*deg*], tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
$\theta_s \times \theta_v$	Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.14.4.2, (LUT148)
$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.14.4.3, (LUT149)
γ	gamma coefficient for ARVI computation [*dl*], *see* Section 6.14.4.10, (LUT156)
iddv	DDV model # [*dl*] (among the 20 DDV models, [0..19])
	CESBIO DDV reflectances files (*i.e.*, *'lut12-xx' with xx in* [*1-20*]), $\rho_{DDV}(\lambda,\theta_v,\Delta\phi,\theta_s,\rho_o)$

Output: $DDV\_ARVI\_LUT[iddv,\theta_s{\times}\theta_v,\Delta\phi]$

ARVI threshold as function of the DDV model (*iddv*) and the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [*dl*]

Warning: The process for generating this table is time-consuming. To avoid loosing data in case of a power failure, several temporary binary files are created after few hours of processing: *LTOA443_xx.LUT160*, *LTOA665_xx.LUT160*, *LTOA865_xx.LUT160 (xx stands for the 20 DDV models [00..19])*. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

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Step-1: Generate TOA normalized radiance $L_{TOA\_aer}[iddv,iaer,\tau^a(\lambda),\theta_s\times\theta_v,\Delta\phi]$ for 442.5 *nm*, 665 *nm* and 865 *nm* (MERIS band #2, 7 and 13 used for ARVI) for a pure aerosol atmosphere over each of the 20 DDV models (*iddv*), for 1 aerosol model (*iaer=37*) and all illumination and viewing configurations ($\theta_s,\theta_v,\Delta\phi$]), with the RTC/UPRAD (SO).

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	2, 7 and 13	442.5, 665 & 865 *nm*
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_land37_b05"	*Junge*'s model #37 (m=1.44, α=-1)
$\tau^{a1}(550)$	0.310 (442.5 *nm*), 0.207 (665 *nm*) and 0.159 (865 *nm*)	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*)
I_s	79	
ρ_s	"./INPUT/lut12_*yy*"	*yy* depends on the DDV model #
E_o	1	
$\sigma^w_{e,\lambda}$	-	N/A
$\omega^w_{o,\lambda}$	-	N/A

Variable	***Value***	***Comments***
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	Use a loop for 78 θ_sxθ_v combinations.
θ_s	*see* inputs	*See* Section 6.14.4.1 and Section 6.14.4.2
θ_v	*see* inputs	*See* Section 6.14.4.1 and Section 6.14.4.2
$\Delta\phi$	*see* inputs	*See* Section 6.14.4.3
pol	1	

$$iddv\ iaer{=}37,\ \tau^a(\lambda),\theta_s \mathrm{x} \theta_v,\Delta\phi$$

$$\downarrow$$

$$\boxed{\begin{array}{c}\text{RTC/UPRAD(SO)}\\ (i\_branch{=}1)\end{array}}$$

$$\downarrow$$

$$L_{TOA\_aer}[iddv,37,\tau^a(\lambda),\theta_s \mathrm{x} \theta_v,\Delta\phi]$$

Step-2: Determine the ARVI threshold ($DDV\_ARVI\_LUT[iddv,\theta_s\times\theta_v,\Delta\phi]$) using the 3 TOA normalized radiances $L_{TOA\_aer}[iddv,37,\tau^a(\lambda),\theta_s\times\theta_v,\Delta\phi]$ at 442.5*nm*, 665*nm* and 865*nm* for each of the 20 DDV models (*iddv*) as follows,

$$DDV\_ARVI\_LUT[iddv,\theta_s\times\theta_v,\Delta\phi] = \frac{L_{865}[iddv,\theta_s\times\theta_v,\Delta\phi]-L_{RB}[iddv,\theta_s\times\theta_v,\Delta\phi]}{L_{865}[iddv,\theta_s\times\theta_v,\Delta\phi]+L_{RB}[iddv,\theta_s\times\theta_v,\Delta\phi]}$$

with $L_{RB} = L_{665} - \gamma \cdot [L_{443} - L_{665}]$

where,

$$L_{443}[iddv,\theta_s\times\theta_v,\Delta\phi] = L_{TOA\_aer}[iddv,37,\ \tau^a(442.5),\theta_s\times\theta_v,\Delta\phi]$$
$$L_{665}[iddv,\theta_s\times\theta_v,\Delta\phi] = L_{TOA\_aer}[iddv,37,\tau^a(665),\theta_s\times\theta_v,\Delta\phi]$$
$$L_{865}[iddv,\theta_s\times\theta_v,\Delta\phi] = L_{TOA\_aer}[iddv,37,\tau^a(865),\theta_s\times\theta_v,\Delta\phi]$$

and, γ=1.3 (optimal value found for dense dark forests)

Scientific content:

$DDV\_ARVI\_LUT[iddv,\theta_s\times\theta_v,\Delta\phi]$ defines the TOA ARVI threshold simulated as function of each DDV model (*iddv*) and each illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$). In the DDV detection algorithm the ARVI is computed for each pixel ($iddv,\theta_s,\theta_v,\Delta\phi$) within the MERIS scene, and this value is compared with the corresponding tabulated ARVI threshold simulated with the RTC/SO at TOA. If the latter is greater than the tabulated ARVI threshold, then the pixel will be identified as a DDV pixel.

Resources:

Estimated CPU time: 94428 *sec*

Output disk space: $20 \times 78 \times 19 \times 4$ bytes/fl = 118560 bytes

Acceptance:

Comparison with another RTC.

6.14.7 ADS Standard Surface Reflectance Ranges for DDV Models

6.14.7.1 Mean DDV reflectances for 412.5 nm, 442.5 nm, 490 nm and 665 nm, $\rho_{DDV\_mean}(iaer,\lambda)$

Reference: DDV_THR_LUT, LUT161

[AD-8] Section 6.14.7, ADSR field 1, 2, 3 and 4

ACRI provided

Dependencies:

LUT147, LUT148, LUT149

Tool:

None

Procedure:

Inputs:	λ	4 MERIS wavelengths [nm] (412.5, 442.5, 490 and 665 nm)
	θ	Zenith angle [deg], tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
	$\theta_s \times \theta_v$	Stored indices for angular combinations [dl] (78 values), *see* Section 6.14.4.2, (LUT148)
	$\Delta\phi$	Relative azimuth angle [deg], *see* Section 6.14.4.3, (LUT149)
	iddv	DDV model # [dl] (among the 20 DDV models, [0..19])
	lut12-xx	*CESBIO DDV* reflectances files, $\rho_{DDV}(\lambda,\theta_v,\Delta\phi,\theta_s,\rho_o)$ (*with xx in* [*1-20*])

Output: $DDV\_THR\_LUT[iddv,\lambda,\theta_s \times \theta_v,\Delta\phi]$

Mean DDV reflectances at 4 wavelengths (λ), as function of the DDV model ($iddv$) and the illumination and viewing configuration ($\theta_s,\theta_v,\Delta\phi$)

units: [dl]

Step: User specified

Scientific content:

$DDV\_THR\_LUT[iddv,\lambda,\theta_s \times \theta_v,\Delta\phi]$ defines the mean DDV reflectances at 412.5, 442.5, 490 and 665 nm for each of the 20 DDV models and for a set of illumination and viewing geometries ($\theta_s,\theta_v,\Delta\phi$). These table is useful for retrieving aerosol optical characteristics over DDV pixels.

Current baseline: (20 × 4 × 78 × 19) values

Resources:

Estimated CPU time: -
Output disk space: 20 × 4 × 78 × 19 × 4 bytes/fl = 474240 bytes

Acceptance:

Corresponds to the latest definitions

6.14.8 ADS Aerosol Spherical Albedo

6.14.8.1 Aerosol spherical albedo, $S_a(iaer, \tau^a)$

Reference: SA_LUT, LUT167

[AD-8] Section 6.14.8, ADSR field 1

Dependencies:

LUT144, LUT154, LUT155

Tools:

OTC/SCAMAT
RTC/GAUSS
RTC/UPRAD (SO)
Numerical integration

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (among the 78 *Junge*'s models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).

τ^a Aerosol optical thickness at 550 *nm* [*dl*] (16 values), *see* Section 6.14.4.9, (LUT155)

θ_s Solar zenith angle[*deg*], *Gaussian* angles computed with RTC/GAUSS

Output: $SA\_LUT[iaer, \tau^a]$
Aerosol spherical albedo for each *Junge*'s model (*iaer*) and each aerosol optical thickness at 550 *nm* (τ^a)

units: [*dl*]

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

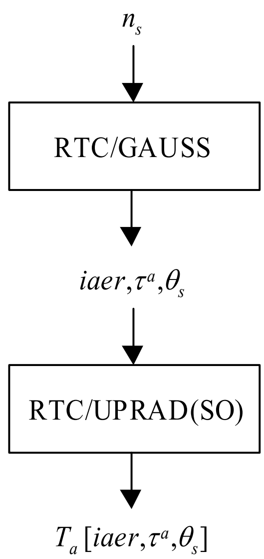
Step-1: Compute *Gaussian* angles μ (=cosθ_s) and their corresponding weighting factors $w(\mu)$ with the RTC/GAUSS (n_s=12).

Step-2: Compute the aerosol transmittance $T_a[iaer,\tau^a,\theta_s]$ corresponding to the first order of *Legendre* decomposition ($I_s=0$) of phase function with the RTC/UPRAD (SO). For extracting the total atmospheric transmittance, we need to set $I_s=0$ and $\theta_v=-1$.

RTC/UPRAD (SO) Inputs (LAND)

Variable	Value	Comments
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1	Not used. Aerosol transmittance is computed as function of τ^{a1} (tabulated values).
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sca_out/sc_land*yy*_b05"	*yy* depends on the *Junge*'s model (*iaer*=1 to 78)
$\tau^{a1}(550)$	tauA1	*See* Section 6.14.4.9, if $\tau^{a1}(550)$=0 then T_a=1.0
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*)
I_s	0	
ρ_s	"./INPUT/lut12_*yy*"	*yy* depends on the DDV model #

Variable	*Value*	*Comments*
E_0	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{0,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	24, 1, 1	Use a loop for 24 θ_s
θ_s	*Gaussian* angles	Computed with RTC/GAUSS
θ_v	-1	To get the total atmospheric transmittance
$\Delta\phi$	0	
pol	1	



Step-3: Compute the aerosol spherical albedo $SA\_LUT[iaer, \tau^a]$ by the following angular numerical integration,

$$SA\_LUT[iaer, \tau^a] = 1 - 2 \cdot \int_0^1 T_a[iaer, \tau^a, \mu] \,.\, w(\mu) \,.\, \mu \,.\, d\mu$$

with μ the *Gaussian* angle ($\mu = \cos(\theta_s)$) and $w(\mu)$ its associated weighting factor.

$T_a[iaer, \tau^a, \theta_s], w(\mu)$

$\downarrow$

Numerical Integration

$1\text{-}2.\Sigma\, T_a[iaer, \tau^a, \theta_s].w(\mu).\mu\,.\delta\mu$

$\downarrow$

$SA\_LUT[iaer, \tau^a]$

Scientific content:

$SA\_LUT[iaer, \tau^a]$ defines the aerosol spherical albedo for each of the 78 continental aerosol models ($iaer$) and each of 16 aerosol optical thicknesses at 550 nm (τ^a). This table is useful to account for the multiple coupling between the ground surface and the aerosol layers in the TOA aerosol correction algorithm over land.

Resources:

Estimated CPU time: 2044 *sec*
Output disk space: 78 × 16 × 4 bytes/fl = 4992 bytes

Acceptance:

Comparison with another RTC.

6.14.9 ADS Aerosol Transmittance

6.14.9.1 Aerosol transmittance, $T_a(iaer, \theta_s, \tau^a)$

Reference: TA_LUT, LUT168

[AD-8] Section 6.14.9, ADSR field 1

Dependencies:

LUT144, LUT147, LUT154, LUT155

Tool:

OTC/SCAMAT
RTC/UPRAD (SO)

Procedure:

Inputs: *iaer* Aerosol model # [*dl*] (among the 78 *Junge*'s models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).

θ_s Solar zenith angle [*deg*], *see* Section 6.14.4.1, (LUT147)

τ^a Aerosol optical thickness at 550 *nm* (16 values), *see* Section 6.14.4.9, (LUT155)

Output: $TA\_LUT[iaer,\tau^a,\theta_s]$ (also referred as $T_a[iaer,\tau^a,\theta_s]$)

Aerosol transmittance for each aerosol model (*iaer*), for each aerosol optical thickness at 550 *nm* (τ^a) and for each illumination direction (θ_s)

units: [*dl*]

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

Step-1: Compute the aerosol transmittance $T_a[iaer,\tau^a,\theta_s]$ with the RTC/UPRAD (SO). For extracting the total atmospheric transmittance, we need to set $I_s=0$ and $\theta_v=-1$.

RTC/UPRAD (SO) Inputs (LAND)

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1	Not used. Aerosol transmittance is computed as function of τ^{a1} (tabulated values).
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sca_out/sc_land*yy*_b05"	*yy* depends on the *Junge*'s model (*iaer*=1 to 78)
$\tau^{a1}(550)$	tauA1	*See* Section 6.14.4.9, if $\tau^{a1}(550)=0$ then $T_a=1.0$
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A

Variable	***Value***	***Comments***
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*)
I_s	0	
ρ_s	"./INPUT/lut12_*yy*"	*yy* depends on the DDV model #
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 1, 1	Use a loop for 12 θ_s
θ_s	*Gaussian* angles	*See* Section 6.14.4.1
θ_v	-1	To get the total atmospheric transmittance
$\Delta\phi$	0	
pol	1	

$$iaer, \tau^a, \theta_s$$

$$\downarrow$$

RTC/UPRAD(SO)

$$\downarrow$$

$$T_a\,[iaer, \tau^a, \theta_s]$$

Scientific content:

TA_LUT[$iaer,\tau^a,\theta_s$] defines the aerosol transmittance for each of the 78 continental aerosol models (*iaer*), for each of 16 aerosol optical thicknesses at 550*nm* (τ^a), and for each of the 12 solar zenith angles (*Gaussian* angles). This table is useful for the TOA aerosol correction algorithm over land.

Resources:

Estimated CPU time: 1022 *sec*
Output disk space: 78 × 12 × 16 × 4 bytes/fl = 59904 bytes

Acceptance:

Comparison with another RTC.

6.14.10 ADS Multiplicative Function to account for Aerosol Multiple Scattering Effects

6.14.10.1 Fourier series terms of polynomial coefficients for multiplicative aerosol scattering function retrieval

Reference: Aermult_LUT, LUT169

[AD-8] Section 6.14.10, ADSR field 1

Dependencies:

LUT144, LUT147, LUT148, LUT149, LUT154, LUT155

Tools:

OTC/SCAMAT
RTC/UPRAD (SO)
Fourier series expansion (FTS)
Polynomial fit

Procedure:

Inputs:	*iaer*	Aerosol model # [*dl*] (among the 78 *Junge*'s models + 3 stratospheric models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).
	θ	Zenith angle [*deg*]; tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
	$\theta_s \times \theta_v$	Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.14.4.2, (LUT148)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.14.4.3, (LUT149)
	τ^a	Aerosol optical thickness at 550 *nm* [*dl*] (16 values), *see* Section 6.14.4.9, (LUT155)
	s	*Fourier* series term [*dl*], s = [0;5]
	k	Polynomial coefficient orders [*dl*], k = [0;3]

Output: *Aermult_LUT* [$iaer, \theta_s \times \theta_v, s, k$]
Fourier series terms of multiplicative aerosol scattering function polynomial coefficients for each continental aerosol model, as function of the acceptable combinations (sun/view zenith angles)

units: [*dl*]

Warning: The process for generating this *Aermult_LUT* table is very time-consuming. To avoid loosing data in case of a power failure during the processing, temporary binary files are created after

Step1 and *Step2* described below: *LTOA_xx.LUT169*, *LP_TOA_xx.LUT169 (where xx stands for the identification of the aerosol model [00 .. 80])* and *MultiFactor.LUT169*, respectively. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

Step-1: Generate TOA normalized radiances $L_{TOA}[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi]$ and the TOA normalized primary radiances $L_{P\_TOA}[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi]$, with the RTC/UPRAD (SO) for a pure aerosol atmosphere over a black land surface.

Note that for a first LUT generation, the computations have been completed with the same '*scamat*' inputs ('*sc_land27_b05*') both for the 3 stratospheric aerosol models. This LUT will be reprocessed as soon as the definitions of these stratospheric aerosol models will be available.

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1 and 11	1 for L_{TOA}, and 11 for L_{P_TOA}
$n(\lambda)$	1	
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sca_out/sc_land*yy*_b05"	*yy* depends on the set of 78 *Junge*'s models + 3 stratospheric models (*iaer*=1 to 81)
$\tau^{a1}(550)$	tauA1	*See* Section 6.14.4.9
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^p_{e,\lambda}$	-	N/A
$\omega^p_{o,\lambda}$	-	N/A
spm	-	N/A

Variable	***Value***	***Comments***
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*)
I_s	79	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 12, 19	Use a loop for 78 θ_sxθ_v combinations.
θ_s	*Gaussian* angles	*See* Section 6.14.4.1 and Section 6.14.4.2
θ_v	*Gaussian* angles	*See* Section 6.14.4.1 and Section 6.14.4.2
$\Delta\phi$	*see* inputs	*See* Section 6.14.4.3
pol	1	

$$iaer,\tau^a,\theta_s \text{x}\, \theta_v,\Delta\phi \quad\quad iaer,\tau^a,\theta_s \text{x}\, \theta_v,\Delta\phi$$

$$\downarrow \quad\quad\quad \downarrow$$

$$\boxed{\begin{array}{c}\text{RTC/UPRAD(SO)}\\(i\_branch=11)\end{array}} \quad\quad \boxed{\begin{array}{c}\text{RTC/UPRAD(SO)}\\(i\_branch=1)\end{array}}$$

$$\downarrow \quad\quad\quad \downarrow$$

$$L_{P\_TOA}[iaer,\tau^a,\theta_s \text{x}\, \theta_v,\Delta\phi] \quad\quad L_{TOA}[iaer,\tau^a,\theta_s \text{x}\, \theta_v,\Delta\phi]$$

Step-2: Compute the multiplicative aerosol scattering function $f_a[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi]$ as follows,

$$f_a[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi] = L_{TOA}[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi] \,/\, L_{P\_TOA}[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi]$$

Step-3: Expand $f_a[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi]$ into a *Fourier* series of 6 terms with the FTS tool (which expands a function into *Fourier* series terms),

$$f_a[iaer,\tau^a,\theta_s\times\theta_v,s] = FTS(f_a[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi])$$

Step-4: Apply a 3rd order polynomial fit on each of the 6 *Fourier* terms of the multiplicative aerosol scattering function (*i.e.*, on each term $f_a[iaer,\tau^a,\theta_s\times\theta_v,\Delta\phi,s]$) as function of the aerosol optical thickness (τ^a) for retrieving polynomial coefficients $Aermult\_LUT\,[iaer,\theta_s\times\theta_v,s,k]$,

$$\begin{aligned} f_a[iaer,\tau^a,\theta_s\times\theta_v,s] = \; & Aermult\_LUT\,[iaer,\theta_s\times\theta_v,s,0] \\ & + Aermult\_LUT\,[iaer,\theta_s\times\theta_v,s,1]\,.\,(\tau^a) \\ & + Aermult\_LUT\,[iaer,\theta_s\times\theta_v,s,2]\,.\,(\tau^a)^2 \end{aligned}$$

$+ \, Aermult\_LUT \, [iaer, \theta_s \times \theta_v, s, 3] \, . \, (\tau^a)^3$

Scientific content:

These sets of polynomial coefficients are useful to compute the multiplicative aerosol scattering function whatever the illumination (θ_s) and viewing (θ_v) configuration, whatever the aerosol model (*iaer*) and aerosol optical thickness at 550*nm* (τ^a), and for each *Fourier* series (*s*) term used in the *Fourier* series expansion of these polynomial coefficients. This multiplicative aerosol scattering function is then used to correct the aerosol primary TOA radiance for the multiple scattering.

Note:

The computation of the aerosol reflectance is based on the same approximations as for the *Rayleigh* reflectance (*i.e.*, by decoupling the primary and the multiple scattering and using the *Fourier* series expansion to remove the azimuthal dependence).

Thus for a selected aerosol model (*iaer*), the aerosol reflectance (ρ_a) is written as,

$$\rho_a(iaer, \vartheta_s, \vartheta_v, \Delta\phi, \tau^a) = \rho_{a,P}(iaer, \vartheta_s, \vartheta_v, \Delta\phi, \tau^a) \, . \, f_a(iaer, \vartheta_s, \vartheta_v, \Delta\phi, \tau^a)$$

with $\rho_{a,P}$ the primary scattering reflectance for the aerosols computed in the atmospheric correction algorithm over land, and f_a the multiplicative aerosol function which depends on the aerosol optical thickness (τ^a) at 550*nm* and accounts for the multiple scattering.

The multiplicative aerosol scattering function (f_a) is then deduced from this formulation by simulating ρ_a and $\rho_{a,P}$ with the RTC/UPRAD (SO). The *Fourier* series expansion is then applied on f_a instead of ρ_a due to the fact that f_a is less sensitive to the azimuthal angle than ρ_a, which permits to reduce the order of the series (*i.e.*, to the first 6 *Fourier* series terms).

For each *Fourier* series term s, a third order polynomial fit as function of τ^a has been determined using the set of multiplicative aerosol scattering functions $(f_a^{(s)})$:

$$f_a^{(s)}(iaer, \vartheta_s, \vartheta_v, \tau^a) = \sum_{i=0}^{3} k_i^{(s)}(iaer, \vartheta_s, \vartheta_v) \, . \, (\tau^a)^i$$

with $k_i^{(s)}$ the polynomial coefficient for the *Fourier* series terms *s*.

The aerosol scattering function (f_a) is then computed by recombining the first 6 *Fourier* series terms:

$$f_a(iaer, \vartheta_s, \vartheta_v, \Delta\phi, \tau^a) = \sum_{s=0}^{5} (2 - \delta_{0,s}) \, . \, f_a^{(s)}(iaer, \vartheta_s, \vartheta_v, \tau^a) \, . \, \cos(s.\Delta\phi) \qquad (1)$$

Resources:

Estimated CPU time: 177329 *sec*

Output disk space: 81 × 78 × 6 × 4 × 4 bytes/fl = 606528 bytes

Acceptance:

Comparison with another RTC.

6.14.11 ADS Aerosol Phase Function times Single Scattering Albedo

6.14.11.1 Aerosol phase function times single scattering albedo, $\omega_o^a(iaer).P_a(iaer,cos\Theta)$

Reference: Aerpha_LUT, LUT170

[AD-8] Section 6.14.11, ADSR field 1

Dependencies:

LUT144, LUT150, LUT154

Tool:

OTC/SCAMAT

Note: The imaginary part of the refractive index is stored in a C.P. file, *see* Section 6.14.1.1. (LUT144).

Procedure:

Inputs:	*iaer*		Aerosol model # [*dl*] (among the 78 *Junge*'s models)
	Sca_cos		Cosine of scattering angle [*dl*], *see* Section 6.14.4.4, (LUT150)
	k		Output index (for selecting the aerosol property)
	Aerosol_refindex[*iaer*]	*k*=1	refractive index (real part) [*dl*],
	Aerosol_angstrom[*iaer*]	*k*=2	*Angström* coefficient (α) [*dl*], *see* Section 6.14.4.8, (LUT154)
	n_i		Imaginary part of refractive index [*dl*], *see* Section 6.14.1.1., (LUT144)
Output:	*Aerpha_LUT*[*iaer*,*Sca_cos*]		Aerosol phase function times single scattering albedo for each aerosol model (*iaer*)
units:	[*dl*]		

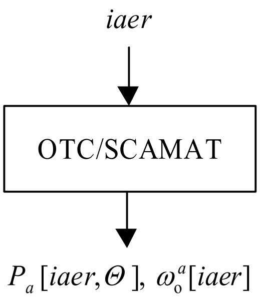
Step-1: Compute the aerosol scattering phase matrix $P_a[iaer,\Theta]$ (with Θ the scattering angle derived from the OTC/SCAMAT) and the single scattering albedo ($\omega_o^a[iaer]$) with the OTC/SCAMAT, for each of the 78 aerosol models.

SCAMAT Inputs

Variable	***Value***	***Comments***

Variable	***Value***	***Comments***
scamat_out	"./INPUT/sca_out/sc_land*yy*_b05"	*yy* depends on the continental aerosol model (*iaer*=1 to 78)
λ	550	Wavelength
λ_{ref}	550	Reference wavelength
n_2	83	Number of scattering angles
N	1	Number of size distribution
$m_\lambda(1)$, $k_\lambda(1)$	*see* inputs	*See* Section 6.14.4.8 and Section 6.14.1.1
$m_{\lambda ref}(1)$, $k_{\lambda ref}(1)$	*see* inputs	*See* Section 6.14.4.8 and Section 6.14.1.1
$r_{min}(1)$, $r_{max}(1)$, $dr(1)$	0.001, 20, 0.001	Minimum, maximum radii and size increment
$ind(1)$, a(1) ,b(1)	1 0.01, $m_\lambda(i+1) + 3$	*Junge* size distribution *See* Section 6.14.4.8 for $m_\lambda(i)$
$n(1)/n$	1	Component mixing ratio

Note: Refractive index are independent on the wavelength for the continental aerosol models.



Step-2: Determine $Aerpha\_LUT[iaer,\Theta]$ for each of the 78 continental aerosol models (*iaer*) as follows,

$$Aerpha\_LUT[iaer,\Theta] = \omega_o^a[iaer] \times P_a[iaer,\Theta].$$

Step-3: Interpolate values from $Aerpha\_LUT[iaer,\Theta]$ to the input scattering angles (Sca_cos) to obtain $Aerpha\_LUT[iaer,Sca\_cos]$ with the interpolation tool.

$$Aerpha\_LUT[iaer,Sca\_cos] = Interpolation(Aerpha\_LUT[iaer,\Theta])$$

Scientific content:

$Aerpha\_LUT[iaer,Sca\_cos]$ determines the aerosol phase function times the single scattering albedo for each of the 78 continental aerosol models. The latter which describes the aerosol reflectances for each aerosol model (*iaer*), is useful for the aerosol correction algorithm over land.

Resources:

Estimated CPU time: 2458 *sec*
Output disk space: 78 × 83 × 4 bytes/fl = 25896 bytes

Acceptance:

Comparison with another OTC, such as the OTC/MIE from the FUB institute.

6.14.12 ADS Volcanic Aerosol Spherical Albedo

6.14.12.1 Volcanic aerosol spherical albedo, $S_{va}(iaer,\lambda)$

Reference: Strato_sphalb, LUT315

[AD-8] Section 6.14.12, ADSR field 1

Dependencies:

None

Tools:

RTC/GAUSS
RTC/UPRAD (SO)
Numerical integration

Procedure:

Inputs:	*iaer*	Aerosol model # [*dl*] (among the 18 volcanic aerosol models)
	θ_s	Solar zenith angle [*deg*], *Gaussian* angles computed with RTC/GAUSS
	λ	MERIS wavelength [*nm*], (15 values)

Output: *Strato_sphalb*[*iaer*,λ]
Volcanic aerosol spherical albedo for each aerosol model (*iaer*) and each MERIS wavelength (λ)
units: [*dl*]

Step-1: Compute *Gaussian* angles μ (=cosθ_s) and their corresponding weighting factors $w(\mu)$ with the RTC/GAUSS (n_s=12).

Step-2: Compute the volcanic aerosol transmittance $T_{va}[iaer,\theta_s,\lambda]$ with the RTC/UPRAD (SO). For extracting the total atmospheric transmittance, we need to set $I_s=0$ and $\theta_v=-1$.

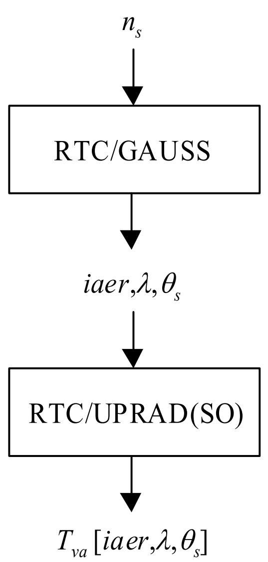
Note that for a first LUT generation, the computations have been completed with the same 'scamat' inputs ('*sc_land27_b05*') both for all the 18 volcanic aerosol models whatever the wavelength. This LUT will be reprocessed as soon as the definitions of these volcanic aerosol models will be available.

RTC/UPRAD (SO) Inputs (LAND)

Variable	*Value*	*Comments*

Variable	***Value***	***Comments***
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, but only one band is implemented in the MERISAT tool.
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_land*yy*_b05"	*yy* depends on the volcanic aerosol model # (*iaer*=1 to 18). However these models are not available, and only 1 aerosol model ('*sc_land27_b05*') is implemented in the MERISAT tool.
$\tau^{a1}(550)$	0.1	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2 *km*)
I_s	0	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	24, 1, 1	Use a loop for 24 θ_s
θ_s	*Gaussian* angles	Computed with RTC/GAUSS
θ_v	-1	To get the total atmospheric transmittance

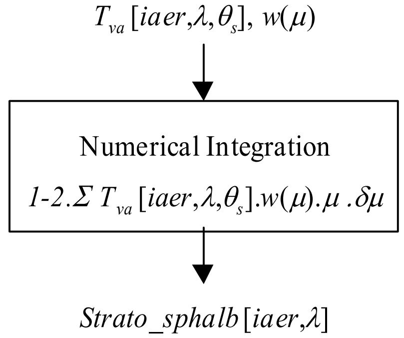
Variable	Value	Comments
$\Delta\phi$	0	
pol	1	



Step-2: Compute the volcanic aerosol spherical albedo *Strato_sphalb*[*iaer*,λ] by the following angular numerical integration,

$$Strato\_sphalb[iaer,\lambda] = 1 - 2 \cdot \int_0^1 T_{va}[iaer,\lambda,\mu] \,.\, w(\mu) \,.\, \mu \,.\, d\mu$$

with μ the *Gaussian* angle ($\mu = \cos(\theta_s)$) and $w(\mu)$ its associated weighting factor.



Scientific content:

Strato_sphalb[*iaer*,λ] defines the volcanic aerosol spherical albedo for each of the 18 volcanic aerosol models (*iaer*) and each of 15 MERIS wavelengths (λ). This table is useful for the stratospheric aerosol correction algorithm over land.

Resources:

Estimated CPU time: 363 *sec*
Output disk space: $18 \times 15 \times 4$ bytes/fl = 1080 bytes

Acceptance:

Comparison with another RTC.

6.14.13 ADS Volcanic Aerosol Transmittance

6.14.13.1 Volcanic aerosol transmittance, $T_{va}(iaer,\lambda,\theta_s)$

Reference: TA_strato_LUT, LUT316

[AD-8] Section 6.14.13, ADSR field 1

Dependencies:

LUT147

Tool:

RTC/UPRAD (SO)

Procedure:

Inputs:
- *iaer* — Aerosol model # [*dl*] (among the 18 volcanic aerosol models)
- θ_s — Solar zenith angle [*deg*], *see* Section 6.14.4.1, (LUT147)
- λ — MERIS wavelength [*nm*],(15 values)

Output: *TA_strato_LUT*[$iaer,\lambda,\theta_s$] (also referred as $T_{va}[iaer,\lambda,\theta_s]$)
Volcanic aerosol transmittance for each aerosol model (*iaer*), for each MERIS wavelength (λ), and for each illumination direction (θ_s)
units: [*dl*]

Step: Compute the volcanic aerosol transmittance $T_{va}[iaer,\lambda,\theta_s]$ with the RTC/UPRAD (SO). For extracting the total atmospheric transmittance, we need to set $I_s=0$ and $\theta_v=-1$.

Note that for a first LUT generation, the computations have been completed with the same 'scamat' inputs ('*sc_land27_b05*') both for all the 18 volcanic aerosol models whatever the wavelength. This LUT will be reprocessed as soon as the definitions of these volcanic aerosol models will be available.

RTC/UPRAD (SO) Inputs (LAND)

Variable	***Value***	***Comments***

Variable	*Value*	*Comments*
out_file	"./OUTPUT/uprad_out"	
i_branch	1	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15	All MERIS bands, but only 1 band is implemented in the MERISAT tool.
U_{H2O}	0	
U_{O2}	0	
ESFT	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	0	
aerosol1	"./INPUT/sc_land*yy*_b05"	*yy* depends on the volcanic aerosol model # (*iaer*=1 to 18). However these models are not available, and only 1 aerosol model ('*sc_land27_b05*') is implemented in the MERISAT tool.
$\tau^{a1}(550)$	0.1	
aerosol2	-	
$\tau^{a2}(550)$	0	
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	-	N/A
cloud2	-	N/A
cloud3	-	N/A
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{e,\lambda}$	-	N/A
vertical	"./INPUT/vertical_out"	Not used, vertical distribution determined in RTC/SO (H_a=2km)
I_s	0	
ρ_s	0	
E_o	1	
$\sigma^{w}_{e,\lambda}$	-	N/A
$\omega^{w}_{o,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	12, 1, 1	Use a loop for 12 θ_s
θ_s	*Gaussian* angles	*See* Section 6.14.4.1
θ_v	-1	To get the total atmospheric transmittance

Variable	Value	Comments
$\Delta\phi$	0	
pol	1	

$iaer,\lambda,\theta_s$

$\downarrow$

RTC/UPRAD(SO)

$\downarrow$

$T_{va}\,[iaer,\lambda,\theta_s]$

Scientific content:

TA_strato_LUT[$iaer,\lambda,\theta_s$] defines the volcanic aerosol transmittance for each of the 18 volcanic aerosol models (*iaer*), for each of 15 MERIS wavelengths (λ), and for each of the 12 solar zenith angles (*Gaussian* angles). This table is useful for the volcanic aerosol correction algorithm over land.

Resources:

Estimated CPU time: 183 *sec*
Output disk space: 18 × 15 × 12 × 4 bytes/fl = 12960 bytes

Acceptance:

Comparison with another RTC.

6.14.14 ADS Volcanic Aerosol Reflectance

6.14.14.1 Volcanic aerosol phase function times single scattering albedo, $\omega_o^{va}(iaer,\lambda).P_{va}(iaer,\lambda,\cos\Theta)$

Reference: Strato_aerpha_LUT, LUT317

[AD-8] Section 6.14.14, ADSR field 1

Dependencies:

LUT150, LUT154

Tools:

OTC/SCAMAT
Interpolation

Procedure:

Inputs:

iaer			Aerosol model # [*dl*] (among the 3 stratospheric models distinguished by the effective volcanic aerosol radius)
Sca_cos			Cosine of scattering angle [*dl*], *see* Section 6.14.4.4, (LUT150)
k			Output index (for selecting the aerosol property)
Aerosol_refindex[*iaer*]	k=1		refractive index (real part) [*dl*],
Aerosol_angstrom[*iaer*]	k=2		*Angström* coefficient (α) [*dl*], *see* Section 6.14.4.8, (LUT154)

Output: *Strato_aerpha_LUT*[*iaer*,λ,*Sca_cos*]

Aerosol phase function times single scattering albedo for each aerosol model (*iaer*)

units: [*dl*]

Step-1: Compute the aerosol scattering phase matrix $P_{va}[iaer,\lambda,\Theta]$ (with Θ the scattering angle derived from the OTC/SCAMAT) and the single scattering albedo ($\omega_o^{va}[iaer,\lambda]$) with the OTC/SCAMAT, for each of the 3 stratospheric aerosol models.

Note that for a first LUT generation, the computations have been completed with the same '*scamat*' inputs ('*sc_land27_b05*') both for all the 3 stratospheric aerosol models whatever the wavelength. This LUT will be reprocessed as soon as the definitions of these volcanic aerosol models will be available.

SCAMAT Inputs

Variable	***Value***	***Comments***
Scamat_out	"./INPUT/sca_out/sc_strato*yy*_b05"	*yy* depends on the stratospheric aerosol model (*iaer*=1 to 3). However these models are not available, and only 1 aerosol model ('*sc_strato_b05*') is implemented in the MERISAT tool.
λ	550	Wavelength
λ_{ref}	550	Reference wavelength
n_2	83	Number of scattering angles
N	1	Number of size distribution
$m_\lambda(1)$, $k_\lambda(1)$	*see* inputs	*See* Section 6.14.4.8 and Section 6.14.1.1
$m_{\lambda ref}(1)$, $k_{\lambda ref}(1)$	*see* inputs	*See* Section 6.14.4.8 and Section 6.14.1.1
$r_{min}(1)$, $r_{max}(1)$, $dr(1)$	0.001, 20, 0.001	Minimum, maximum radii and size increment
ind(1), a(1) ,b(1)	1 0.01, $m_\lambda(i+1) + 3$	*Junge* size distribution *See* Section 6.14.4.8 for $m_\lambda(i)$
$n(1)/n$	1	Component mixing ratio

Note: These scamat inputs are the same as for the continental aerosol models du to the fact that the definitions of the 3 stratospheric aerosol models are not available.

$$iaer,\lambda \;\downarrow\; \boxed{\text{OTC/SCAMAT}} \;\downarrow\; P_{va}[iaer,\lambda,\Theta],\ \omega_o^{va}[iaer,\lambda]$$

Step-2: Determine *Strato_aerpha_LUT*[*iaer*,λ,Θ] for each of the 3 stratospheric aerosol models (*iaer*) as follows,

$$Strato\_aerpha\_LUT[iaer,\lambda,\Theta] = \omega_o^{va}[iaer,\lambda] \times P_{va}[iaer,\lambda,\Theta]$$

Step-3: Interpolate values from *Strato_aerpha_LUT*[*iaer*,λ,Θ] to the input scattering angles (*Sca_cos*) to obtain *Strato_aerpha_LUT*[*iaer*,λ,*Sca_cos*] with the interpolation tool.

$$Strato\_aerpha\_LUT[iaer,\lambda,Sca\_cos] = Interpolation(Strato\_aerpha\_LUT[iaer,\lambda,\Theta])$$

Scientific content:

Strato_aerpha_LUT[*iaer*,λ,*Sca_cos*] defines the stratospheric aerosol phase function times the single scattering albedo for each of the 3 volcanic aerosol models, and each of the 15 MERIS wavelengths. The latter, which describes the volcanic aerosol spectral reflectances for each model (*iaer*), is useful for the volcanic aerosol correction algorithm over land.

Resources:

Estimated CPU time: 40 *sec*
Output disk space: 3 × 15 × 83 × 4 bytes/fl = 14940 bytes

Acceptance:

Comparison with another OTC, such as the OTC/MIE from the FUB institute.

6.14.14.2 Spectral dependence of the volcanic aerosol optical thickness (with normalization at reference wavelength)

Reference: Strato_spectr, LUT318

[AD-8] Section 6.14.14, ADSR field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs:	*iaer*	Volcanic aerosol model # (among 3 models)
	b	MERIS band # (15 bands)
Outputs:	*Strato_spectr[iaer,b]*	
		Spectral dependence ($f_{strato}[iaer,\lambda]$) of the volcanic aerosol optical thickness (with normalization at reference wavelength)

units: [*dl*]

Step: User specified.

Scientific content:

$f_{strato}[iaer,\lambda]$ describes the spectral dependence of the volcanic aerosol optical thickness (stratosphere), for each of the 3 aerosol models (*iaer*) and for each of the 15 MERIS wavelengths (λ). These values are normalized to the reference wavelength at 865 nm.

Current baseline: (3 x 15) values set to 1

Resources:

Estimated CPU time: -

Output disk space: $3 \times 15 \times 4$ bytes/fl = 180 bytes

Acceptance:

Corresponds to the latest definition.

6.14.15 GADS Dense Dark Vegetation Climatology

6.14.15.1 Biome index, DDV_clim(lat,long)

Reference: DDV_clim, LUT319

[AD-8] Section 6.14.15, ADSR field 1

ACRI provided

Dependencies:

LUT310, LUT311

Tool:

None

Procedure:

Inputs:	*lat*	Latitude [*deg*] (180 values), *see* Section 6.14.4.13 (LUT310)
	long	Longitude [*deg*] (360 values), *see* Section 6.14.4.14 (LUT311)

Outputs: *DDV_clim[lat,long]*

Spectral dependence ($f_{strato}[iaer,\lambda]$) of the volcanic aerosol optical thickness (with normalization at reference wavelength)

units: [*dl*]

Step: User specified.

Scientific content:

DDV climatology given on a geographic map with a 1 *deg* cell resolution in (*lat*, *long*)

Current baseline: (180 x 360) values.

Resources:

Estimated CPU time: -

Output disk space: 180 × 360 × 1 byte/uc = 64800 bytes

Acceptance:

Corresponds to the latest definition.

6.14.16 ADS DDV Parameters for Bidirectionality Correction

6.14.16.1 Rayleigh-ground DDV coupling bidirectionality term, $\overline{\rho}_{RG}(iddv,\lambda,\theta_v)$

Reference: robar_Rg_LUT, LUT320

[AD-8] Section 6.14.16, ADSR field 1

Dependencies:

LUT147

Tools:

RTC/MOS (lut_rhob_Rgddv)
Interpolation
Numerical integration (*Gauss* quadrature)
Numerical integration (*Newton-Cotes* method)

Note: Both the interpolation and numerical integrations tools are included in the RTC/MOS (lut_rhob_Rgddv). The latter has been developed for the sun/view geometries in the MOS ground-segment.

Procedure:

Inputs:	λ	4 MERIS wavelengths [*nm*] (412.5, 442.5, 490 and 665 *nm*)
	θ	Zenith angle [*deg*]; tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
	$\Delta\phi$	Relative azimuth angle [*deg*]; 72 values derived from a parabolic distribution centred at 0 *deg*.
	iddv	DDV model # [*dl*] (among the 20 DDV models, [0..19])
	param_Hapke	CESBIO input file containing 4 *Hapke*'s parameters (ω, g, S and h) for each of the 20 DDV models, each of the 4 wavelengths (*i.e.*, 412.5, 442.5, 490 and 665 *nm*) and for all illumination and viewing configurations (*see* [AD-7] for more details). ω : single scattering albedo g : assymmetry factor S : amplitude of the hot-spot h : width of the hot-spot

Output: *robar_Rg_LUT*[$iddv,\lambda,\theta_v$], referred also as $\bar{\rho}_{RG}[iddv,\lambda,\theta_v]$

Rayleigh-ground DDV coupling bidirectionality term as function of the DDV model (*iddv*), the wavelength (λ), and the viewing zenith angle (θ_v)

units: [*dl*]

The steps, described hereafter, are implemented in the RTC/MOS (lut_rhob_Rgddv).

Step-1: Generate the DDV BRDF $R_{DDV}[iddv,\lambda,\vartheta',\vartheta_v,\Delta\phi']$ with the RTC/MOS (*lut_rhob_Rgddv*) using the *Hapke*'s parameters (ω,g,S,h) file, for each DDV model, each wavelength, and each illumination and viewing configuration ϑ', ϑ_v and $\Delta\phi'$ ($N_{\vartheta'} = 24$; $N_{\vartheta_v} = 12$; $N_{\Delta\phi'} = 72$). The zenith angles (ϑ', ϑ_v) (within [0°;90°[) derive from the *Gauss* quadratures and the relative azimuth angles ($\Delta\phi'$) (within [-180°;180°]) follow a parabolic distribution centred at 0°.

$\lambda, \theta_v, iddv(\omega, g, S, h)$

$\downarrow$

RTC/MOS(*lut_rhob_Rgddv*)

$\downarrow$

$R_{DDV}[iddv, \lambda, \theta', \theta_v, \Delta\phi']$

Step-2: Compute the *Rayleigh*-ground DDV coupling bidirectionality term $robar\_Rg\_LUT[iddv,\lambda,\theta_v]$ for each DDV model, each wavelength λ, and each viewing angle ϑ_v, using the numerical angular integration of $R_{\mathrm{DDV}}[iddv,\lambda,\vartheta',\vartheta_v,\Delta\phi']$ on μ' and $\Delta\phi'$:

$$robar\_Rg\_LUT[iddv,\lambda,\vartheta_v] = \frac{1}{2\pi} \cdot \int_0^{2\pi}\int_0^{1} R_{DDV}[iddv,\lambda,\vartheta',\vartheta_v,\Delta\phi'] \cdot d\mu' \cdot d\Delta\phi'$$

This angular integration on μ' is performed using a *Gauss* quadrature whereas the azimuthal integration on $\Delta\phi'$ is completed with the *Newton-Cotes* method.

$R_{DDV}[iddv, \lambda, \theta', \theta_v, \Delta\phi']$

$\downarrow$

Numerical integration:
Gauss quadrature for θ'
Newton-Cotes for $\Delta\phi'$

$\downarrow$

$robar\_Rg\_LUT[iddv, \lambda, \theta_v]$

Scientific content:

$robar\_Rg\_LUT[iddv,\lambda,\theta_v]$ defines the *Rayleigh*-ground DDV coupling bidirectionality term as function of the DDV model (*iddv*), the wavelength (λ), and the viewing zenith angle (θ_v). The latter which accounts for the multiple scatterings between the ground DDV interface and the *Rayleigh* atmosphere, is useful for the atmospheric correction algorithm over land.

Resources:

Estimated CPU time: 5 *sec* (If ASCII LUT exists)
Output disk space: $20 \times 4 \times 12 \times 4$ bytes/fl = 3840 bytes

Acceptance:

Comparison with another code.

6.14.16.2 Aerosol-ground DDV coupling bidirectionality term, $\overline{\rho}_{aG}\,(iddv,\lambda,iaer,\theta_s x\theta_v,s)$

Reference: robar_ag_LUT, LUT321

[AD-8] Section 6.14.16, ADSR field 2

Dependencies:

LUT144, LUT147, LUT148, LUT150, LUT154

Tools:

OTC/SCAMAT
RTC/MOS (lut_rhob_agddv)
Fourier series expansion (FTS)
Interpolation
Numerical integration (*Gauss* quadrature)
Numerical integration (*Newton-Cotes* method)

Note: Both the FTS, interpolation and numerical integrations tools are included in the RTC/MOS (lut_rhob_agddv). The latter has been developed for the sun/view geometries in the MOS ground-segment.

Procedure:

Inputs:	λ	4 MERIS wavelengths [*nm*] (412.5, 442.5, 490 and 665 *nm*)
	θ	Zenith angle [*deg*]; tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
	$\theta_s \times \theta_v$	Stored indices for angular combinations [*dl*] (78 values), *see* Section 6.14.4.2, (LUT148)
	$\Delta\phi$	Relative azimuth angle [*deg*]; 72 values derived from a parabolic distribution centred at 0 *deg*.
	iaer	Aerosol model # [*dl*] (among the 78 *Junge*'s models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).
	Sca_cos	Cosine of scattering angle [*dl*], *see* Section 6.14.4.4, (LUT150)
	iddv	DDV model # [*dl*] (among the 20 DDV models, [0..19])
	param_Hapke	CESBIO input file containing 4 *Hapke*'s parameters (ω, g, S and h) for each of the 20 DDV models, each of the 4 wavelengths (*i.e.*, 412.5, 442.5, 490 and 665 *nm*) and for all illumination and viewing configurations (*see* [AD-7] for more details). ω : single scattering albedo g : assymmetry factor S : amplitude of the hot-spot h : width of the hot-spot
	phase_aer78	Input file containing scattering phase functions for 78 aerosol models (*see* [AD-7] for more details).

Output: *robar_ag_LUT*[$iddv,\lambda,iaer,\theta_s\times\theta_v,s$], referred also as $\bar{\rho}_{aG}$ [$iddv,\lambda,iaer,\theta_s\times\theta_v,s$]

Aerosol-ground DDV coupling bidirectionality term as function of the DDV model (*iddv*), the wavelength (λ), the aerosol model (*iaer*), the illumination and viewing geometry (θ_s,θ_v), and the *Fourier* term (s) used to remove the azimuthal dependence

units: [*dl*]

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

Step-1: For each of the 78 aerosol models (*iaer*), interpolate the scattering phase function $P_{scat}[iaer,\Theta]$ to the input scattering angles (*Sca_cos*) to get $P_{scat}[iaer, Sca\_cos]$ with the interpolation tool,

$$P_{scat}[iaer,Sca\_cos] = Interpolation(P_{scat}[iaer,\Theta]),$$

and generate the input file, *phase_aer78*, with the 78 interpolated scattering phase functions.

The steps, described hereafter, are implemented in the RTC/MOS (lut_rhob_agddv).

Step-2: Generate the DDV BRDF $R_{DDV}[iddv,\lambda,\vartheta',\vartheta_v,\Delta\phi']$ with the RTC/MOS (*lut_rhob_agddv*) using the *Hapke*'s parameters (ω,g,S,h) file, for each DDV model, each wavelength, and each illumination and viewing configuration ϑ',ϑ_v and $\Delta\phi'$ $(N_{\vartheta'}=24\,;N_{\vartheta_v}=12\,;N_{\Delta\phi'}=72)$. The zenith angles (ϑ',ϑ_v) (within [0°;90°[) derive from the *Gauss* quadratures and the relative azimuth angles $(\Delta\phi')$ (within [-180°;180°]) follow a parabolic distribution centred at 0°.

$\lambda,\theta_v,iddv(\omega,g,S,h)$

↓

RTC/MOS(*lut_rhob_agddv*)

↓

$R_{DDV}[iddv,\lambda,\theta',\theta_v,\Delta\phi']$

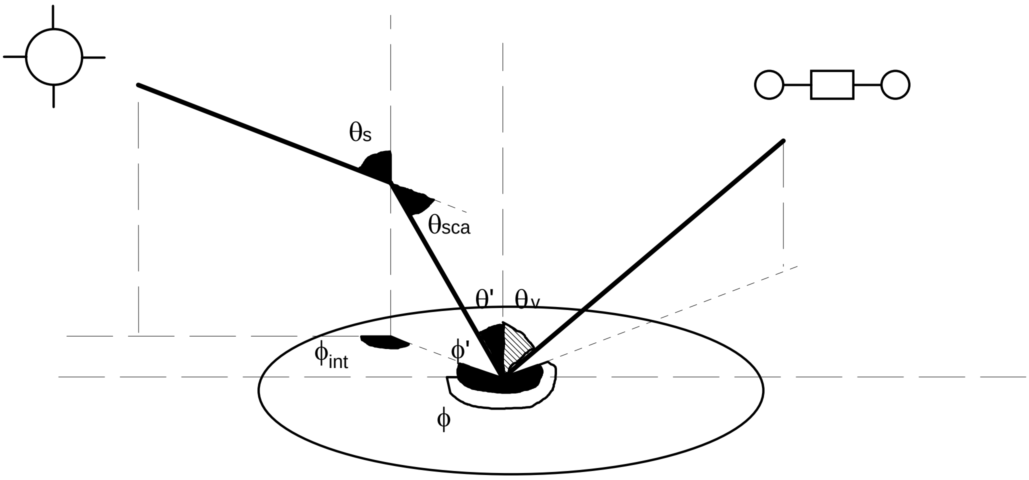
Step-3: Set a table with pre-computed values of downward normalized aerosol phase function with $N_{\vartheta_s}=12,\ N_{\vartheta'}=24,\ N_{\Delta\phi'}=30,\ N_{\Delta\phi}=72$ for all the aerosol models $(N_{aer}=78)$ and all the scattering geometries $(N_\theta=83)$.

For each combination $(\vartheta_s,\vartheta',\Delta\phi,\Delta\phi')$, we compute:

(a) the scattering angle θ_{sca} as follows:

$$\cos(\theta_{sca})=\cos(\vartheta_s)\cos(\vartheta')+\sin(\vartheta_s)\cdot\sin(\vartheta')\cdot\cos(\Delta\phi'-\Delta\phi)$$

(*b*) the aerosol phase function $P(\theta_{sca}, iaer)$ for each aerosol model (*iaer*) by interpolation from tabulated values of $P(\theta, N_{aer})$.



$12\,\theta_s, 24\,\theta', 30\,\Delta\phi, 72\,\Delta\phi'$

↓

Compute downward scattering angles θ_{sca}

↓

$\Theta_{sca}[\theta_s, \theta', \Delta\phi, \Delta\phi']$

↓

For each aerosol model (*iaer*) interpolate the aerosol phase function $P(\theta, iaer)$ at θ_{sca}

↓

$P[\theta_s, \theta', \Delta\phi, \Delta\phi', iaer]$

Step-4: Compute the aerosol-ground DDV coupling bidirectionality term $\overline{\rho}_{aG}[iddv, \lambda, iaer, \vartheta_s, \vartheta_v, \Delta\phi]$ for each DDV, each wavelength λ, each aerosol model *iaer* and each illumination and viewing configuration $(\vartheta_s, \vartheta_v, \Delta\phi)$ (with $N_{\vartheta_s} = 12$, $N_{\vartheta_v} = 12$, $N_{\Delta\phi} = 30$):

$$\bar{\rho}_{\mathrm{aG}}[iddv,\lambda,iaer,\vartheta_s,\vartheta_v,\Delta\phi]=\frac{\int_0^{2\pi}\int_0^{1} R_{DDV}[iddv,\lambda,\vartheta',\vartheta_v,\Delta\phi']\cdot P[\vartheta_s,\vartheta',\Delta\phi,\Delta\phi',iaer]\cdot d\mu'\cdot d\Delta\phi'}{\int_0^{2\pi}\int_0^{1} P[\vartheta_s,\vartheta',\Delta\phi,\Delta\phi',iaer]\cdot d\mu'\cdot d\Delta\phi'}$$

This angular integration is numerically performed using a *Gauss* quadrature for μ' and the *Newton-Cotes* method for $\Delta\phi'$.

For each $iddv,\lambda,iaer,\theta_s,\theta_v,\Delta\phi$:
call $P[\theta_s,\theta',\Delta\phi,\Delta\phi',iaer]$
call $R_{DDV}[iddv,\lambda,\theta',\theta_v,\Delta\phi']$

↓

Numerical integration:
Gauss quadrature for θ'
Newton-Cotes for $\Delta\phi'$

↓

$\bar{\rho}_{aG}[iddv,\lambda,iaer,\theta_s,\theta_v,\Delta\phi]$

Step-5: Remove the azimuthal dependence $\Delta\phi$ by expanding $\bar{\rho}_{\mathrm{aG}}[iddv,\lambda,iaer,\vartheta_s,\vartheta_v,\Delta\phi]$ into *Fourier* series at the 4th order:

$\bar{\rho}_{aG}[iddv,\lambda,iaer,\theta_s,\theta_v,\Delta\phi]$

↓

FTS (*Fourier* series expansion)

↓

$robar\_ag\_LUT[iddv,\lambda,iaer,\theta_s \mathrm{x} \theta_v,s]$

Scientific content:

$robar\_ag\_LUT[iddv,\lambda,iaer,\theta_s\times\theta_v,s]$ defines the aerosol-ground DDV coupling bidirectionality term as function of the DDV model (*iddv*), the wavelength (λ),the aerosol model (*iaer*), the illumination and viewing geometry (θ_s,θ_v), and the *Fourier* term (*s*) used to remove the azimuthal dependence. The latter which accounts for the multiple scatterings between the ground DDV interface and the aerosol atmosphere, is useful for the atmospheric correction algorithm over land.

Resources:

Estimated CPU time:	6 *sec* (If ASCII LUT exists)
Output disk space:	20 × 5 × 4 × 78 × 78 × 4 bytes/fl = 9734400 bytes

Acceptance:

Comparison with another code.

6.14.16.3 Ground DDV albedo, $\rho_{DDV}(iddv,\lambda)$

Reference: albedo_g, LUT322

[AD-8] Section 6.14.16, ADSR field 3

Dependencies:

None

Tool:

RTC/MOS (lut_alb_gddv)

Procedure:

Inputs:

λ	4 MERIS wavelengths [*nm*] (412.5, 442.5, 490 and 665 *nm*)
iddv	DDV model # [*dl*] (among the 20 DDV models, [0..19])
param_Hapke	CESBIO input file containing 4 *Hapke*'s parameters (ω, g, S and h) for each of the 20 DDV models, each of the 4 wavelengths (*i.e.*, 412.5, 442.5, 490 and 665 *nm*) and for all illumination and viewing configurations (*see* [AD-7] for more details). ω : single scattering albedo g : assymmetry factor S : amplitude of the hot-spot h : width of the hot-spot

Output: *albedo_g*[*iddv*,λ], referred also as ρ_{DDV}[*iddv*,λ]
Ground albedo for each DDV model (*iddv*) and each wavelength (λ)

units: [*dl*]

Step : Generate the ground DDV albedo *albedo_g*[*iddv*,λ] for each DDV model and each wavelength, with the RTC/MOS (*lut_alb_gddv*).

$$\lambda, iddv(\omega, g, S, h)$$

$$\downarrow$$

$$\boxed{\mathrm{RTC/MOS}(lut\_alb\_gddv)}$$

$$\downarrow$$

$$albedo\_g\,[iddv, \lambda]$$

Scientific content:

albedo_g[*iddv*,λ] defines the ground DDV albedo as function of the DDV model (*iddv*) and the wavelength (λ). The latter is useful for the atmospheric correction algorithm over land.

Resources:

Estimated CPU time: 7 *sec* (If ASCII LUT exists)
Output disk space: 20 × 4 × 4 bytes/fl = 320 bytes

Acceptance:

Comparison with another code.

6.14.17 ADS Aerosol Parameters for Bi-Directionality Correction

6.14.17.1 Polynomial coefficients for aerosol-molecule coupling bidirectionality term retrieval

Reference: robar_aR_LUT, LUT324

[AD-8] Section 6.14.17, ADSR field 1

Dependencies:

LUT144, LUT147, LUT150, LUT154, LUT169

Tool:

OTC/SCAMAT
RTC/MOS (lut_rhob_aR)
Numerical integration (*Gauss* quadrature)
Polynomial fit

Note: Both the numerical integration and polynomial fit tools are included in the RTC/MOS (lut_rhob_aR). The latter has been developed for the sun/view geometries in the MOS ground-segment.

Procedure:

Inputs:

	θ	Zenith angle [*deg*]; tabulated values used for ($\theta_s \times \theta_v$) combinations, *see* Section 6.14.4.1, (LUT147)
	τ^a	Aerosol optical thickness at 550 *nm* [*dl*] (15 values in [0.1;1.5] by step of 0.1)
	iaer	Aerosol model # [*dl*] (among the 78 *Junge*'s models) characterized by an *Angström* exponent (α) and a refractive index, *see* Section 6.14.4.4 (LUT144) and Section 6.14.1.1 (LUT154).
	Sca_cos	Cosine of scattering angle [*dl*], *see* Section 6.14.4.4, (LUT150)
	phase_aer78	Input file containing scattering phase functions for 78 continental aerosol models (*see* [AD-7] for more details).
	k	Polynomial coefficient orders [*dl*], $k = [0;3]$

Output: *robar_aR_LUT*[*iaer*,θ,*k*]

Polynomial coefficients for the aerosol-molecule coupling bidirectionality term retrieval as function of the aerosol model (*iaer*), and the solar zenith angle θ

units: [*dl*]

Step-0: Compute the IOPs (aerosol phase function, single scattering albedo, extinction coefficient) for all the 78 aerosol models. Eiher generate the LUT170 (*see* Section 6.14.11) or launch the *Mie*'s computations with OTC/SCAMAT using as inputs the *Angström* exponent and refractive index (real and imaginary parts).

Step-1: For each of the 78 aerosol models (*iaer*), interpolate the scattering phase function $P_{scat}[iaer,\Theta]$ to the input scattering angles (*Sca_cos*) to get $P_{scat}[iaer, Sca\_cos]$ with the interpolation tool,

$$P_{scat}[iaer,Sca\_cos] = Interpolation(P_{scat}[iaer,\Theta]),$$

and generate the input file, *phase_aer78*, with the 78 interpolated scattering phase functions.

The steps, described hereafter, are implemented in the RTC/MOS (lut_rhob_agddv).

Step-2: Generate the top of aerosol normalized radiance $L^{(0)}_{TOA\_aer}[iaer,\tau^a,\theta_s,\theta_v]$ corresponding to the first order of *Legendre* decomposition ($I_s=0$) of phase function, over a black land surface with the RTC/MOS (*lut_rhob_aR*). Computations have to be completed for each of the 78 continental aerosol models (*iaer*), each of the 15 aerosol optical thickness (τ^a) at 550 *nm* (*i.e.*, [0.1;1.5] by step of 0.1), and the pre-selected illumination and viewing configurations (θ_s,θ_v).

$$iaer,\tau^a,\theta_s,\theta_v$$

$$\downarrow$$

$$\boxed{\text{RTC/MOS}(lut\_rhob\_aR)}$$

$$\downarrow$$

$$L^{(0)}_{TOA\_aer}[iaer,\tau^a,\theta_s,\theta_v]$$

Step-3: Determine the aerosol-molecule coupling bidirectionality term retrieval $\bar{\rho}_{aR}(iaer,\tau^a,\vartheta_s)$ for each aerosol model (*iaer*) and each aerosol optical thickness (τ^a) at 550 nm by performing the numerical angular integration of the top of aerosol normalized radiance $L^{(0)}{}_{TOA\_aer}[iaer,\tau^a,\theta_s,\theta_v]$ over the hemispherical sphere (*i.e.*, over the 24 *Gaussian* angles, $\mu_v = \cos\theta_v$) as follows,

$$\bar{\rho}_{aR}(iaer,\tau^a,\vartheta_s) = \int_0^1 L^{(0)}(iaer,\tau^a,\vartheta_s,\vartheta_v)\,.\,d\mu_v$$

$L^{(0)}{}_{TOA\_aer}[iaer,\tau^a,\theta_s,\theta_v]$

↓

Numerical integration: *Gauss* quadrature for θ_v

↓

$\bar{\rho}_{aR}[iaer,\tau^a,\theta_s]$

Step-4: Apply a 3rd order polynomial fit on the $\bar{\rho}^{aR}(iaer,\tau^a,\vartheta_s)$ as function of the aerosol optical thickness (τ^a) at 550 nm, for retrieving the polynomial coefficients *robar_aR_LUT*[*iaer*,θ, *k*],

$$\begin{aligned}\bar{\rho}_{aR}(iaer,\tau^a,\vartheta_s) = \; & robar\_aR\_LUT[iaer,\theta,0] \\ & + robar\_aR\_LUT[iaer,\theta,1]\,.\,(\tau^a) \\ & + robar\_aR\_LUT[iaer,\theta,2]\,.\,(\tau^a)^2 \\ & + robar\_aR\_LUT[iaer,\theta,3]\,.\,(\tau^a)^3\end{aligned}$$

$\bar{\rho}_{aR}[iaer,\tau^a,\theta_s]$

↓

Polynomial fit of 3rd order on τ^a

↓

robar_aR_LUT[*iaer*,θ,*k*]

Scientific content:

robar_aR_LUT[*iaer*,θ, *k*] defines the polynomial coefficients for the aerosol-molecule coupling bidirectionality term retrieval as function of the aerosol model (*iaer*), and the solar zenith angle θ. The latter which accounts for the coupling between the aerosol and the molecule scatterings, is useful for the atmospheric correction algorithm over land.

Resources:

Estimated CPU time: 54 *sec*
Output disk space: 78 × 12 × 4 × 4 bytes/fl = 14976 bytes

Acceptance:

Comparison with another RTC.

6.14.17.2 (Spare)

Reference:

[AD-8] Section 6.14.17, ADSR field 2

6.14.18 ADS DDV Reflectance Correction Parameters

6.14.18.1 Monthly adjustment for bands at 412.5 nm, 442.5 nm, 490 nm & 665 nm, C*(month, lat, long, band)*

Reference: C, LUT434

[AD-8] Section 6.14.18, ADSR field 1

ACRI provided

Dependencies:

LUT310, LUT311

Tool:

None

Procedure:

Inputs:
month Month [*dl*] (12 values)
lat Latitude [*deg.*] (180 values)
long Longitude [*deg.*] (360 values)
iband DDV band # [*dl*] (among 4 MERIS bands: 412.5, 442.5, 490 & 665 *nm*)

Output: C[*month*, *lat*, *long*, *iband*]
Monthly adjustment as function of geographic location (*lat*, *long*) and for each of the 4 MERIS DDV bands

units: [*dl*]

Step: User specified.

Scientific content:

Monthly adjustement coefficients applied on the DDV reflectances at 412.5, 442.5, 490 and 665 *nm*.

Current baseline: (12 x 180 x 360 x 4) values

Resources:

Estimated CPU time: -
Output disk space: 12 × 180 × 360 × 4 × 4 bytes/fl = 12441600 bytes

Acceptance:

Corresponds to the latest definition.

6.14.18.2 Linear corrections for bands at 412.5 nm, 442.5 nm, 490 nm & 665 nm, LC*(month, lat, long, band)*

Reference: LC, LUT435

[AD-8] Section 6.14.18, ADSR field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs:	*month*	Month [*dl*] (12 values)
	lat	Latitude [*deg.*] (180 values)
	long	Longitude [*deg.*] (360 values)
	iband	DDV band # [*dl*] (among 4 MERIS bands: 412.5, 442.5, 490 & 665 *nm*)
Output:	*LC*[*month*, *lat*, *long*, *iband*]	
		Monthly linear correction as function of geographic location (*lat*, *long*) and for each of the 4 MERIS DDV bands

units: [*dl*]

Step: User specified.

Scientific content:

Monthly linear corrections applied on the DDV reflectances at 412.5, 442.5, 490 and 665 *nm*.

Resources:

Estimated CPU time: -
Output disk space: 12 × 180 × 360 × 4 × 4 bytes/fl = 12441600 bytes

Acceptance:

Corresponds to the latest definition.

6.14.18.3 Minimum and maximum seasonal variation of ARVI, [$\Delta ARVI_{min}$, $\Delta ARVI_{max}$](month, DDV model)

Reference: ΔARVI$_{min}$, ΔARVI$_{max}$, LUT436

[AD-8] Section 6.14.18, ADSR field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs:	*month*	Month [*dl*] (12 values)
	lat	Latitude [*deg.*] (180 values)
	long	Longitude [*deg.*] (360 values)

Outputs: *ΔARVI_min*[*month*, *lat, long*], *ΔARVI_max*[*month*, *lat, long*]
Montly minimum and maximum seasonal variation of the ARVI
units: [*dl*]

Step: User specified.

Scientific content:

Monthly minimum and maximum seasonal variation of ARVI.

Resources:

Estimated CPU time: -
Output disk space: 12 × 180 × 360 × 2 × 4 bytes/fl = 6220800 bytes

Acceptance:

Corresponds to the latest definition.

6.15 OCEAN CASE-I PARAMETERS

6.15.1 C.P.

6.15.1.1 C.P. Extinction coefficient and single scattering albedo for chlorophyll

Reference: Q_{ext} [chl,λ], ω_o[chl,λ] LUT418

Configuration file

PARBLEU provided

Dependencies:

None

Tool:

None

Procedure:

Input: λ MERIS wavelength [nm] (412.5, 442.5, 490, 510, 560, 620, 665, 681.25 and 708.75 nm)

chl Chlorophyll content [$mg.m^{-3}$] (0.03, 0.1, 0.3, 1.0, 3.0 and 10 $mg.m^{-3}$)

Output: $Q_{ext}[chl,\lambda], \omega_o[chl,\lambda]$

Extinction coefficient and single scattering albedo for chlorophyll, for 6 *chl*-contents and 9 wavelengths (6 x 9 x 2 values)

units: [μm^{-1}, dl]

Step: User specified.

Scientific content:

The approach used to compute the inherent optical properties (IOPs) of chlorophyll (*i.e.*, the extinction coefficient $\sigma^p_{e,\lambda}$ and the single scattering albedo $\omega^p_{o,\lambda}$ of phytoplankton) are detailed in [AD-6]. These IOPs are tabulated as function of 9 MERIS wavelengths and 6 chlorophyll contents:

Current baseline: (6 x 9 x 2) values

λ	$\sigma^{p}_{e,\lambda}[chl,\lambda]$	$\omega^{p}_{o,\lambda}[chl,\lambda]$	$\sigma^{p}_{e,\lambda}[chl,\lambda]$	$\omega^{p}_{o,\lambda}[chl,\lambda]$	$\sigma^{p}_{e,\lambda}[chl,\lambda]$	$\omega^{p}_{o,\lambda}[chl,\lambda]$
$[chl]\ mg/m^3$	*0.03*	*0.03*	*0.1*	*0.1*	*0.3*	*0.3*
412.50	0.04697350	0.78449339	0.10981160	0.78280801	0.23639670	0.78764635
442.50	0.04276818	0.80822474	0.10192190	0.80578268	0.22355400	0.80918258
490.00	0.03609181	0.87273818	0.08890710	0.86450017	0.20056330	0.86488408
510.00	0.03307195	0.91832507	0.08366360	0.89510131	0.19162710	0.89043772
560.00	0.02792019	0.99888992	0.07462377	0.94434255	0.17617400	0.93198204
620.00	0.02541830	1.00000000	0.06595910	1.00000000	0.15759933	0.99909687
665.00	0.02384580	1.00000000	0.06302240	1.00000000	0.15298200	1.00000000
681.25	0.02332680	1.00000000	0.06204120	1.00000000	0.15147001	1.00000000
708.75	0.02250040	1.00000000	0.06046560	1.00000000	0.14902399	1.00000000
$[chl]\ mg/m^3$	*1.00*	*1.00*	*3.00*	*3.00*	*10*	*10*
412.50	0.54620302	0.79520619	1.19614506	0.80683446	2.93732905	0.82630515
442.50	0.52726638	0.81513631	1.17101502	0.82414913	2.89315701	0.83892095
490.00	0.48726630	0.86866462	1.10366905	0.87443882	2.74862409	0.88303459
510.00	0.47157121	0.89220464	1.07605398	0.89687973	2.68517804	0.90389913
560.00	0.44491819	0.93247926	1.02966285	0.93728840	2.57210302	0.94363642
620.00	0.42658740	0.95781308	1.01728654	0.94869143	2.55924201	0.94837844
665.00	0.42385781	0.95390248	1.03372216	0.93360770	2.61654711	0.92760801
681.25	0.42002830	0.95912111	1.03110266	0.93597960	2.61319804	0.92879683
708.75	0.40047300	1.00000000	0.96509099	1.00000000	2.42712998	1.00000000

Resources:

Estimated CPU time: -
Output disk space: 6 × 9 × 2 × 4 bytes/fl = 216 bytes

Acceptance:

Corresponds to the latest definition.

6.15.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.15.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.15.4 GADS General

6.15.4.1 Wind-speeds for GADS geometrical factor R_{goth}

Reference: Ws_Rg, LUT171

[AD-8] Section 6.15.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ws_Rg* Wind-speed (w_s) just above sea level for GADS geometrical $\mathcal{R}(w_s)$ factor (4 values)

units: $[m.s^{-1}]$

Step: User specified.

Scientific content:

Set of 4 wind-speeds (w_s) just above sea level used for GADS geometrical $\mathcal{R}(w_s)$ factor

Current baseline: {0, 4, 10, 16} $m.s^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 4 × 1 byte/uc = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.2 Wavelengths for ADS f_1/Q

Reference: Wvl_fQ, LUT172

[AD-8] Section 6.15.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl_fQ* MERIS nominal wavelength for ADS f_1/Q (9 values)
units: [*nm*]

Step: User specified.

Scientific content:

Current baseline: {412.5, 442.5, 490.0, 510.0, 560.0, 620.0, 665.0, 681.25, 708.75} *nm*

Resources:

Estimated CPU time: -
Output disk space: 9 × 4 bytes/fl = 36 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.3 Solar zenith angles for ADS f_1/Q

Reference: SZA_fQ, LUT173

[AD-8] Section 6.15.4, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

79 Veilleux street • St Jean/Richelieu (Qc) – CANADA J3B-3W7 • Phone: (+450) 357-9140 • Fax: (+450) 346-6914

Output: *SZA_fQ* Solar zenith angle for ADS f_l/Q (6 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 6 solar zenith angles (θ_s) regularly spaced

Current baseline: {0, 15, 30, 45, 60, 75} *deg*

Resources:

Estimated CPU time: -
Output disk space: 6 × 4 bytes/ul = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.4 Solar zenith angles for GADS thresholds and ADS glint reflectance

Reference: SZA, LUT174

[AD-8] Section 6.15.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angle for GADS thresholds and ADS glint reflectance (27 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 27 solar zenith angles (θ_s) regularly spaced

Current baseline: 27 angles in [15 ; 80] *deg.* by step of 2.5 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 27 × 4 bytes/ul = 108 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.5 Zenith angles in water for ADS f_1/Q

Reference: theta_fQ, LUT175

[AD-8] Section 6.15.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *theta_fQ* Zenith angle in water for ADS f_1/Q (14 values)
units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Set of 14 zenith angles in water (θ_w)

Current baseline: {1.078, 3.411, 6.289, 9.278, 12.30, 15.33, 18.37, 21.41, 24.45, 27.50, 30.54, 33.59, 36.64, 39.69} *deg.*

Resources:

Estimated CPU time: -
Output disk space: 14 × 4 bytes/ul = 56 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.6 Zenith angles in water for GADS geometrical factor R_{goth}

Reference: theta_Rg, LUT176

[AD-8] Section 6.15.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *theta_Rg* Zenith angle in water for GADS geometrical $\mathcal{R}(w_s)$ factor (19 values)

units: $[10^{-6} deg.]$

Step: User specified.

Scientific content:

Set of 19 zenith angles in water (θ_w) used for GADS geometrical $\mathcal{R}(w_s)$ factor

Current baseline: {0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 60, 60, 60, 60, 60, 60} *deg.*

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.7 View zenith angles for GADS thresholds and ADS glint reflectance

Reference: VZA, LUT177

[AD-8] Section 6.15.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA* View zenith angle for GADS thresholds and ADS glint reflectance (19 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 19 view zenith angles (θ_v) regularly spaced

Current baseline: 19 angles in [0 ; 45] *deg.* by step of 2.5 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.8 Relative azimuth angles for ADS f_1/Q

Reference: RAA_fQ, LUT178

[AD-8] Section 6.15.4, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA_fQ* Relative azimuth angle for ADS f_l/Q (13 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 13 relative azimuth angles ($\Delta\phi$) regularly spaced

Current baseline: 13 values in [0 ; 180] *deg.* by step of 15 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 13 × 4 bytes/ul = 52 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.9 Relative azimuth angles for GADS thresholds and ADS glint reflectance

Reference: RAA, LUT179

[AD-8] Section 6.15.4, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle for GADS thresholds and ADS glint reflectance (25 values)

units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Set of 25 relative azimuth angles ($\Delta\phi$) regularly spaced

Current baseline: 25 values in [0 ; 180] *deg.* by step of 7.5 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 25 × 4 bytes/ul = 100 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.10 Chlorophyll contents for ADS f_1/Q

Reference: Chl1, LUT180

[AD-8] Section 6.15.4, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl1* Chlorophyll content for ADS f_l/Q (5 values)

units: [10^{-3} $mg.m^{-3}$]

Step: User specified.

Scientific content:

Set of 5 chlorophyll contents

Current baseline: {0.03, 0.10, 0.30, 1.0, 3.0} $mg.m^{-3}$.

Resources:

Estimated CPU time: -
Output disk space: 5 × 4 bytes/fl = 20 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.11 Aerosol optical thicknesses for ADS f_1/Q

Reference: tauA, LUT181

[AD-8] Section 6.15.4, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *tauA* Aerosol optical thickness for ADS f_l/Q (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 5 chlorophyll contents

Current baseline: {0.2, 0.6}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.12 Wind-speeds for ADS f_1/Q

Reference: Ws_fQ, LUT182

[AD-8] Section 6.15.4, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ws_fQ* Wind-speed just above sea level for ADS f_1/Q (2 values)
units: $[m.s^{-1}]$

Step: User specified.

Scientific content:

Set of 2 wind-speeds (w_s) just above sea level

Current baseline: {0, 7.2} $m.s^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.13 Initial algal pigment index value for ADS f_1/Q

Reference: Chl1_fQ, LUT183

[AD-8] Section 6.15.4, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl1_fQ* Chlorophyll content for ADS f_l/Q (2 values)
units: $[mg \cdot m^{-3}]$

Step: User specified.

Scientific content:

This initial algal pigment index value is required by the *Chl1_fQ* algorithm. The latter is computed from chlorophyll tabulated values f_l/Q used for correction of viewing angle.

Typical values range between 0.03 < *Chl1_fQ* < $Chl1_fQ_{thres}$rangeout

Current baseline: 0.3 $mg \cdot m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.14 C_i constants for downward atmospheric transmittance

Reference: Ci, LUT184

[AD-8] Section 6.15.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ci* Constants for downward atmospheric transmittance (6 values)

units: [*dl*]

Step: User specified.

Scientific content:

These constants are used for computing the downward atmospheric transmittance.

Current baseline: {0.15; 93.885; 1.253; 1.0035; 0.007; 0.95}

Resources:

Estimated CPU time: -
Output disk space: 6 × 4 bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.15 C_7 constant for scattering detection

Reference: C7, LUT185

[AD-8] Section 6.15.4, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *C7* Constant for scattering detection

units: [*dl*]

Step: User specified.

Scientific content:

This constant is used for scattering detection.

Current baseline: 1.7

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.16 Factor relating b_b/a to reflectance just below water surface for a sun at zenith

Reference: (No variable used), LUT186

[AD-8] Section 6.15.4, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Factor relating b_b/a to reflectance just below water surface for a sun at zenith

units: [*dl*]

Step: User specified.

Scientific content:

$f_0(\lambda, Chl1)$ defines the factor which relates the reflectance just below the surface (R) to the IOP of the water (b_b/a) for a sun at zenith ($\theta_s = 0$) as follows:

$$R(\lambda, Chl1) = f_0(\lambda, Chl1) \,.\, \frac{b_b(\lambda)}{a(\lambda)}$$

with b_b the backscattering coefficient directly related to the selected scattering phase function, and a the absorption coefficient. R is defined as the ratio of the upward ($E_{u,(0-)}$) to downward ($E_{d,(0-)}$) irradiances just beneath the water surface.

Current baseline: 0.33

Resources:

Estimated CPU time: -

Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.17 Wind-speeds for GADS glint reflectance

Reference: Ws_rhoG, LUT187

[AD-8] Section 6.15.4, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ws_Rg* Wind-speed (w_s) just above sea level for GADS glint reflectance (4 values)

units: [$m.s^{-1}$]

Step: User specified.

Scientific content:

Set of 5 wind-speeds (w_s) just above sea level used for GADS glint reflectance

Current baseline: {3.0, 5.0, 7.0, 10., 14.} $m.s^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 5 × 4 bytes/fl = 20 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.18 Wind azimuth orientations for GADS glint reflectance

Reference: Xhi, LUT188

[AD-8] Section 6.15.4, GADS field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Xhi* Wind azimuth orientations for GADS glint reflectance (7 values)

units: [10^{-6}*deg*]

Step: User specified.

Scientific content:

Set of 7 wind azimuth orientations (χ) regularly spaced for GADS glint reflectance

Current baseline: 7 values in [0 ; 180] *deg.* by step of 30 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 7×4 bytes/fl = 28 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.19 (Spare)

Reference:

[AD-8] Section 6.15.4, GADS field 19

6.15.4.20 Value of f/Q factor for a nadir viewing angle at 510nm

Reference: fQ510_nadir, LUT326

[AD-8] Section 6.15.4, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *fQ510_nadir* Value of f_l/Q factor for a nadir viewing angle at 510 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Value of f_l/Q factor for a nadir viewing angle at 510 *nm*

Current baseline: 0.095624961

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.21 Mean value of chlorophyll content

Reference: Chl_mean, LUT327

[AD-8] Section 6.15.4, GADS field 21

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl_mean* Chlorophyll content in mean value

units: [$mg.m^{-3}$]

Step: User specified.

Scientific content:

Chlorophyll content in mean value

Current baseline: 0.1 $mg.m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.22 Water refractive index

Reference: Nw, LUT328

[AD-8] Section 6.15.4, GADS field 22

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Nw* Water refractive index

units: [*dl*]

Step: User specified.

Scientific content:

79 Veilleux street • St Jean/Richelieu (Qc) – CANADA J3B-3W7 • Phone: (+450) 357-9140 • Fax: (+450) 346-6914

Refractive index of sea water (assumed to be constant whatever the temperature and salinity)

Current baseline: 1.34

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.23 Value of $\Delta\rho_{510}$ to set the annotation flag

Reference: DRO510_LIM, LUT329

[AD-8] Section 6.15.4, GADS field 23

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *DRO510_LIM*
Value of $\Delta\rho_{510}$ to set the annotation flag

units: [*dl*]

Step: User specified.

Scientific content:

$\Delta\rho_{510}$ to set the annotation flag

Current baseline: 0.005

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.24 Value of the scattering angle Θ_p for a nadir viewing

Reference: ThetaP_Zenith, LUT330

[AD-8] Section 6.15.4, GADS field 24

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *ThetaP_Zenith*
Value of the scattering angle (Θ_p) for a nadir viewing

units: [10^{-6}*deg*]

Step: User specified.

Scientific content:

Scattering angle (Θ_p) for a nadir viewing

Current baseline: 0 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.25 Scaling factor for decoding mean value of water-leaving reflectance at 510 nm

Reference: rhow510mean_scale, LUT440

[AD-8] Section 6.15.4, GADS field 25

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhow510mean_scale*
Scaling factor for decoding mean value of water-leaving reflectance at 510 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor for decoding mean value of water-leaving reflectance at 510 *nm*

Current baseline: $6.25\ 10^{-5}$

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.26 Offset for decoding mean value of water-leaving reflectance at 510nm

Reference: rhow510mean_offset, LUT441

[AD-8] Section 6.15.4, GADS field 25

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhow510mean_offset*
Offset factor for decoding mean value of water-leaving reflectance at 510 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor for decoding mean value of water-leaving reflectance at 510 *nm*

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.27 Scaling factor for decoding variability value of water-leaving reflectance at 510nm

Reference: rhow510var_scale, LUT442

[AD-8] Section 6.15.4, GADS field 27

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhow510var_scale*
Scaling factor for decoding variability value of water-leaving reflectance at 510 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Scaling factor for decoding variability value of water-leaving reflectance at 510 *nm*

Current baseline: $1.953125\ 10^{-5}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.28 Offset for decoding variability value of water-leaving reflectance at 510nm

Reference: rhow510var_offset, LUT443

[AD-8] Section 6.15.4, GADS field 28

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhow510var_offset*
Offset factor for decoding variability value of water-leaving reflectance at 510 *nm*

units: [*dl*]

Step: User specified.

Scientific content:

Offset factor for decoding variability value of water-leaving reflectance at 510 *nm*

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.29 Latitudes for mean values of water-leaving reflectance at 510nm

Reference: Latitude[lat], LUT444

[AD-8] Section 6.15.4, GADS field 29

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Latitude[lat]*

Latitude for mean values of water-leaving reflectance at 510*nm* (1024 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Latitudes used for geographic map of mean values of water-leaving reflectance at 510*nm*

Current baseline: 1024 latitude values in [89.912109 ; -89.912109] *deg.* by step of -0.175781 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 1024 × 4 bytes/sl = 4096 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.30 Longitudes for water-leaving reflectance mean values at 510nm (tabulated values)

Reference: Longitude[long], LUT445

[AD-8] Section 6.15.4, GADS field 30

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Longitude[long]*

Longitude for mean values of water-leaving reflectance at 510*nm* (2048 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Longitudes used for geographic map of mean values of water-leaving reflectance at 510 *nm*

Current baseline: 2048 longitude values in [-179.912109 ; -179.912109] *deg.* by step of 0.175781 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 2048 × 4 bytes/sl = 8192 bytes

Acceptance:

Corresponds to the latest definition.

6.15.4.31 Chlorophyll contents for ADS f_o factor

Reference: Chl_fo, LUT490

[AD-8] Section 6.15.4, GADS field 31

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl_fo* Chlrophyll contents for ADS f_o factor (6 values)
units: [10^{-3} $mg.m^{-3}$]

Step: User specified.

Scientific content:

Chlrophyll contents for ADS f_o factor

Current baseline: {0.03, 0.1, 0.3, 1, 3, 10} $mg.m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 6 × 4 bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.15.5 GADS Geometrical factor R_{goth}

6.15.5.1 Geometrical factor $R_{goth}(\theta',w_s)$

Reference: R_{ghot}[θ',ws], LUT189

[AD-8] Section 6.15.5, GADS field 1

ACRI provided

Dependencies:

LUT171, LUT176, LUT328

Tool:

None

Procedure:

Input:	θ'	Zenith angle in water (19 values), *see* Section 6.15.4.6 (LUT176)
	w_s	Wind-speed (w_s) just above sea level [$m.s^{-1}$] (4 values), *see* Section 6.15.4.1 (LUT170)
	n_W	Water refractive index [*dl*], *see* Section 6.15.4.22 (LUT328)
Output:	R_{ghot} [θ',w_s]	Geometrical factor $\mathcal{R}(\theta',w_s)$
units:	[*dl*]	
Step:	User specified.	

Scientific content:

R_{ghot} [θ',w_s] defines the geometrical factor, accounting for all refraction and reflection effects at the *air-sea* interface, as function of the solar zenith angle (θ_s) and the wind-speed (w_s) just above sea level. The latter is expressed with the *Morel and Gentili* (1996) [RD-10] formula as follows:

$$R_{ghot}[\theta', w_s] = \frac{(1-\bar{\rho}).(1-\rho_F(\theta'))}{n_w^2.(1-\bar{r}.R)}$$

with n_w : the refractive index of water (n_w=1.34)

$\rho_F(\theta')$: the *Fresnel* reflection coefficient for incident angle θ'

$\bar{\rho}$: the mean reflection coefficient for the downwelling irradiance at the sea surface

$\bar{r}$: the average reflection for upwelling irradiance at the *water-air* interface

R : the irradiance reflectance just below the surface (or the diffuse reflectance at null depth) defined as the ratio of the upward (E_u) to downward (E_d) irradiance.

Note that θ' is expressed as:

$$\theta' = \sin^{-1}\left(\frac{\sin(\theta_v)}{n_w}\right)$$

Current baseline: (19 x 4) values

ϑ' $[w_s]$ $m.s^{-1}$	$\Re[\vartheta', w_s]$ 0	$\Re[\vartheta', w_s]$ 4	$\Re[\vartheta', w_s]$ 10	$\Re[\vartheta', w_s]$ 16
0	0.5287	0.5287	0.5287	0.5287
5	0.5287	0.5287	0.5287	0.5287
10	0.5287	0.5287	0.5287	0.5287
15	0.5287	0.5287	0.5286	0.5286
20	0.5286	0.5286	0.5285	0.5284
25	0.5284	0.5283	0.5283	0.5282
30	0.5280	0.5279	0.5278	0.5276
35	0.5274	0.5272	0.5270	0.5268
40	0.5262	0.5260	0.5257	0.5253
45	0.5242	0.5239	0.5234	0.5229
50	0.5209	0.5204	0.5197	0.5191
55	0.5153	0.5147	0.5138	0.5129
60	0.5061	0.5053	0.5042	0.5034

Resources:

Estimated CPU time: -

Output disk space: 19 × 4 × 4 bytes/fl = 304 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6 GADS Thresholds

6.15.6.1 Threshold on water reflectance at 560nm for input validity

Reference: rhow560_thresh, LUT190

[AD-8] Section 6.15.6, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhow560_thresh* Threshold on water reflectance at 560*nm* ($\rho_{w\_thresh}(560)$)

units: [*dl*]

Step: User specified.

Scientific content:

This reflectance threshold defines the maximum reflectance value at 560*nm* for which the *Chl1* algorithm can be applied.

Current baseline: 0.3

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6.2 Chlorophyll content range (thresholds) for output validity

Reference: Chl1_thresh, LUT191

[AD-8] Section 6.15.6, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: $Chl1_{thresh}$ Range of chlorophyll content (*min*, *max* values)

units: $[10^{-3}\ mg.m^{-3}]$

Step: User specified.

Scientific content:

This range of chlorophyll content defines the validity domain of retrieved chlorophyll content with the *Chl1* algorithm.

Current baseline: $\{0.01, 30\}\ mg.m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6.3 (Spare)

Reference:

[AD-8] Section 6.15.6, GADS field 3

6.15.6.4 (Spare)

Reference:

[AD-8] Section 6.15.6, GADS field 4

6.15.6.5 Low glint threshold

Reference: lowG_thresh, LUT194

[AD-8] Section 6.15.6, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *lowG_thresh* Threshold on the low glint reflectance

units: [*dl*]

Step: User specified.

Scientific content:

Threshold on the low glint reflectance

Current baseline: $5\ 10^{-4}$

Resources:

Estimated CPU time: -

Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6.6 Medium glint threshold

Reference: medG_thresh, LUT195

[AD-8] Section 6.15.6, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *medG_thresh* Threshold on the medium glint reflectance

units: [*dl*]

Step: User specified.

Scientific content:

Threshold on the medium glint reflectance

Current baseline: 0.2

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6.7 Wind-speed threshold for whitecaps flagging

Reference: Ws_thresh, LUT196

[AD-8] Section 6.15.6, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ws_thresh* Threshold on the wind-speed to flag whitecaps

units: $[m.s^{-1}]$

Step: User specified.

Scientific content:

Threshold on the wind-speed to flag whitecaps

Current baseline: 10 $m.s^{-1}$

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6.8 Reflectance thresholds at 708.75nm for turbid water identification

Reference: ROW9_LUT, LUT197

[AD-8] Section 6.15.6, GADS field 8

Dependencies:

LUT174, LUT177, LUT179, LUT328, LUT417

Tools:

OTC/RAYLEIGH (or used LUT417)
RTC/FUB (MOMO)

Note: *'Mom_in/mom_def'* input file have to be correctly set for computing the water-leaving radiance just below the *water-air* interface. The following parameter have to be set into:

' CtrlString (30) - ESA_L_0- ' 1

Procedure:

Inputs:	$n(\lambda)$	MERIS band #9 (λ=708.75 *nm*)
	θ_s	Solar zenith angles [*deg*], *see* Section 6.15.4.4, (LUT174)
	θ_v	View zenith angles [*deg*], *see* Section 6.15.4.7, (LUT177)
	$\Delta\phi$	Relative azimuth angles [*deg*], *see* Section 6.15.4.9, (LUT179)
	n_w	Refractive index of water [*dl*], *see* Section 6.15.4.22 (LUT328)
	ρ_F	*Fresnel* reflectance coefficients as function of wind-speed (w_s) and incident angle (θ), *see* Section 3.2, (LUT417)

Output: $ROW9\_LUT[\theta_s,\theta_v,\Delta\phi]$

radiometric thresholds on atmospherically corrected TOA water reflectance at 708.75 *nm* as a function of the solar zenith angle (θ_s), view zenith angle (θ_v) and relative azimuth angle ($\Delta\phi$) between sun and viewing directions.

units: [*dl*]

Note: The radiometric thresholds on the water reflectance at the 708.75 *nm* (MERIS band #9) will be based on the computation of the water-leaving radiances just below the *water-air* interface $L_{w(0-)\_9}[\theta_s,\theta_v,\Delta\phi]$ rather than the water-leaving radiances just above the *water-air* interface $L_{w(0+)\_9}[\theta_s,\theta_v,\Delta\phi]$. In fact, the reflected atmospheric radiances $L_{w(0+)}$ contain both the sun glint and the reflection of diffuse sky light (sometimes referred as the sky glitter). For the sun glint, only one direction is affected when the sea suface is perfectly flat, while all the directions can be concerned as soon as the sea surface becomes rough. For the sky glitter, all directions are virtually concerned. There exist a simple way to cope with the sun glint (by computing it separately) while the sky glitter cannot be easily removed. Consequently a simple and valid solution will consist in taking the upward radiances just below the sea surface and to apply the *Snellius-Fresnel* law.

Step-1: Generate the water-leaving radiances $L_{w(0-)\_9}[\theta_s,\theta_v,\Delta\phi]$ just below the *water-air* interface from a turbid water (SPM=1 $g.m^{-3}$) at the 708.75 *nm* wavelength (MERIS band #9) and for all geometries ($\theta_s,\theta_v,\Delta\phi$), with the RTC/MOMO. For that, simulations have to be completed over a wind-roughened oceanic surface with purely SPM waters under a maritime atmosphere. The aerosol assemblage #0 with one aerosol optical thickness is selected (*see* table in Section 6.13.5.1).

RTC/MOMO Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./up_out/uprad_out"	
i_branch	2	
$n(\lambda)$	9	708.75 *nm*
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A

Variable	***Value***	***Comments***
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./sca_out/sc_mar99_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a1}(550)$	0.2	
aerosol2	"./sca_out/sc_conti_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a2}(550)$	0	
aerosol3	"./sca_out/sc_H2SO4_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a3}(550)$	0	
cloud1	-	N/A
$\tau^{c1}(550)$	0	
cloud2	-	N/A
$\tau^{c2}(550)$	0	
cloud3	-	N/A
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	0	Chl=0.0$mg.m^{-3}$
$\omega^{p}_{o,\lambda}$	0	Chl=0.0$mg.m^{-3}$
spm	"./sca_out/sc_spm_1_0.s"	SPM=1.0$g.m^{-3}$
$\sigma^{spm}_{e,\lambda}$	0.4810840	SPM=1.0$g.m^{-3}$
$\omega^{spm}_{o,\lambda}$	0.9933980	SPM=1.0$g.m^{-3}$
$\sigma^{ys}_{a,\lambda}$	0	
vertical	"./sca_vert/oce/vtp1_12_ocean"	Vertical profile with 12 atmospheric layers and 2 oceanic layers (levels at -1m and -500m): boundary layer [0;2km]; troposphere [2;12km]; stratosphere [>12km]
I_s	70	
ρ_s	0	
E_o	1	
$\sigma^{w}_{a,\lambda}$	0.79150	Database: *Pope and Fry* (1997) [RD-13]
w_s	3.0	
n_s , n_v , $n_{\Delta\phi}$	27, 19, 25	
θ_s	*Gaussian* angles	*See* Section 6.15.4.4
θ_v	*Gaussian* angles	*See* Section 6.15.4.7
$\Delta\phi$	*see* inputs	*See* Section 6.15.4.9

Step-2: Extract the downwelling spectral irradiance just above the *water-air* interface $E_{d(0+)\_9}[\theta_s]$ from *'FUB/mom_out/flux_0001'* file. The latter is the sum of the *'DOWNWARD DIFFUSE VECTOR IRRAD.'* and the *'DOWNWARD DIRECT VECTOR IRRAD.'* at the height = 0.

Step-3: Determine the water-leaving radiance just above the *water-air* interface $L_{w(0+)\_9}[\theta_s,\theta_v,\Delta\phi]$, by applying the *Snellius-Fresnel* law on the upward radiances just below the sea surface $L_{w(0-)\_9}[\theta_s,\theta_v,\Delta\phi]$ as follows,

$$L_{w(0+)\_9}[\theta_s,\theta_v,\Delta\phi] = L_{w(0-)\_9}[\theta_s,\theta_v,\Delta\phi]\,.\left(\frac{1-\rho_F}{n_w^2}\right)$$

with ρ_F the relevant *Fresnel* reflection coefficient and n_w the water refractive index (n_w=1.34).

Step-4: Compute the radiometric thresholds on the water reflectance just above the *water-air* interface from a wind-roughened turbid water, as follows,

$$ROW9\_LUT[\theta_s,\theta_v,\Delta\phi] = \pi\,.\frac{L_{w(0+)\_9}[\theta_s,\theta_v,\Delta\phi]}{E_{d(0+)\_9}[\theta_s]}$$

Scientific content:

In the turbid water identification algorithm, the single scattering corrected water reflectance at *708.75 nm* is compared to the corresponding radiometric threshold interpolated from the *ROW9_LUT*$[\theta_s,\theta_v,\Delta\phi]$ table. If this corrected water reflectance is greater than the threshold value then the pixel will be considered as a turbid water, otherwise it will not be it.

Resources:

Estimated CPU time: 24 *sec*
Output disk space: 27 × 19 × 25 × 4 bytes/fl = 51300 bytes

Acceptance:

Comparisons with another RTC should have to be done.

6.15.6.9 Water vapour high glint threshold

Reference: (No variable used), LUT205

[AD-8] Section 6.15.6, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Water vapour high glint threshold

units: [*dl*]

Step: User specified.

Scientific content:

Water vapour high glint threshold

Current baseline: 0.6

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.6.10 Shallow water depth threshold

Reference: (No variable used), LUT206

[AD-8] Section 6.15.6, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold on shallow water depth

units: [*m*]

Step: User specified.

Scientific content:

Threshold on shallow water depth

Current baseline: 1000 *m*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.7 GADS Log10 polynomial coefficients

6.15.7.1 Log10 polynomial coefficients for 443, 490 and 510nm

Reference: log10coeff, LUT198

[AD-8] Section 6.15.7, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *log10coeff* Log10 polynomial coefficients (6 values)
units: [*dl*]

Step: User specified.

Scientific content:

Ratios of (b_b/a) at 443, 490 and 510 *nm* upon (b_b/a) at 560 *nm* are computed for several chlorophyll contents (*Chl*) using the models from [RD-11] and from [RD-12]. For each of the 3 wavelengths (λ= 443, 490 and 510 *nm*), the corresponding set of $[b_b(\lambda)/a(\lambda)]/[b_b(560)/a(560)]$ values are then fitted to a 5th order polynomial in $\log_{10}(Chl)$.

This table contains 3 sets of 6 polynomial coefficients (*i.e.*, for each of the 3 wavelengths λ), which allows one to determine the pigment index from the ratio $[b_b(\lambda)/a(\lambda)]$ / $[b_b(560)/a(560)]$ either at λ = 443, 490, or 510 *nm*.

These coefficients are here empirically estimated from *Morel*'s measurements [RD-12], and they are used in the Case 1 waters algorithm for deriving the chlorophyll content.

Current baseline: {0.4389, -3.3626, 3.9348, -3.0787, 0.6298, 0.}

Resources:

Estimated CPU time: -
Output disk space: 6 × 4 bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest computations completed at ACRI.

6.15.7.2 Convergence criterium for iterative chlorophyll retrieval

Reference: (No variable used), LUT199

[AD-8] Section 6.15.7, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Convergence criterium for iterative chlorophyll retrieval

units: [*dl*]

Step: User specified.

Scientific content:

Convergence criterium for iterative *Chl1* retrieval algorithm

Current baseline: 0.01

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.15.7.3 Irradiance reflectance ratio validity range for algal1 computation using log10 polynomials

Reference: (No variable used), LUT491

[AD-8] Section 6.15.7, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Irradiance reflectance ratio validity range for algal1 computation using log10 polynomials (*min*, *max* values)

units: [*dl*]

Step: User specified.

Scientific content:

Validity range of irradiance reflectance ratio for algla1computation with the log10 polynomials

Current baseline: {0.5, 20}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.15.7.4 Highest order of log10 polynomial coefficients used in the Case-1 waters algorithm

Reference: N_{A1}, LUT201

[AD-8] Section 6.15.7, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: N_{A1} Highest order of log10 polynomial coefficients used in the Case-1 waters algorithm

units: [*dl*]

Step: User specified.

Scientific content:

Highest order of log10 polynomials used in the Case-1 waters algorithm

Current baseline: 5

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.15.7.5 Bands selected for computation of chlorophyll content *(Chl1)* (band number starting at 1)

Reference: (No variable used), LUT202

[AD-8] Section 6.15.7, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* MERIS bands selected for *Chl1* computation (3 bands)

units: [*dl*]

Step: User specified.

Scientific content:

Selected bands used for algal pigment index retrieval (*see* Section 6.15.7.1). Note that the $\log_{10}$ coefficients change from band to band, and depend on the chlorophyll content thresholds.

3 MERIS bands are currently selected for *Chl1* computation: band#2 (442.5*nm*), band#3 (490*nm*) and band#4 (510*nm*)

Current baseline: {2, 3, 4}

Resources:

Estimated CPU time: -
Output disk space: 3×1 byte/uc = 3 bytes

Acceptance:

Corresponds to the latest definition.

6.15.8 ADS f/Q Factor

6.15.8.1 f/Q factor

Reference: f_over_Q1_LUT, LUT203

[AD-8] Section 6.15.8, GADS field 1, 2, 3 & 4

Dependencies:

LUT172, LUT173, LUT175, LUT178, LUT180, LUT181, LUT182, LUT418

Tools:

OTC/RAYLEIGH (or used LUT417)
RTC/FUB (MOMO)

Note: *'Mom_in/mom_def'* input file have to be correctly set for computing the water-leaving radiance just below the *water-air* interface. The following parameter have to be set into:

' CtrlString (30) - ESA_L_0- ' 1

Procedure:

Inputs:	λ	MERIS wavelength [*nm*] (9 values), *see* Section 6.15.4.2, (LUT172)
	θ_s	Solar zenith angle [*deg*], *see* Section 6.15.4.3, (LUT173)
	θ'	View zenith angle [*deg*], *see* Section 6.15.4.5, (LUT175)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.15.4.8, (LUT178)
	w_s	Wind-speed [$m.s^{-1}$] (2 values), *see* Section 6.15.4.12, (LUT182)
	τ^a	Aerosol optical thickness at 550*nm* (2 values), *see* Section 6.15.4.11, (LUT181)
	Chl	Chlorophyll content [$mg.m^{-3}$] (5 values), *see* Section 6.15.4.10,(LUT180)
	$\sigma^p_{e,\lambda}, \omega^p_{o,\lambda}$	Extinction coefficient and single scattering albedo for chlorophyll, *see* Section 6.15.1.1,(LUT418)

Output: $f\_over\_Q\_LUT[\lambda,w_s,\tau^a,Chl,\theta_s,\theta',\Delta\phi]$

f/Q factor characterizing the bidirectionality for oceanic diffuse reflectance as a function of the MERIS wavelength (λ), the wind-speed (w_s), the chlorophyll content (*Chl*), the aerosol optical thickness at 550*nm* (τ^a), the solar zenith angle (θ_s), view zenith angle (θ') and relative azimuth angle ($\Delta\phi$) between sun and viewing directions.

units: [*dl*]

Step-1: Extract according to the chlorophyll content (*Chl*) the absorption *a* and backscattering coefficients b_b from a table provided by ACRI (*see* Section 6.15.1.1).

Step-2: Calculate θ_v = asin(n_w.sinθ') with n_w the water refractive index (n_w=1.34). Note that this step is automatically taken care by the RTC/MOMO because there exist two sets of *Gauss-Lobatto* quadrature angles, one in the atmosphere and another in the water.

Step-3: Generate the water-leaving radiances $L_{w(0-)}[\lambda,w_s,\tau^a,Chl,\theta_s,\theta_v,\Delta\phi]$ just below the *water-air* interface from a turbid water (with cholorophyll only) at 9 MERIS wavelengths (λ), for 2 wind-speeds (w_s), 2 aerosol optical thicknesses (τ^a), 5 chlorophyll contents (*Chl*), and for all geometries ($\theta_s,\theta_v,\Delta\phi$), with the RTC/MOMO. For that, simulations have to be completed over purely chlorophyll waters under a maritime atmosphere. The aerosol assemblage #0 is selected (*see* table in Section 6.13.5.1).

RTC/MOMO Inputs (OCEAN)

Variable	***Value***	***Comments***
out_file	"./up_out/uprad_out"	
i_branch	2	
$n(\lambda)$	1, 2, 3, 4, 5, 6, 7, 8 and 9	*See* Section 6.15.4.2
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/Rayleigh
aerosol1	"./sca_out/sc_mar99_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a1}(550)$	0.2 and 0.6	*See* Section 6.15.4.11
aerosol2	"./sca_out/sc_conti_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a2}(550)$	0	
aerosol3	"./sca_out/sc_H2SO4_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a3}(550)$	0	
cloud1	-	N/A
$\tau^{c1}(550)$	0	
cloud2	-	N/A
$\tau^{c2}(550)$	0	
cloud3	-	N/A
$\tau^{c3}(550)$	0	
phyto	"./sca_out/sc_chl_*y_y*.s"	*y_y* depends on the *Chl* concentration. *Chl*=0.03, 0.1, 0.3, 1.0 and 3.0 $mg.m^{-3}$
$\sigma^p_{e,\lambda}$	ChlExt	Values extracted from CP-LUT"Extinction coefficient and single scattering albedo for chlorophyll". *See* Section 6.15.1.1
$\omega^p_{o,\lambda}$	ChlAlb	Values extracted from CP-LUT"Extinction coefficient and single scattering albedo for chlorophyll". *See* Section 6.15.1.1

Variable	***Value***	***Comments***
spm	-	N/A
$\sigma_{e,\lambda}^{spm}$	0	*SPM*=0.0 $g.m^{-3}$
$\omega_{o,\lambda}^{spm}$	0	*SPM*=0.0 $g.m^{-3}$
$\sigma_{a,\lambda}^{ys}$	0	
vertical	"./sca_vert/oce/vtp1_12_ocean"	Vertical profile with 12 atmospheric layers and 2 oceanic layers (levels at -1 m and -500 m): boundary layer [0;2 km]; troposphere [2;12 km]; stratosphere [>12 km]
I_s	70	
ρ_s	0	
E_o	1	
$\sigma_{a,\lambda}^{w}$	Water_Abs	Database: *Pope and Fry* (1997) [RD-13]
w_s	0 and 7.2	*See* Section 6.15.4.12
n_s , n_v , $n_{\Delta\phi}$	6, 14, 13	
θ_s	*see* inputs	*See* Section 6.15.4.3
θ_v	*see* inputs	*See* Section 6.15.4.5
$\Delta\phi$	*see* inputs	*See* Section 6.15.4.8

Step-4: Extract the downwelling spectral irradiance just below the *water-air* interface $E_{d(0-)}[\lambda,w_s,\tau^a,Chl,\theta_s]$ from *'FUB/mom_out/flux_0001'* file. The latter is the sum of the *'DOWNWARD DIFFUSE VECTOR IRRAD.'* and the *'DOWNWARD DIRECT VECTOR IRRAD.'* at the height = 0.01

Step-5: Interpolate $L_{w(0-)}[\lambda,w_s,\tau^a,Chl,\theta_s,\theta_v,\Delta\phi]$ and $E_{d(0-)}[\lambda,w_s,\tau^a,Chl,\theta_s]$ to the desired geometry

Step-6: Determine the $f\_over\_Q\_LUT[\lambda,w_s,\tau^a,Chl,\theta_s,\theta',\Delta\phi]$ ratio as follows,

$$f\_over\_Q\_LUT[\lambda,w_s,\tau^a,Chl,\theta_s,\theta',\Delta\phi] = \frac{L_{w(0-)}[\lambda,w_s,\tau^a,Chl,\theta_s,\theta',\Delta\phi]}{E_{d(0-)}[\lambda,w_s,\tau^a,Chl,\theta_s]} \cdot \frac{a[\lambda,Chl]}{b_b[\lambda,Chl]}$$

Scientific content:

$f\_over\_Q\_LUT[\lambda,w_s,\tau^a,Chl,\theta_s,\theta',\Delta\phi]$ characterizes the bidirectionality for oceanic diffuse reflectance and the sun zenith dependence of the relationship between this reflectance and the inherent optical properties of the Case 1 waters. This LUT, which is function of the MERIS wavelength (λ), the wind-speed (w_s), the chlorophyll content (*Chl*), the aerosol optical thickness at 550 nm (τ^a), the solar zenith angle (θ_s), view zenith angle (θ') and relative azimuth angle ($\Delta\phi$) between sun and viewing directions, is used for the computation of the pigment index and the normalized water-leaving radiances from the water-leaving radiances (which are output of the atmospheric corrections).

The MERIS band #9 (708.75 nm) is not used in the chlorophyll content retrieval algorithm.

Current baseline:

- λ corresponds to the 9 following MERIS wavelengths: 412.5, 442.5, 490, 510, 560, 620, 665, 681.25, and 708.75 nm
- w_s corresponds to the 2 following wind-speeds: 0 and 7.2 $m.s^{-1}$
- τ^a corresponds to the 2 following optical thicknesses: 0.2 and 0.6
- *Chl* corresponds to the 5 following values: 0.03, 0.1, 0.3, 1.0, 3.0 $mg.m^{-3}$
- θ_s corresponds to the 6 following solar zenith angles: from 0º to 75º with a step of 15º
- θ' corresponds to the 14 following view zenith angles from the *Gauss-Lobatto* quadrature (*i.e.*, ranging from 1.078º to 39.69º)
- $\Delta\phi$ corresponds to the 13 following relative azimuth angles: from 0º to 180º with a step of 15º

Resources:

Estimated CPU time: 4356 *sec*
Output disk space: 6 × 2 × 2 × 9 × 14 × 13 × 5 × 4 bytes/fl = 786240 bytes

The storage of this table is achieved by records for different combinations of τ^a and w_s (*see* [AD-8] for exact structure).

Acceptance:

The range checking as well as the examination of trends will be performed (*i.e.*, change as a function of wavelength or of viewing angle).

6.15.9 ADS Glint reflectance

6.15.9.1 Glint reflectance

Reference: rhoG[θ_s,w_s,χ,θ_v,$\Delta\phi$], LUT207

[AD-8] Section 6.15.9, ADS field 1, 2, 3 ,4 ,5

ACRI provided

Dependencies:

LUT174, LUT177, LUT179, LUT187; LUT188

Tool:

None

Procedure:

Input:	θ_s	Solar zenith angle [*deg*] (27 values), *see* Section 6.15.4.4, (LUT174)
	θ_v	View zenith angle [*deg*] (19 values), *see* Section 6.15.4.7, (LUT177)
	$\Delta\phi$	Relative azimuth angle [*deg*] (25 values), *see* Section 6.15.4.9, (LUT179)

w_s	Wind-speed [$m.s^{-1}$] (5 values), *see* Section 6.15.4.17, (LUT187)
χ	Wind azimuth orientations [*deg.*] (7 values), *see* Section 6.15.4.18, (LUT188)

Output: $rhoG[\theta_s,w_s,\chi,\theta_v,\Delta\phi]$
Glint reflectance (27 x 19 x 25 x 5 x 7 values)

units: [*dl*]

Step: User specified.

Scientific content:

This LUT contains specular reflectance as a function of geometry, wind-speed and wind direction.

Current baseline:

w_s	corresponds to 5 values = 3, 5, 7, 10, 14 $m{\cdot}s^{-1}$
χ_w	corresponds to 7 values varying from 0º to 180º with increment 30º
θ_s	corresponds to 27 values varying from 15º to 80º with increment 2.5º
θ_v	corresponds to 19 values varying from 0º to 45º with increment 2.5º
$\Delta\phi$	corresponds to 25 values varying from 0º to 180º with increment 7.5º

Resources:

Estimated CPU time: -
Output disk space: 27 × 5 × 7 × 19 × 25 × 4 bytes/fl = 1795500 bytes

Acceptance:

Corresponds to the latest definition.

6.15.10 ADS Mean water-leaving reflectance at 510nm

6.15.10.1 Mean value of water-leaving reflectance at 510 nm, rhow510_mean(month,lat,long)

Reference: rhow510_mean[month,lat,long], LUT446

[AD-8] Section 6.15.10, GADS field 1

ACRI provided

Tool:

None

Procedure:

Inputs: *month* Month (12 values)

lat	Latitude [*deg*] (1024 values), *see* Section 6.15.4.29, (LUT444)
long	Longitude [*deg*] (2048 values), *see* Section 6.15.4.30, (LUT445)

Output: *rhow510_mean*[*month*, *lat*, *long*]

Mean value of water-leaving reflectance at 510*nm* as a function of the period (*month*) and the geographic location (*lat*, *long*).

units: [*dl*]

Step: User specified.

Scientific content:

This LUT contains the mean value of water-leaving reflectance at 510*nm* as function of the geographic location (*lat*, *long*) and the period (*month*).

Current baseline:

lat corresponds to 1024 values varying from -90º to 90º with increment 0.176º

long corresponds to 2048 values varying from -180º to 180º with increment 0.176º

Resources:

Estimated CPU time: -

Output disk space: 12 × 1024 × 2048 × 1 byte/uc = 25165824 bytes

Acceptance:

Corresponds to the latest definition.

6.15.10.2 Variability of water-leaving reflectance at 510 nm, rhow510_var(month,lat,long)

Reference: rhow510_var[month,lat,long], LUT447

[AD-8] Section 6.15.10, GADS field 2

ACRI provided

Tool:

None

Procedure:

Inputs:		
	month	Month (12 values)
	lat	Latitude [*deg*] (1024 values), *see* Section 6.15.4.29, (LUT444)
	long	Longitude [*deg*] (2048 values), *see* Section 6.15.4.30, (LUT445)

Output: *rhow510_var*[*month*, *lat*, *long*]

Variability of water-leaving reflectance at 510*nm* as a function of the period (*month*) and the geographic location (*lat*, *long*).

units: [*dl*]

Step: User specified.

Scientific content:

This LUT contains the variability of water-leaving reflectance at 510*nm* as function of the geographic location (*lat*, *long*) and the period (*month*).

Current baseline:
lat corresponds to 1024 values varying from -90º to 90º with increment 0.176º
long corresponds to 2048 values varying from -180º to 180º with increment 0.176º

Resources:

Estimated CPU time: -
Output disk space: 12 × 1024 × 2048 × 1 byte/uc = 25165824 bytes

Acceptance:

Corresponds to the latest definition.

6.15.11 GADS f_o factor

6.15.11.1 Factor f_o

Reference: f_o[iband,Chl], LUT492

[AD-8] Section 6.15.11, GADS field 1

ACRI provided

Tool:

None

Procedure:

Inputs: *iband* Index of MERIS band (4 bands) (starting from 0)
Chl Chlorophyll content [$mg.m^{-3}$] (6 values), *see* Section 6.15.4.31, (LUT490)

Output: f_o[*iband*, *Chl*] f_o factor as a function of the MERIS wavelength (*iband*) and the chlorophyll content (*Chl*).

units: [*dl*]

Step: User specified.

Scientific content:

The $f_o[\lambda, Chl]$ factor relates the ratio of 2 water IOPs (b_b/a) to the irradiance reflectance just beneath the surface when the Sun is at the zenith. b_b and a are respectively the backscattering and absorption coefficients of sea water.

This LUT contains $f_o[\lambda, Chl]$ as function of the MERIS wavelength and the chlorophyll content (Chl).

Current baseline:

λ corresponds to the MERIS band#2 (442.5 nm), band#3 (490 nm), band#4 (510 nm) and band#5 (560 nm)

Chl corresponds to 6 values of chlorophyll contents: {0.03, 0.1, 0.3, 1, 3, 10} $mg.m^{-3}$

λ [chl] mg/m^3	$f_o[\lambda,chl]$ 0.03	$f_o[\lambda,chl]$ 0.10	$f_o[\lambda,chl]$ 0.30	$f_o[\lambda,chl]$ 1.0	$f_o[\lambda,chl]$ 3.0	$f_o[\lambda,chl]$ 10
442.50	0.311601	0.328292	0.341049	0.352109	0.360004	0.370684
490.00	0.347460	0.345364	0.350692	0.362050	0.374337	0.389326
510.00	0.360108	0.350301	0.349293	0.359842	0.376623	0.398074
560.00	0.375790	0.358839	0.349959	0.357937	0.383813	0.424393

Resources:

Estimated CPU time: -

Output disk space: 4 × 6 × 4 bytes/fl = 96 bytes

Acceptance:

Corresponds to the latest definition.

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6.16 OCEAN CASE-II PARAMETERS

6.16.1 C.P.

Not covered in this document (*see* [AD-8] for a detailed description)

6.16.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.16.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.16.4 GADS General

6.16.4.1 Wavelengths (tabulated values)

Reference: Wvl, LUT332

[AD-8] Section 6.16.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Wvl* MERIS wavelength (10 values)

units: [*nm*]

Step: User specified.

Scientific content:

Set of 15 nominal wavelenghts (λ) of the 15 MERIS spectral bands

Current baseline: {412.50, 442.50, 490.00, 510.00, 560.00, 620.00, 665.00, 681.25, 708.75, 753.75, 761.875, 778.75, 865.00, 885.00, 900.00} *nm*

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.2 Number of polynomial coefficients in Fp computation

Reference: Ncoef, LUT333

[AD-8] Section 6.16.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ncoef* Number of polynomial coefficients in F_p computation
units: [*dl*]

Step: User specified.

Scientific content:

Number of polynomial coefficients in F_p computation

Current baseline: 8

Resources:

Estimated CPU time: -

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Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.3 Wind-speeds for ADS Fp factor

Reference: Ws, LUT334

[AD-8] Section 6.16.4, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ws* Wind-speed (w_s) just above sea level (4 values) for ADS F_p factor

units: [$m.s^{-1}$]

Step: User specified.

Scientific content:

Set of 4 wind-speeds (w_s)

Current baseline: {0.25, 1.0, 2.75, 5.0} $m.s^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 4 × 4 bytes/fl = 16 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.4 View zenith angles for ADS Fp factor

Reference: VZA, LUT335

[AD-8] Section 6.16.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA* View zenith angle (θ_v) for ADS F_p factor (5 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 5 view zenith angles (θ_v) regularly spaced

Current baseline: 5 values of θ_v within [0;60]*deg.* with a step of 15*deg.*

Resources:

Estimated CPU time: -
Output disk space: 5 × 4 bytes/ul = 20 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.5 Solar zenith angles for ADS Fp factor

Reference: SZA, LUT336

[AD-8] Section 6.16.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angle (θ_s) for ADS F_p factor (5 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 5 solar zenith angles (θ_s) regularly spaced

Current baseline: 5 values of θ_s within [15;75]*deg.* with a step of 15*deg.*

Resources:

Estimated CPU time: -

Output disk space: 5 × 4 bytes/ul = 20 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.6 Relative azimuth angles for ADS Fp factor

Reference: RAA, LUT337

[AD-8] Section 6.16.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle ($\Delta\phi$) for ADS F_p factor (13 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 13 relative azimuth angles ($\Delta\phi$) regularly spaced

Current baseline: 13 values of $\Delta\phi$ within [0;180] *deg.* with a step of 15 *deg.*

Resources:

Estimated CPU time: -

Output disk space: 13 × 4 bytes/ul = 52 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.7 View zenith angles for GADS anomalous scattering detection

Reference: VZA_asd, LUT338

[AD-8] Section 6.16.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *VZA_asd* View zenith angle (θ_v) for GADS anomalous scattering detection (10 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 10 view zenith angles (θ_v) regularly spaced

Current baseline: 10 values of θ_v within [0;45]*deg.* with a step of 5*deg.*

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/ul = 40 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.8 Solar zenith angles for GADS anomalous scattering detection

Reference: SZA_asd, LUT339

[AD-8] Section 6.16.4, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA_asd* Solar zenith angle (θ_v) for GADS anomalous scattering detection (10 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 10 solar zenith angles (θ_v) regularly spaced

Current baseline: {0, 8.33, 16.66, 25.00, 33.33, 41.66, 50.00, 58.33, 66.66, 75} *deg*

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/ul = 40 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.9 Relative azimuth angles for GADS anomalous scattering detection

Reference: RAA_asd, LUT340

[AD-8] Section 6.16.4, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA_asd* Relative azimuth angle ($\Delta\phi$) for GADS anomalous scattering detection (19 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 19 relative azimuth angles ($\Delta\phi$) regularly spaced

Current baseline: 19 values in [0;180]*deg.* with a setp of 10*deg.*

Resources:

Estimated CPU time: -
Output disk space: 19 × 4 bytes/ul = 76 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.10 Conversion factors for Chl2

Reference: (No variable used), LUT431

[AD-8] Section 6.16.4, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Conversion factors for chlorophyll content (*Chl2*) (4 values)
units: [$mg.m^{-3}$, *dl*, *dl*, *dl*]

Step: User specified.

Scientific content:

Set of 4 conversion factors for chlorophyll content in Case-2 waters (*Chl2*)

Current baseline: {21, 0, 0, 1.04} $mg.m^{-3}$, *dl*, *dl*, *dl*

Resources:

Estimated CPU time: -
Output disk space: 4 × 4 bytes/fl = 16 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.11 Conversion factors for SPM

Reference: (No variable used), LUT432

[AD-8] Section 6.16.4, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Conversion factors for SPM content

units: $[g.m^{-3}]$

Step: User specified.

Scientific content:

Conversion factor for SPM content in Case-2 waters (*SPM*)

Current baseline: 1.73 $g.m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.12 Absorption coefficients of pure water

Reference: a_w[iband], LUT448

[AD-8] Section 6.16.4, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *iband* Index of MERIS band (15 bands) (starting from 0)

Output: $a_w[iband]$ Absorption coefficient ($a_w(\lambda)$) of pure water in the 15 MERIS spectral bands (15 values)

units: $[m^{-1}]$

Step: User specified.

Scientific content:

Set of 15 absorption coefficients of pure water ($a_w(\lambda)$) given at the 15 MERIS wavelengths

Current baseline: 15 values

λ [nm]	$a_w(\lambda)$ $[m^{-1}]$
412.500	0.00460
442.500	0.00688
490.000	0.01518
510.000	0.03185
560.000	0.06202
620.000	0.27554
665.000	0.42828
681.250	0.47929
708.750	0.81911
753.750	2.86712
761.875	2.86710
778.750	2.69492
865.000	4.61577
885.000	5.55930
900.000	6.40580

Resources:

Estimated CPU time: -

Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.13 Backscattering coefficients of pure water

Reference: b_w[iband], LUT449

[AD-8] Section 6.16.4, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *iband* Index of MERIS band (15 bands) (starting from 0)

Output: $b_w[iband]$ Backscattering coefficient ($b_w(\lambda)$) of pure water in the 15 MERIS spectral bands (15 values)

units: $[m^{-1}]$

Step: User specified.

Scientific content:

Set of 15 backscattering coefficients of pure water ($b_w(\lambda)$) given at the 15 MERIS wavelengths

Current baseline: 15 values

λ [nm]	$b_w(\lambda)$ $[m^{-1}]$
412.500	0.00330584
442.500	0.00244100
490.000	0.00157132
510.000	0.00132193
560.000	0.00088255
620.000	0.00056857
665.000	0.00042007
681.250	0.00037847
708.750	0.00031899
753.750	0.00024451

λ [nm]	$b_w(\lambda)$ [m^{-1}]
761.875	0.00023510
778.750	0.00021236
865.000	0.00013490
885.000	0.00012221
900.000	0.00011365

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.14 Specific backscattering coefficients of coccoliths

Reference: b_{sc}[iband], LUT450

[AD-8] Section 6.16.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *iband* Index of MERIS band (15 bands) (starting from 0)

Output: b_{sc}*[iband]* Specific backscattering coefficient ($b_{sc}(\lambda)$) of coccoliths in the 15 MERIS spectral bands (15 values)

units: [$m^2.g^{-1}$]

Step: User specified.

Scientific content:

Set of 15 specific backscattering coefficients of coccoliths ($b_{sc}(\lambda)$) given at the 15 MERIS wavelengths

Current baseline: 15 values

λ [nm]	$b_{sc}(\lambda)$ [$m^2.g^{-1}$]
412.500	0.01186331
442.500	0.01153480
490.000	0.01107381
510.000	0.01089801
560.000	0.01049784
620.000	0.01007903
665.000	0.00980046
681.250	0.00970628
708.750	0.00955384
753.750	0.00932147
761.875	0.00928768
778.750	0.00920060
865.000	0.00882204
885.000	0.00874174
900.000	0.00868317

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.15 Specific backscattering coefficients of SPM

Reference: b_{spm}[iband], LUT451

[AD-8] Section 6.16.4, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *iband* Index of MERIS band (15 bands) (starting from 0)

Output: $b_{spm}[iband]$ Specific backscattering coefficient ($b_{spm}(\lambda)$) of SPM in the 15 MERIS spectral bands (15 values)

units: $[m^2.g^{-1}]$

Step: User specified.

Scientific content:

Set of 15 specific backscattering coefficients of SPM ($b_{spm}(\lambda)$) given at the 15 MERIS wavelengths

Current baseline: 15 values

λ [nm]	$b_{spm}(\lambda)$ $[m^2.g^{-1}]$
412.500	0.01186331
442.500	0.01153480
490.000	0.01107381
510.000	0.01089801
560.000	0.01049784
620.000	0.01007903
665.000	0.00980046
681.250	0.00970628
708.750	0.00955384
753.750	0.00932147
761.875	0.00928768
778.750	0.00920060
865.000	0.00882204
885.000	0.00874174
900.000	0.00868317

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.16 Number of iterations in brigth pixel atmospheric correction for band set LOW and band set HIGH

Reference: (No variable used), LUT452

[AD-8] Section 6.16.4, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Number of iterations in brigth pixel atmospheric correction for band set LOW and band set HIGH (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

Number of iterations to be used in BPAC for band set LOW and band set HIGH

Current baseline: {30, 60}

Resources:

Estimated CPU time: -
Output disk space: 2 × 2 bytes/us = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.17 Threshold value on total suspended particulate matters to raise CASE2_S flag

Reference: (No variable used), LUT453

[AD-8] Section 6.16.4, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold on total SPM to raise CASE2_S flag

units: [$g.m^{-3}$]

Step: User specified.

Scientific content:

Threshold on total SPM to raise CASE2_S flag

Current baseline: 0.75 $g.m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.18 Convergence criteria on bbp in the BPAC iterations

Reference: (No variable used), LUT342

[AD-8] Section 6.16.4, GADS field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Convergence criteria on *bbp* in the BPAC iterations

units: [*dl*]

Step: User specified.

Scientific content:

Convergence criteria on *bbp* in the BPAC iterations

Current baseline: 0.001

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.19 Convergence criteria on bb in the rhow_to_bb routine

Reference: (No variable used), LUT343

[AD-8] Section 6.16.4, GADS field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Convergence criteria on *bb* in the *rhow_to_bb* routine
units: [*dl*]

Step: User specified.

Scientific content:

Convergence criteria on *bb* in the *rhow_to_bb* routine

Current baseline: 0.0001

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.20 Number of iterations in the rhow_to_bb routine

Reference: (No variable used), LUT344

[AD-8] Section 6.16.4, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Number of iterations in the *rhow_to_bb* routine
units: [*dl*]

Step: User specified.

Scientific content:

Number of iterations in the *rhow_to_bb* routine

Current baseline: 70

Resources:

Estimated CPU time: -
Output disk space: 1 × 2 bytes/us = 2 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.21 Specific absorption coefficients of coccoliths

Reference: a_c[iband], LUT345

[AD-8] Section 6.16.4, GADS field 21

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *iband* Index of MERIS band (15 bands) (starting from 0)

Output: $a_c[iband]$ Specific absorption coefficient ($a_c(\lambda)$) of coccoliths in the 15 MERIS spectral bands (15 values)

units: $[m^2.g^{-1}]$

Step: User specified.

Scientific content:

Set of 15 specific absorption coefficients of coccoliths ($a_c(\lambda)$) given at the 15 MERIS wavelengths

Current baseline: 15 values

λ [nm]	$a_c(\lambda)$ $[m^2.g^{-1}]$
412.500	0
442.500	0
490.000	0
510.000	0
560.000	0
620.000	0
665.000	0
681.250	0
708.750	0.98298699
753.750	0.88159001
761.875	0
778.750	0.82985902

λ [nm]	$a_c(\lambda)$ [$m^2.g^{-1}$]
865.000	0.67356098
885.000	0.64175397
900.000	0

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.22 Specific absorption coefficients of SPM

Reference: a_{spm}[iband], LUT346

[AD-8] Section 6.16.4, GADS field 22

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: *iband* Index of MERIS band (15 bands) (starting from 0)

Output: $a_{spm}[iband]$ Specific absorption coefficient ($a_c(\lambda)$) of SPM in the 15 MERIS spectral bands (15 values)

units: [$m^2.g^{-1}$]

Step: User specified.

Scientific content:

Set of 15 specific absorption coefficients of SPM ($a_{spm}(\lambda)$) given at the 15 MERIS wavelengths

Current baseline: 15 values

λ [nm]	$a_c(\lambda)$ [$m^2.g^{-1}$]
412.500	0
442.500	0
490.000	0
510.000	0
560.000	0
620.000	0
665.000	0
681.250	0
708.750	0.98298699
753.750	0.88159001
761.875	0
778.750	0.82985902
865.000	0.67356098
885.000	0.64175397
900.000	0

Resources:

Estimated CPU time: -
Output disk space: 15 × 4 bytes/fl = 60 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.23 Initial estimate of backscatters at 778.75 nm for the LOW and HIGH band estimates

Reference: (No variable used), LUT347

[AD-8] Section 6.16.4, GADS field 23

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Initial estimate of backscatters at 778.75 *nm* for the LOW and HIGH band estimates (2 values)

units: [m^{-1}]

Step: User specified.

Scientific content:

Initial estimate of backscatters at 778.75 *nm* for the LOW and HIGH band estimates

Current baseline: {0.001, 0.5} m^{-1}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.24 Initial estimate of the Angstroem exponent

Reference: (No variable used), LUT348

[AD-8] Section 6.16.4, GADS field 24

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Initial estimate of the *Angstroem* exponent

units: [*dl*]

Step: User specified.

Scientific content:

Initial estimate of the *Angstroem* exponent

Current baseline: -0.4

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.25 Threshold on water-leaving reflectance at 778.75 nm to activate the HIGH band set

Reference: (No variable used), LUT349

[AD-8] Section 6.16.4, GADS field 25

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold on water-leaving reflectance at 778.75 nm to activate the HIGH band set

units: [dl]

Step: User specified.

Scientific content:

Threshold on water-leaving reflectance at 778.75 nm to activate the HIGH band set

Current baseline: 0.015

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.26 Threshold on water-leaving reflectance at 778.75 nm to desactivate the LOW band set

Reference: (No variable used), LUT350

[AD-8] Section 6.16.4, GADS field 26

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold on water-leaving reflectance at 778.75 nm to desactivate the LOW band set

units: [dl]

Step: User specified.

Scientific content:

Threshold on water-leaving reflectance at 778.75 nm to desactivate the LOW band set

Current baseline: 0.02

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.27 Minimum TOA normalized radiance measurable at 708.75 nm

Reference: (No variable used), LUT351

[AD-8] Section 6.16.4, GADS field 27

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Minimum TOA normalized radiance measurable at 708.75 nm

units: $[sr^{-1}]$

Step: User specified.

Scientific content:

Minimum TOA normalized radiance measurable at 708.75 nm

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.28 bbp value to initialize the rhow_to_bb routine

Reference: (No variable used), LUT352

[AD-8] Section 6.16.4, GADS field 28

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* *bbp* value to initialize the *rhow_to_bb* routine

units: $[m^{-1}]$

Step: User specified.

Scientific content:

bbp value to initialize the *rhow_to_bb* routine

Current baseline: 10^{-5} m^{-1}

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.29 Threshold for flagging yellow substance dominated waters

Reference: YS_thresh, LUT353

[AD-8] Section 6.16.4, GADS field 29

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *YS_thresh* Threshold for flagging yellow substance dominated waters

units: [*dl*]

Step: User specified.

Scientific content:

Threshold for flagging yellow substance dominated waters

Current baseline: 5

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.30 Chl values for GADS anomalous scattering detection

Reference: Chl_asd, LUT454

[AD-8] Section 6.16.4, GADS field 30

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Chl_asd* Chlorophyll contents for GADS anomalous scattering detection (26 values) units: [$mg.m^{-3}$]

Step: User specified.

Scientific content:

Set of 26 chlorophyll contents (*Chl*) for GADS anomalous scattering detection

Current baseline: {0.03162, 0.03981, 0.05012, 0.063096, 0.07943, 0.10000, 0.12589, 0.15849, 0.19953, 0.25119, 0.31623, 0.39811, 0.50119, 0.63096, 0.79433, 1.00000, 1.25893, 1.58489, 1.99526, 2.51189, 3.16228, 3.98107, 5.01187, 6.30957, 7.94328, 10.00000} $mg.m^{-3}$

Resources:

Estimated CPU time: -
Output disk space: 26 × 4 bytes/fl = 104 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.31 Floor values for NN inputs [reflectance threshold, floor NN input]

Reference: (No variable used), LUT455

[AD-8] Section 6.16.4, GADS field 31

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Floor values for NN inputs [reflectance threshold, floor NN input] (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

Floor values for NN inputs: reflectance threshold, floor NN input

Current baseline: {3 10^{-4}, -9. 6458282}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.16.4.32 Threshold for white scatterers detection

Reference: (No variable used), LUT456

[AD-8] Section 6.16.4, GADS field 32

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Threshold for white scatterers detection

units: [*dl*]

Step: User specified.

Scientific content:

Threshold for white scatterers detection

Current baseline: 4.8

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.16.5 GADS Case II Yelow Substance Detection Coefficients

6.16.5.1 B_i constants

Reference: Bi, LUT354

[AD-8] Section 6.16.5, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: B_i Constant values (2 values)

units: [*dl*]

Step: User specified.

Scientific content:

2 constant values

Current baseline: {2, 2}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definition.

6.16.5.2 A_i constants for H(443 nm, 560 nm) estimation

Reference: A_b2_b5, LUT355

[AD-8] Section 6.16.5, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *A_b2_b5* Constants for *H*(443,560) estimation (3 values)

units: [*dl*]

Step: User specified.

Scientific content:

3 constant values for *H*(443,560) estimation

Current baseline: {20, -20, -1}

Resources:

Estimated CPU time: -

Output disk space: 3 × 4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.16.5.3 A_i constants for H(490 nm, 560 nm) estimation

Reference: A_b3_b5, LUT356

[AD-8] Section 6.16.5, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *A_b3_b5* Constants for *H*(490,560) estimation (3 values)

units: [*dl*]

Step: User specified.

Scientific content:

3 constant values for *H*(490,560) estimation

Current baseline: {20, -20, -1}

Resources:

Estimated CPU time: -
Output disk space: 3 × 4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.16.5.4 A_i constants for H(510 nm, 560 nm) estimation

Reference: A_b4_b5, LUT357

[AD-8] Section 6.16.5, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *A_b4_b5* Constants for $H(510,560)$ estimation (3 values)

units: [*dl*]

Step: User specified.

Scientific content:

3 constant values for $H(510,560)$ estimation

Current baseline: {20, -20, -1}

Resources:

Estimated CPU time: -
Output disk space: 3×4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.16.5.5 Ni exponents

Reference: Ni, LUT358

[AD-8] Section 6.16.5, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: N_1, N_2, N_3 Exponents (3 values)

units: [*dl*]

Step: User specified.

Scientific content:

3 exponent values (N_1, N_2, N_3)

Current baseline: {0, 0, 0}

Resources:

Estimated CPU time: -
Output disk space: 3 × 4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.16.6 GADS Anomalous Scattering Detection

6.16.6.1 Threshold on reflectance at 560nm

Reference: rhow560_thresh[θ_s, θ_v, $\Delta\phi$, *Chl2*] LUT457

[AD-8] Section 6.16.6, GADS field 1

ACRI provided

Dependencies:

LUT338, LUT339, LUT340, LUT454

Tool:

None

Procedure:

Input:	θ_s	Solar zenith angle (10 values) [*dl*], (*see* Section 6.16.4.8), LUT339
	θ_v	View zenith angle (10 values) [*deg.*], (*see* Section 6.16.4.7), LUT338
	$\Delta\phi$	Relative azimuth angle (19 values) [*deg.*], (*see* Section 6.16.4.9), LUT340
	Chl2	Chlorophyll content (26 values) [mg/m^3], (*see* Section 6.16.4.30), LUT454

Output: rhow560_thresh[θ_s, θ_v, $\Delta\phi$, *Chl2*]
Threshold on reflectance at $560nm$ as function of illumination and viewing geometries (θ_s, θ_v, $\Delta\phi$) and chlorophyll content (*Chl2*)

Units: [*dl*]

Step: User Specified

Scientific content:

This LUT contains the thresholds on reflectance at $560nm$ as function of sun/view geometries (θ_s, θ_v, $\Delta\phi$) and several chlorophyll contents (*Chl2*).

Current baseline: (10 × 10 × 19 × 26) values

Resources:

Estimated CPU time: -
Output disk space: 10 × 10 × 19 × 26 × 4 bytes/fl = 197600 bytes

Acceptance:

Corresponds to the latest definition.

6.16.7 GADS Coefficient of F' Factor to IOPs Relation

6.16.7.1 Coefficients of F_p factor to IOPs relation for 4 wind-speeds

Reference: Coef[θ_s, w_s, k, λ, θ_v, $\Delta\phi$], LUT371

[AD-8] Section 6.16.7, GADS field 1

ACRI provided

Dependencies:

LUT332, LUT333, LUT334, LUT335, LUT336,LUT337

Tool:

None

Procedure:

Input:	λ	MERIS wavelength (15 values) [*dl*], (*see* Section 6.16.4.1), LUT332
	θ_s	Solar zenith angle (5 values) [*dl*], (*see* Section 6.16.4.5), LUT336
	θ_v	View zenith angle (5 values) [*deg.*], (*see* Section 6.16.4.4), LUT335
	$\Delta\phi$	Relative azimuth angle (13 values)[*deg.*], (*see* Section 6.16.4.6), LUT337

w_s Wind-speed just above sea level (4 values) [$m.s^{-1}$], (*see* Section 6.16.4.3), LUT334

k Polynomial coefficient order (8 values) [*dl*], (*see* Section 6.16.4.2), LUT333

Output: Coef[θ_s, w_s, k, λ, θ_v, $\Delta\phi$]
Coefficients of *F'* factor to IOPs relation as function of wavelength (λ), illumination and viewing geometries (θ_s, θ_v, $\Delta\phi$), and wind-speed just above sea level (w_s)

Units: [*dl*]

Step: User Specified

Scientific content:

This LUT contains the 7th order polynomial coefficients of *F'* factor to IOPs relation (*Coef*) as function of wavelength (λ), illumination and viewing geometries (θ_s, θ_v, $\Delta\phi$), and wind-speed just above sea level (w_s).

Current baseline: (5 × 4 × 8 × 15 × 5 × 13) values

Resources:

Estimated CPU time: -
Output disk space: 5 × 4 × 8 × 15 × 5 × 13 × 4 bytes/fl = 624000 bytes

Acceptance:

Corresponds to the latest definition.

6.16.8 GADS CASE-II Water Neural Network Parameters

6.16.8.1 Case-2 waters neural network parameters

Reference: (No variable used), LUT372

[AD-8] Section 6.16.10, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Case-2 waters NN Parameters

units: [*dl*]

Step: User specified.

Scientific content:

This LUT contains the case-2 waters NN parameters.

Current baseline: 262144 values

Resources:

Estimated CPU time: -
Output disk space: 262144 × 1 byte/uc = 262144 bytes

Acceptance:

Corresponds to the latest definition.

6.16.8.2 Switch for reflectance log-scaling

Reference: (No variable used), LUT458

[AD-8] Section 6.16.10, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Switch for reflectance log-scaling

units: [*dl*]

Step: User specified.

Scientific content:

Switch for reflectance log-scaling

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1×1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.17 CLOUD PARAMETERS

6.17.1 C.P.

6.17.1.1 C.P. Normalized TOA radiances, $L_{TOA}(\lambda,\theta_s,\theta_v,\Delta\phi)$

Reference: (no variable used) LUT402

Intermediate results stored in LUTs.

LUT dimension: $N_{SZA} \times N_{VZA} \times N_{RAA} = 27 \times 18 \times 25$.

Number of intermediate LUTs:
- with RTC/FUB: 1754 output simulation files

Resources:

Estimated CPU time: -
Output disk space: $1754 \times 27 \times 18 \times 25 \times 4$ bytes/fl = 85244400 bytes

6.17.1.2 C.P. Cloud spherical albedos, $Calb(\theta_s)$

Reference: Calb[θ_s], LUT404

Intermediate results stored in LUTs.

LUT dimension: $N_{SZA} = 27$.

Number of intermediate LUTs:
- with RTC/FUB: 1754 output simulation files

Resources:

Estimated CPU time: -
Output disk space: $1754 \times 27 \times 4$ bytes/fl = 189432 bytes

6.17.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.17.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

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6.17.4 GADS General

6.17.4.1 Latitudes for ADS surface albedo at 761.875 nm

Reference: lat, LUT212

[AD-8] Section 6.17.4, ADSR field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Inputs: none

Outputs: *lat* Latitude (3600 values)
units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 3600 latitudes (*lat*) used as the geographic grid for the surface albedo map at 761.875 *nm*

Current baseline: [89.975;-89.975] *deg.* by step of -0.05 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 3600 × 4 bytes/sl = 14400 bytes

Acceptance:

Corresponds to the latest definition.

6.17.4.2 Longitudes for ADS surface albedo at 761.875 nm

Reference: long, LUT213

[AD-8] Section 6.17.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *long* Longitudes (7200 values)

units: [10^{-6} *deg.*]

Step: User specified.

Scientific content:

Set of 7200 longitudes (*long*) used as the geographic grid for the surface albedo map at 761.875 *nm*

Current baseline: [-179.975;179.975] *deg.* by step of 0.05 *deg.*

Resources:

Estimated CPU time: -
Output disk space: 7200 × 4 bytes/sl = 28800 bytes

Acceptance:

Corresponds to the latest definition.

6.17.4.3 Solar zenith angles for ADS polynomial coefficients for cloud albedo retrieval & for ADS polynomial coefficients for cloud optical thickness retrieval

Reference: SZA, LUTT214

[AD-8] Section 6.17.4, GADS field 3

ACRI provided

Dependencies:

None

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Tool:

None

Procedure:

Input: none

Output: *SZA* Solar zenith angle (θ_s) for ADS polynomial coefficients for CALB & COT retrievals (27 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 27 solar zenith angles (θ_s) regularly spaced

Current baseline: 27 values in [15;80] *deg.* by step of 2.5 *deg*

Resources:

Estimated CPU time: -
Output disk space: 27 × 4 bytes/ul = 108 bytes

Acceptance:

Corresponds to the latest definition.

6.17.4.4 View zenith angles for ADS polynomial coefficients for cloud albedo retrieval & for ADS polynomial coefficients for cloud optical thickness retrieval

Reference: VZA, LUTT215

[AD-8] Section 6.17.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *SZA* View zenith angle (θ_v) for ADS polynomial coefficients for CALB & COT retrievals (18 values)

units: [10^{-6}*deg.*]

Step: User specified.

Scientific content:

Set of 18 view zenith angles (θ_s) regularly spaced

Current baseline: 18 values in [0;42.5]*deg.* by step of 2.5*deg*

Resources:

Estimated CPU time: -
Output disk space: 18 × 4 bytes/ul = 72 bytes

Acceptance:

Corresponds to the latest definition.

6.17.4.5 Relative azimuth angles for ADS polynomial coefficients for cloud albedo retrieval & for ADS polynomial coefficients for cloud optical thickness retrieval

Reference: RAA, LUT216

[AD-8] Section 6.17.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RAA* Relative azimuth angle for ADS polynomial coefficients for CALB & COT retrievals (25 values)

units: [10^{-6} *deg*]

Step: User specified.

Scientific content:

Set of 25 relative azimuth angle ($\Delta\phi$) regularly spaced

Current baseline: 25 values within [180;0] *deg*., with a step of -7.5 *deg*.

Resources:

Estimated CPU time: -
Output disk space: 25 × 4 bytes/ul = 100 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.6 Surface albedos for ADS polynomial coefficients for cloud albedo retrieval & for ADS polynomial coefficients for cloud optical thickness retrieval

Reference: Salb, LUT217

[AD-8] Section 6.17.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Salb* Suface albedo for ADS polynomial coefficients for CALB & COT retrievals (9 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 9 surface albedo (S_{alb})

Current baseline: {0., 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8}.

Resources:

Estimated CPU time: -
Output disk space: 9 × 4 bytes/fl = 36 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.7 Surface albedo scaling factor

Reference: Salb_scale, LUT218

[AD-8] Section 6.17.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Scale_Salb* Scaling factor for suface albedo
units: [*dl*]

Step: User specified.

Scientific content:

Scale factor for surface albedo

Current baseline: 0.0039215686

Resources:

Estimated CPU time: -
Output disk space: 1 × 8 bytes/db = 8 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.8 Cloud top pressure neural network solar flux at 753.75 nm & for the 761.875 nm / 753.75 nm ratio

Reference: Eo_754, Eo_ratio LUT416

[AD-8] Section 6.17.4, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Eo_754, Eo_ratio*
Solar flux at 753.75 *nm* and solar fluxes ratio between 761.875 *nm* and 753.75 *nm* MERIS bands

units: $[W.m^2.\mu m^{-1}, dl]$

Step: User specified.

Scientific content:

Both the solar flux at 753.75 *nm* and the solar fluxes ratio between 761.875 *nm* and 753.75 *nm* are used in the cloud top pressure NN. These fluxes (*i.e.*, extraterrestrial solar irradiances) are not corrected for the *Sun-Earth* distance.

Current baseline: {1261.5169678, 1.0184140205} $W.m^2.\mu m^{-1}$ and *dl*, respectively.

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

Acceptance:

Corresponds to the latest definitions

6.17.4.9 Minimum acceptable radiance value for TOA reflectance at 753.75 nm

Reference: min_TOARb753, LUT373

[AD-8] Section 6.17.4, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *min_TOARb753* Minimum acceptable radiance value for TOA reflectance at 753.75 nm

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

Minimum radiance value which can be accepted for TOA reflectance at 753.75 nm

Current baseline: 0 $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.10 Maximum acceptable radiance value for TOA reflectance at 753.75 nm

Reference: max_TOARb753, LUT374

[AD-8] Section 6.17.4, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *max_TOARb753* Maximum acceptable radiance value for TOA reflectance at 753.75 nm

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

Maximum radiance value which can be accepted for TOA reflectance at 753.75 nm

Current baseline: 700 $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.11 Minimum acceptable radiance value for TOA reflectance at 761.875 nm

Reference: min_TOARb762, LUT375

[AD-8] Section 6.17.4, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *min_TOARb762* Minimum acceptable radiance value for TOA reflectance at 761.875 *nm*

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

Minimum radiance value which can be accepted for TOA reflectance at 761.875 *nm*

Current baseline: 0 $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.12 Maximum acceptable radiance value for TOA reflectance at 761.875 nm

Reference: max_TOARb762, LUT376

[AD-8] Section 6.17.4, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *max_TOARb762*
Maximum acceptable radiance value for TOA reflectance at 761.875 *nm*

units: $[W.m^{-2}.\mu m^{-1}.sr^{-1}]$

Step: User specified.

Scientific content:

Maximum radiance value which can be accepted for TOA reflectance at 761.875 *nm*

Current baseline: 400 $W.m^{-2}.\mu m^{-1}.sr^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.13 Switch to use spectral shift index

Reference: NN_Use_Shift, LUT415

[AD-8] Section 6.17.4, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *NN_Use_shift* Shift used for spectral shift index

units: [*dl*]

Step: User specified.

Scientific content:

Shift used for the spectral shift index

Current baseline: 1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/ul = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.14 FR-band#11 wavelengths for surface pressure neural network

Reference: NN_FR_b11, LUT493

[AD-8] Section 6.17.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *NN_FR_b11* FR-band#11wavelengths for surface pressure NN (3700 values)

units: [*nm*]

Step: User specified.

Scientific content:

Set of 3700 wavelengths for MERIS band#11 to be used in the surface pressure NN in the full resolution mode

Current baseline: 3700 values

Resources:

Estimated CPU time: -
Output disk space: 3700 × 4 bytes/fl = 14800 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.15 RR-band#11 wavelengths for surface pressure neural network

Reference: NN_RR_b11, LUT494

[AD-8] Section 6.17.4, GADS field 15

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *NN_RR_b11* RR- band#11wavelengths for surface pressure NN (925 values)
units: [*nm*]

Step: User specified.

Scientific content:

Set of 925 wavelengths for MERIS band#11 to be used in the surface pressure NN in the reduced resolution mode

Current baseline: 925 values

Resources:

Estimated CPU time: -
Output disk space: 925 × 4 bytes/fl = 3700 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.16 FR residual stray-light correction factor

Reference: FR_SL_corr, LUT495

[AD-8] Section 6.17.4, GADS field 16

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *FR_SL_corr* FR residual stray-light correction factor (3700 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 3700 corrective factors for the residual effect of the stray-light in the full resolution mode

Current baseline: 3700 values

Resources:

Estimated CPU time: -
Output disk space: 3700 × 4 bytes/fl = 14800 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.17 RR residual stray-light correction factor

Reference: RR_SL_corr, LUT496

[AD-8] Section 6.17.4, GADS field 17

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *RR_SL_corr* RR residual stray-light correction factor (925 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 925 corrective factors for the residual effect of the stray-light in the reduced resolution mode

Current baseline: 925 values

Resources:

Estimated CPU time: -
Output disk space: 925 × 4 bytes/fl = 3700 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.18 Minimum acceptable value for surface albedo

Reference: Min_Salb, LUT377

[AD-8] Section 6.17.4, GADS field 18

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *min_Salb* Minimum acceptable value for surface albedo

units: [*dl*]

Step: User specified.

Scientific content:

Minimum value which can be accepted for surface albedo

Current baseline: 0

Resources:

Estimated CPU time: -
Output disk space: 1×4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.19 Maximum acceptable value for surface albedo

Reference: Max_Salb, LUT378

[AD-8] Section 6.17.4, GADS field 19

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *max_Salb* Maximum acceptable value for surface albedo

units: [*dl*]

Step: User specified.

Scientific content:

Minimum value which can be accepted for surface albedo

Current baseline: 1.

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.20 Cloud top pressures (CTP) for ADS cloud type index

Reference: Ctype_P_range, LUT379

[AD-8] Section 6.17.4, GADS field 20

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ctype_P_range* Cloud top pressure for ADS cloud type index (10 values)

units: [*hPa*]

Step: User specified.

Scientific content:

Set of 10 cloud top pressures used for ADS cloud type index

Current baseline: {50., 440., 680., 1000., 1000., 1000., 1000., 1000., 1000., 1000.} *hPa*

Resources:

Estimated CPU time: -
Output disk space: 10×4 bytes/fl = 40 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.21 Cloud optical thicknesses (CTP) for ADS cloud type index

Reference: Ctype_OT_range, LUT380

[AD-8] Section 6.17.4, GADS field 21

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ctype_OT_range*
Cloud optical thickness for ADS cloud type index (10 values)

units: [*dl*]

Step: User specified.

Scientific content:

Set of 10 cloud optical thicknesses used for ADS cloud type index

Current baseline: {0., 3.6, 23., 379., 379., 379., 379., 379., 379., 379.}

Resources:

Estimated CPU time: -
Output disk space: 10 × 4 bytes/fl = 40 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.22 Number of cloud top pressures

Reference: Ctype_n_P, LUT381

[AD-8] Section 6.17.4, GADS field 22

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ctype_n_P* Number of cloud top pressures
units: [*dl*]

Step: User specified.

Scientific content:

Number of cloud top pressures used for ADS cloud type index

Current baseline: 4

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition

6.17.4.23 Number of cloud optical thicknesses

Reference: Ctype_n_OT, LUT382

[AD-8] Section 6.17.4, GADS field 23

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Ctype_n_OT* Number of cloud optical thicknesses

units: [*dl*]

Step: User specified.

Scientific content:

Number of cloud optyical thicknesses for ADS cloud type index

Current baseline: 4

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition

6.17.4.24 Solar flux at 753.75 nm for cloud LUTs

Reference: Eo_754, LUT383

[AD-8] Section 6.17.4, GADS field 24

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Eo_754*
Solar flux at 753.75 *nm*

units: [$W.m^2.\mu m^{-1}$, *dl*]

Step: User specified.

Scientific content:

Solar flux at 753.75 *nm* used for the cloud LUTs. This flux (*i.e.*, extraterrestrial solar irradiances) is not corrected for the *Sun-Earth* distance.

Current baseline: 1261.5169678 $W.m^2.\mu m^{-1}$

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.25 Minimum valid values for surface pressure neural network inputs

Reference: (no variable used), LUT497

[AD-8] Section 6.17.4, GADS field 25

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Minimum valid values for surface pressure NN inputs (7 values)

units: [*dl*]

Step: User specified.

Scientific content:

Minimum valid values for the surface pressure NN input parameters

Current baseline: {0.0129, 0.181, 0.149, 0.342, 0.680, -0.733, 760.00}

Resources:

Estimated CPU time: -
Output disk space: 7 × 4 bytes/fl = 28 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.26 Maximum valid values for surface pressure neural network inputs

Reference: (no variable used), LUT498

[AD-8] Section 6.17.4, GADS field 26

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Maximum valid values for surface pressure NN inputs (7 values)

units: [*dl*]

Step: User specified.

Scientific content:

Maximum valid values for the surface pressure NN input parameters

Current baseline: {0.307, 0.771, 0.151, 0.975, 1.000, 0.733, 763.00}

Resources:

Estimated CPU time: -
Output disk space: 7 × 4 bytes/fl = 28 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.27 Minimum valid value for surface pressure neural network output

Reference: (no variable used), LUT499

[AD-8] Section 6.17.4, GADS field 27
ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Minimum valid value for surface pressure NN output

units: [*hPa*]

Step: User specified.

Scientific content:

Minimum valid values for the surface pressure NN output

Current baseline: 300 *hPa*

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.28 Maximum valid value for surface pressure neural network output

Reference: (no variable used), LUT500

[AD-8] Section 6.17.4, GADS field 28

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Maximum valid value for surface pressure NN output

units: [*hPa*]

Step: User specified.

Scientific content:

Maximum valid values for the surface pressure NN output

Current baseline: 1050 *hPa*

Resources:

Estimated CPU time: -

Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.29 Default AOT value for surface pressure neural network

Reference: (no variable used), LUT501

[AD-8] Section 6.17.4, GADS field 29

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Default AOT value for surface pressure NN

units: [*dl*]

Step: User specified.

Scientific content:

Default AOT value for surface pressure NN

Current baseline: 0.15

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.4.30 Maximum allowed surface pressure difference

Reference: (no variable used), LUT502

[AD-8] Section 6.17.4, GADS field 30

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Maximum allowed surface pressure difference

units: [hPa]

Step: User specified.

Scientific content:

Maximum allowed surface pressure difference

Current baseline: 60

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition

6.17.5 GADS Surface Albedo

6.17.5.1 Surface albedo at 761.875 nm, S_{alb}(month,latitude,longitude)

Reference: Salb, LUT219

[AD-8] Section 6.17.5, GADS field 1

ACRI provided

Dependencies:

LUT212, LUT213

Tool:

None

Procedure:

Inputs:	*month*	Month [*dl*] (12 values)
	lat	Latitude [*deg*] (3600 values), *see* Section 6.17.4.1 (LUT212)
	long	Longitude [*deg*] (7200 values), *see* Section 6.17.4.2 (LUT213)

Outputs: *Salb[month, lat, long]*

Monthly value of surface albedo at 761.875 *nm* as function of geographic location (*lat*, *long*)

units: [*dl*]

Step: User specified.

Scientific content:

Salb[*month*, *lat*, *long*] describes the monthly surface albedo at 761.875 *nm* (band#11), for an angular grid of 0.05 *deg.* in latitude (*lat*) and in longitude (*long*).

Current baseline: Set of 311040000 values given for 12 months and for an accurate angular *lat*-*long* grid (3600 x 7200).

Resources:

Estimated CPU time: -

Output disk space: $12 \times 3600 \times 7200 \times 1$ byte/uc = 311040000 bytes

Acceptance:

Corresponds to the latest definition.

6.17.6 ADS Polynomial Coefficients for Cloud Albedo Retrieval

6.17.6.1 Polynomial coefficients for cloud albedo retrieval

Reference: Calb, LUT220

[AD-8] Section 6.17.6, GADS field 1, 2 & 3

ACRI provided

Dependencies:

LUT214, LUT215, LUT216, LUT217

Tool:

OTC/RAYLEIGH
RTC/FUB (MOMO)
Polynomial fit

Procedure:

Inputs:	θ_s	Solar zenith angle [*deg*], *see* Section 6.17.4.3, (LUT214)
	θ_v	View zenith angle [*deg*], *see* Section 6.17.4.4, (LUT215)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.17.4.5, (LUT216)
	S_{alb}	Surface albedo [*dl*], *see* Section 6.17.4.6, (LUT217) or the input database from the *'FUB/input.cloud'* file (9 values)
	k	Polynomial coefficient orders [*dl*], $k = [0;2]$

Output: $Calb[S_{alb},\theta_s,\theta_v,\Delta\phi, k]$
Polynomial coefficients for cloud albedo retrieval

units: [*dl*]

Step-1: Build input cards for the RTC/MOMO using the input database from the *'FUB/input.cloud'* file. The latter is formatted in 6 columns and comprises,
(*a*) the identification number of the simulation case (*xxxx*)
(*b*) the cloud optical thickness (τ^c) at 550*nm*
(*c*) the cloud top height (z_c) [*m*]
(*d*) the effective radius of cloud droplets (r_e) [μm]
(*e*) the index (*itau*) to select the aerosol type (*i.e.*, for selecting the aerosol layer, #1 or #2)
(*f*) the surface albedo x 100 (S_{alb})

A LUT file with TOA normalized radiances will be generated for each case (*i.e.*, for each input data line from the *'FUB/input.cloud'* file) at 753.75*nm* (MERIS band #10) and for all illumination/viewing geometries ($\theta_s,\theta_v,\Delta\phi$).

Step-2: Generate TOA normalized radiances $L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi]$ for each case (*i.e.*, for each input data line from the *'FUB/input.cloud'* file), for all illumination/viewing geometries ($\theta_s,\theta_v,\Delta\phi$) over a black/reflective surface (S_{alb}), with the RTC/MOMO.

Warning: The process for generating this table is very time-consuming. To avoid loosing data in case of a power failure, temporary binary files are created after few hours of processing: *CLOUD_xxx.LUT404 (xxx stands for the simulation identification)*. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process.

RTC/MOMO Inputs (CLOUD)

Variable	Value	Comments
out_file	"./up_out/uprad_out"	
i_branch	3	
$n(\lambda)$	10	753.75 *nm*
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./sca_out/sc_marcld90_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a1}(550)$	0.15	Only if *aerotype* = 0 otherwise $\tau^{a1}(550) = 0$ Value of aerotype is taken from the *'FUB/input.wv.cloud'* definition table
aerosol2	"./sca_out/sc_conticld_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a2}(550)$	0.3	Only if *aerotype* = 1 otherwise $\tau^{a2}(550) = 0$ Value of aerotype is taken from the *'FUB/input.wv.cloud'* definition table
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	"./sca_out/sc_cld*yy*_b*xx*.s"	*xx* depends on $n(\lambda)$ and *yy* on the effective cloud droplets radius. *yy* is taken from the *'FUB/input.cloud'* definition table.
$\tau^{c1}(550)$	tauC/2 (if *cloudtype*=10) or tauC (otherwise)	Values of *cloudtype* and *tauC* are taken from the *'FUB/input.cloud'* definition table
cloud2	"./sca_out/sc_cld17_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{c2}(550)$	tauC/2 (if cloudtype=10) or 0 (otherwise)	Values of *cloudtype* and *tauC* are taken from the *'FUB/input.cloud'* definition table
cloud3	-	
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A

Variable	Value	Comments
$\omega_{o,\lambda}^{spm}$	-	N/A
$\sigma_{a,\lambda}^{ys}$	-	N/A
vertical	"./sca_vert/cld/vtp1_*zzzz*"	zzzz depends on the cloud top altitude (2500, 5000, 7500 and 10000 m). The latter is taken from the *'FUB/input.cloud'* definition table
I_s	70	
ρ_s	Salb	Surface albedo taken from the *'FUB/input.cloud'* definition table (*see* Section 6.17.4.7)
E_o	1	
$\sigma_{a,\lambda}^{w}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	27, 18, 25	
θ_s	*Gaussian* angles	*See* Section 6.17.4.3
θ_v	*Gaussian* angles	*See* Section 6.17.4.4
$\Delta\phi$	*see* inputs	*See* Section 6.17.4.5

Extract after each simulation the cloud albedo ($S_{cld}[S_{alb},\theta_s,\theta_v,\Delta\phi]$) from the *'FUB/mom_out/flux_0001'* file. The latter is referred as the *'HEMISPHERICAL REFLECTANCE'* label at the TOA and the corresponding value is saved in the MERISAT internal tables: *CLOUD_xxx.LUT404*.

Step-3: Apply a 2nd order polynomial fit on the cloud albedos $S_{cld}[S_{alb},\theta_s,\theta_v,\Delta\phi]$ (extracted from *CLOUD_xxx.LUT404* files) as function of the TOA normalized radiances $L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi]$, for retrieving polynomial coefficients $Calb\_LUT[S_{alb},\theta_s,\theta_v,\Delta\phi, k]$.

$$\begin{aligned} S_{cld}[S_{alb},\theta_s,\theta_v,\Delta\phi] = &\ Calb\_LUT[S_{alb},\theta_s,\theta_v,\Delta\phi,0] \\ &+ Calb\_LUT[S_{alb},\theta_s,\theta_v,\Delta\phi,1]\ .\ L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi] \\ &+ Calb\_LUT[S_{alb},\theta_s,\theta_v,\Delta\phi,2]\ .\ (L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi])^2 \end{aligned}$$

Scientific content:

$Calb\_LUT[S_{alb},\theta_s,\theta_v,\Delta\phi, k]$ describes the coefficients of the polynomial fit applied on the cloud albedos $S_{cld}[S_{alb},\theta_s,\theta_v,\Delta\phi]$, as function of the TOA normalized radiances $L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi]$, computed in the MERIS band #10. These regression coefficients ($k=[0;2]$) depends on the illumination and viewing geometries ($\theta_s,\theta_v,\Delta\phi$) and on the surface albedo (S_{alb}) at 753.75 nm.

Note that the radiance computations with the RTC/MOMO are completed with an angular grid ($\theta_s,\theta_v,\Delta\phi$) which differs from the one defined as input. In fact, the radiance propagation directions (zenith angles) within the RTC/MOMO are determined with the *Gauss-Lobatto* quadrature. Consequently, an interpolation scheme will be applied to superimpose the output radiance matrices derived from the RTC/MOMO computations with the requested angular grid (specified as input).

Current baseline:

θ_s corresponds to 27 solar zenith angles from 15º to 80º with a step of 2.5º
θ_v corresponds to 18 view zenith angles from 0º to 42.5º with a step of 2.5º
$\Delta\phi$ corresponds to 25 relative azimuth angles from 0º to 180º with a step of 7.5º
S_{alb} corresponds to 9 surface albedos from 0 to 0.8 with a step of 0.1

Resources:

Estimated CPU time: 19129 *sec*
Output disk space: 27 × 3 × 18 × 25 × 9 × 4 bytes/fl = 1312200 bytes

The storage of this table is completed with several records for the different indices of polynomial coefficients (*see* [AD-8] for the exact structure).

Acceptance:

The quality check of the polynomial fits can be tested by applying them on the input dataset.

6.17.7 ADS Polynomial Coefficients for Cloud Optical Thickness Retrieval

6.17.7.1 Polynomial coefficients for cloud optical thickness retrieval

Reference: Cthick_LUT, LUT223

[AD-8] Section 6.17.7, GADS field 1, 2, 3 & 4

ACRI provided

Dependencies:

LUT214, LUT215, LUT216, LUT217

Tool:

OTC/RAYLEIGH
RTC/FUB (MOMO)
Polynomial fit

Procedure:

Inputs:	θ_s	Solar zenith angle [*deg*], *see* Section 6.17.4.3, (LUT214)
	θ_v	View zenith angle [*deg*], *see* Section 6.17.4.4, (LUT215)
	$\Delta\phi$	Relative azimuth angle [*deg*], *see* Section 6.17.4.5, (LUT216)
	S_{alb}	Surface albedo [*dl*], *see* Section 6.17.4.6, (LUT217) or the input database from the *'FUB/input.cloud'* file (9 values)
	k	Polynomial coefficient orders [*dl*], k = [0;3]

Output: $COT[S_{alb},\theta_s,\theta_v,\Delta\phi, k]$

Polynomial coefficients for cloud optical thickness retrieval

units: [*dl*]

Step-1: Build input cards for the RTC/MOMO using the input database from the *'FUB/input.cloud'* file. The latter is formatted in 6 columns and comprises,

(*a*) the identification number of the simulation case (*xxxx*)
(*b*) the cloud optical thickness (τ^c) at 550 *nm*
(*c*) the cloud top height (z_c) [*m*]
(*d*) the effective radius of cloud droplets (r_e) [μm]
(*e*) the index (*itau*) to select the aerosol type (*i.e.*, for selecting the aerosol layer, #1 or #2)
(*f*) the surface albedo x 100 (S_{alb})

A LUT file with TOA normalized radiances will be generated for each case (*i.e.*, for each input data line from the *'FUB/input.cloud'* file) at 753.75 *nm* (MERIS band #10) and for all illumination/viewing geometries ($\theta_s,\theta_v,\Delta\phi$).

Step-2: Generate TOA normalized radiances $L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi]$ for each case (*i.e.*, for each input data line from the *'FUB/input.cloud'* file), for all illumination/viewing geometries ($\theta_s,\theta_v,\Delta\phi$) over a black/reflective surface (S_{alb}), with the RTC/MOMO.

Warning: The process for generating this table is very time-consuming. To avoid loosing data in case of a power failure, temporary binary files are created after few hours of processing: *CLOUD_xxx.LUT402(xxx stands for the simulation identification)*. This allows one to resume the processing after a power failure. If we want fully restart the generation procedure, then the temporary binary files should be first deleted before relaunching the process. Note that the output radiances will be the same as those computed for LUT220 (*see* Section 6.17.6.1).

RTC/MOMO Inputs (CLOUD)

Variable	*Value*	*Comments*
out_file	"./up_out/uprad_out"	
i_branch	3	
$n(\lambda)$	10	753.75 *nm*
U_{H2O}	0	
$ESFT_{H2O}$	-	N/A
U_{O2}	0	
$ESFT_{O2}$	-	N/A
U_{O3}	0	
$ESFT_{O3}$	-	N/A
P_s	1013.25	
$\tau^R(\lambda)$	tauR	Computed with OTC/RAYLEIGH
aerosol1	"./sca_out/sc_marcld90_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{a1}(550)$	0.15	Only if *aerotype* = 0 otherwise $\tau^{a1}(550) = 0$ Value of aerotype is taken from the *'FUB/input.wv.cloud'* definition table
aerosol2	"./sca_out/sc_conticld_b*xx*.s"	*xx* depends on $n(\lambda)$

Variable	***Value***	***Comments***
$\tau^{a2}(550)$	0.3	Only if *aerotype* = 1 otherwise $\tau^{a2}(550) = 0$ Value of aerotype is taken from the *'FUB/input.wv.cloud'* definition table
aerosol3	-	
$\tau^{a3}(550)$	0	
cloud1	"./sca_out/sc_cld*yy*_b*xx*.s"	*xx* depends on $n(\lambda)$ and *yy* on the effective cloud droplets radius. *yy* is taken from the *'FUB/input.cloud'* definition table.
$\tau^{c1}(550)$	tauC/2 (if *cloudtype*=10) or tauC (otherwise)	Values of *cloudtype* and *tauC* are taken from the *'FUB/input.cloud'* definition table
cloud2	"./sca_out/sc_cld17_b*xx*.s"	*xx* depends on $n(\lambda)$
$\tau^{c2}(550)$	tauC/2 (if cloudtype=10) or 0 (otherwise)	Values of *cloudtype* and *tauC* are taken from the *'FUB/input.cloud'* definition table
cloud3	-	
$\tau^{c3}(550)$	0	
phyto	-	N/A
$\sigma^{p}_{e,\lambda}$	-	N/A
$\omega^{p}_{o,\lambda}$	-	N/A
spm	-	N/A
$\sigma^{spm}_{e,\lambda}$	-	N/A
$\omega^{spm}_{o,\lambda}$	-	N/A
$\sigma^{ys}_{a,\lambda}$	-	N/A
vertical	"./sca_vert/cld/vtp1_*zzzz*"	zzzz depends on the cloud top altitude (2500, 5000, 7500 and 10000 m). The latter is taken from the *'FUB/input.cloud'* definition table
I_s	70	
ρ_s	Salb	Surface albedo taken from the *'FUB/input.cloud'* definition table (*see* Section 6.17.4.7)
E_o	1	
$\sigma^{w}_{a,\lambda}$	-	N/A
w_s	0	
n_s , n_v , $n_{\Delta\phi}$	27, 18, 25	
θ_s	*Gaussian* angles	*See* Section 6.17.4.3
θ_v	*Gaussian* angles	*See* Section 6.17.4.4
$\Delta\phi$	*see* inputs	*See* Section 6.17.4.5

Step-2: Extract the cloud optical thicknesses (τ^c) for all the simulation cases from the input database *'FUB/input.cloud'.'*

Step-3: Apply a 3rd order polynomial fit on the cloud optical thicknesses (τ^c) as function of the TOA normalized radiances $L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi]$, for retrieving the polynomial coefficients $COT[S_{alb},\theta_s,\theta_v,\Delta\phi, k]$.

$$\begin{aligned}\tau^c = \quad \text{Exp}\ \{\ & COT[S_{alb},\theta_s,\theta_v,\Delta\phi,0] \\ & + COT[S_{alb},\theta_s,\theta_v,\Delta\phi,1]\ .\ L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi] \\ & + COT[S_{alb},\theta_s,\theta_v,\Delta\phi,2]\ .\ (L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi])^2\ \} \\ & + COT[S_{alb},\theta_s,\theta_v,\Delta\phi,3]\ .\ (L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi])^3\ \}\end{aligned}$$

Scientific content:

$Cthick\_LUT[S_{alb},\theta_s,\theta_v,\Delta\phi, k]$ describes the coefficients of the polynomial fit applied on the cloud optical thicknesses τ^c, as function of the TOA radiances $L_{TOA\_10}[S_{alb},\theta_s,\theta_v,\Delta\phi]$, computed in the MERIS band #10. These regression coefficients ($k=[0;3]$) depends on the illumination and viewing geometries ($\theta_s,\theta_v,\Delta\phi$) and on the surface albedo (S_{alb}) at 753.75 nm.

Note that the radiance computations with the RTC/MOMO are completed with an angular grid ($\theta_s,\theta_v,\Delta\phi$) which differs from the one defined as input. In fact, the radiance propagation directions (zenith angles) within the RTC/MOMO are determined with the *Gauss-Lobatto* quadrature. Consequently, an interpolation scheme will be applied to superimpose the output radiance matrices derived from the RTC/MOMO computations with the requested angular grid (specified as input).

Current baseline:

- θ_s corresponds to the 27 following solar zenith angles: from 15º to 80º with a step of 2.5º
- θ_v corresponds to the 18 following view zenith angles: from 0º to 42.5º with a step of 2.5º
- $\Delta\phi$ corresponds to the 25 following relative azimuth angles: from 0º to 180º with a step of 7.5º
- S_{alb} corresponds to the 9 following surface albedos: from 0 to 0.8 with a step of 0.1

Resources:

Estimated CPU time: 19016 *sec*
Output disk space: 27 × 4 × 18 × 25 × 9 × 4 bytes/fl = 1749600 bytes

Acceptance:

The quality check of the polynomial fits can be tested by applying them on the input dataset.

6.17.8 GADS Cloud Top Pressure Neural Network for not null Surface Albedo

6.17.8.1 Cloud top pressure neural network for not null surface albedo

Reference: (No variable used), LUT384

[AD-8] Section 6.17.8, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Cloud top pressure NN parameters for not null surface albedo

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

Cloud top pressure NN parameters for not null surface albedo

Current baseline: 262144 values

Resources:

Estimated CPU time: -
Output disk space: 262144 × 1 byte/uc = 262144 bytes

Acceptance:

Corresponds to the latest definition

6.17.9 GADS Cloud Top Pressure Neural Network for null Surface Albedo

6.17.9.1 Cloud top pressure neural network for null surface albedo

Reference: (No variable used), LUT385

[AD-8] Section 6.17.9, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *(no variable)* Cloud top pressure NN parameters for null surface albedo

units: [*dl*]

Step: User specified.

LUT processed at the FUB institute with a NN tool and delivered to ACRI.

Scientific content:

Cloud top pressure NN parameters for null surface albedo

Current baseline: 262144 values

Resources:

Estimated CPU time: -
Output disk space: 262144 × 1 byte/uc = 262144 bytes

Acceptance:

Corresponds to the latest definition

6.17.10 GADS Cloud type index

6.17.10.1 Cloud type index

Reference: Ctype[ctp,cot], LUT386

[AD-8] Section 6.17.10, GADS field 1

ACRI provided

Dependencies:

LUT379, LUT380

Tool:

None

Procedure:

Input: *ctp* Cloud top pressure [*hPa*] (10 values), *see* Section 6.17.4.20, LUT379
cot Cloud top pressure [*dl*] (10 values), *see* Section 6.17.4.21, LUT380

Output: *Ctype[ctp,cot]* Cloud type index as function of the cloud top pressure (*ctp*) and of the cloud optical thickness (*cot*).

units: [*dl*]

Step: User specified.

Scientific content:

Cloud type index (*Ctype*[*ctp,cot*]) depending on the cloud top pressure (*ctp*) and the cloud optical thickness (*cot*)

Current baseline: (10 ×10) values

Resources:

Estimated CPU time: -
Output disk space: 10 ×10 × 1 byte/uc = 100 bytes

	Cloud Top Pressure [hPa]									
COT	*50*	*440*	*680*	*1000*	*1000*	*1000*	*1000*	*1000*	*1000*	*1000*
0.0	135	136	137	128	128	128	128	128	128	128
3.6	132	133	134	128	128	128	128	128	128	128
23.0	129	130	131	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128
379.0	128	128	128	128	128	128	128	128	128	128

Acceptance:

Corresponds to the latest definition

6.17.11 GADS Surface Pressure Neural Network Parameters

6.17.11.1 Surface pressure neural network

Reference: (No variable used), LUT503

[AD-8] Section 6.17.10, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: None

Output: *(No variable)* Surface pressure NN parameters.

units: [*dl*]

Step: User specified.

Scientific content:

Surface pressure NN parameters

Current baseline: 262144 values

Resources:

Estimated CPU time: -

Output disk space: 262144 × 1 byte/uc = 262144 bytes

Acceptance:

Corresponds to the latest definition

6.18 LAND VEGETATION INDEX PARAMETERS

6.18.1 C.P.

None

6.18.2 MPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.18.3 SPH

Not covered in this document (*see* [AD-8] for a detailed description)

6.18.4 GADS General

6.18.4.1 Blue wavelength band number for TOA-VI computation

Reference: Blue_band_N, LUT387

[AD-8] Section 6.18.4, GADS field 1

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Blue_band_N* Blue band # for TOA-vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band in the blue region used for computation of TOA vegetation index

Current baseline: 2

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.18.4.2 Red wavelength band number for TOA-VI computation

Reference: Red_band_N, LUT388

[AD-8] Section 6.18.4, GADS field 2

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Red_band_N* Red band # for TOA-vegetation index computation
units: [*dl*]

Step: User specified.

Scientific content:

MERIS band in the red region used for computation of TOA vegetation index

Current baseline: 8

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.18.4.3 Near-infrared wavelength band number for TOA-VI computation

Reference: NIR_band_N, LUT389

[AD-8] Section 6.18.4, GADS field 3

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *NIR_band_N* NIR band # for TOA-vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band in the NIR region used for computation of TOA vegetation index

Current baseline: 13

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.18.4.4 K_i normalization parameters for blue, red & NIR bands and for vegetated & bright soils

Reference: K_i, LUT390

[AD-8] Section 6.18.4, GADS field 4

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *K_i* k_i normalization parameters for blue, red & NIR bands and for vegetated & bright soils (2 x 3 values)

units: [*dl*]

Step: User specified.

Scientific content:

K_i normalization parameters in blue, red and NIR MERIS bands for vegetated and bright soils

Current baseline: 2 sets of 3 coefficients $k(\lambda)$ in 3 spectral bands (blue, red, NIR) for vegetated and bright soils

	k(*blue*)	*k*(*red*)	*k*(*NIR*)
Vegetated	0.56192	0.70879	0.86523
Bright soil	0.68545	0.87412	0.89788

Resources:

Estimated CPU time: -
Output disk space: 2 × 3 ×4 bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.18.4.5 Theta_i normalization parameters for blue, red & NIR bands and for vegetated & bright soils

Reference: Theta_i, LUT391

[AD-8] Section 6.18.4, GADS field 5

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Theta_i* θ_i normalization parameters for blue, red & NIR bands and for vegetated & bright soils (2 x 3 values)

units: [*dl*]

Step: User specified.

Scientific content:

Theta_i normalization parameters in blue, red and NIR MERIS bands for vegetated area and bright soils

Current baseline: 2 sets of 3 coefficients $\theta(\lambda)$ in 3 spectral bands (blue, red, NIR) for vegetated and bright soils

	θ (*blue*)	θ (*red*)	θ (*NIR*)
Vegetated	-0.04203	0.03700	-0.00123
Bright soil	-0.02263	-0.00357	-0.01377

Resources:

Estimated CPU time: -
Output disk space: 2 × 3 ×4 bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.18.4.6 Rho_i normalization parameters for blue, red & NIR bands and for vegetated & bright soils

Reference: Rho_i, LUT392

[AD-8] Section 6.18.4, GADS field 6

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Rho_i* ρ_i normalization parameters for blue, red & NIR bands and for vegetated & bright soils (2 x 3 values)

units: [*dl*]

Step: User specified.

Scientific content:

Rho_i normalization parameters in blue, red and NIR MERIS bands for vegetated area and bright soils

Current baseline: 2 sets of 3 coefficients $\rho(\lambda)$ in 3 spectral bands (blue, red, NIR) for vegetated and bright soils

	ρ (*blue*)	ρ (*red*)	ρ (*NIR*)
Vegetated	0.24012	-0.46273	0.63841
Bright soil	0.42640	0.55649	0.65740

Resources:

Estimated CPU time: -
Output disk space: $2 \times 3 \times 4$ bytes/fl = 24 bytes

Acceptance:

Corresponds to the latest definition.

6.18.4.7 Maximum reflectances for blue, red and NIR bands used in TOA-VI computation

Reference: Rho_max, LUT393

[AD-8] Section 6.18.4, GADS field 7

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *Rho_max* Maximum reflectances for blue, red and NIR bands used in TOA vegetation index computation (3 values)

units: [*dl*]

Step: User specified.

Scientific content:

Maximum reflectances for blue, red and NIR bands used in TOA-VI computation

Current baseline: {0.3, 0.5, 0.7}

Resources:

Estimated CPU time: -
Output disk space: 3 × 4 bytes/fl = 12 bytes

Acceptance:

Corresponds to the latest definition.

6.18.4.8 Polynomial coefficients for blue, red and NIR bands for TOA-VI computation

Reference: L, LUT394

[AD-8] Section 6.18.4, GADS field 8

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *L* Polynomial coefficients for blue, red and 3 NIR bands used in TOA vegetation index computation (12 x 5 values)

units: [*dl*]

Step: User specified.

Scientific content:

Polynomial coefficients for blue, red and NIR bands used in TOA-VI computation

Current baseline: Set of 12 coefficients $L(\lambda)$ for 5 spectral bands (blue, red, NIR#1, NIR#2, NIR#3)

Coefficient	L_l	*2*	*3*	*4*	*5*	*6*
Blue band	0.00000	0.00000	0.00000	-0.30600	0.25500	0.00450
Red band	-9.26150	3.25450	9.82680	0.53737	0.36349	0.00235
NIR band #1	-0.47131	-0.04516	-0.80707	0.19812	-0.00691	-0.02108
NIR band #2	0.79999	-0.24396	-1.73300	0.40182	-0.30209	-0.04305
NIR band #3	-0.10065	0.12671	-0.39783	0.08429	-0.07737	-0.00584

Coefficient	*7*	*8*	*9*	*10*	*11*	*12*
Blue band	1.00000	1.00000	0.00000	0.64000	-0.64000	0.19980
Red band	0.00000	0.00000	0.00000	0.00000	0.00000	1.00000
NIR band#1	-0.04836	-0.54507	-1.10270	0.12063	0.51893	-0.19873
NIR band #2	6.30930	-0.10645	-9.12470	2.03210	0.60438	-0.69423
NIR band #3	0.56605	-0.11131	-0.87161	0.05628	0.23144	-0.11890

Resources:

Estimated CPU time: -
Output disk space: $5 \times 12 \times 4$ bytes/fl = 240 bytes

Acceptance:

Corresponds to the latest definition.

6.18.4.9 Infrared to NIR reflectance ratio threshold for TOA-VI computation

Reference: IR-NIR_rho_ratio_thresh, LUT395

[AD-8] Section 6.18.4, GADS field 9

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *IR-NIR_rho_ratio_thresh*
Threshold on reflectance ratio between infrered and NIR for TOA vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

Threshold on infrared to NIR reflectance ratio for TOA-VI computation

Current baseline: 1.3

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

Acceptance:

Corresponds to the latest definition.

6.18.4.10 Red wavelength band number for BOA-VI computation

Reference: BOAVI_Red_band_N, LUT396

[AD-8] Section 6.18.4, GADS field 10

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_Red_band_N*
Red band # used in BOA vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band in the red region used for computation of BOA vegetation index

Current baseline: 8

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

Acceptance:

Corresponds to the latest definition.

6.18.4.11 Near-infrared wavelength band #1 for BOA-VI computation

Reference: BOAVI_NIR_band1_N, LUT397

[AD-8] Section 6.18.4, GADS field 11

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_NIR_band1_N*
NIR band #1 used in BOA vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band#1 in the NIR region used for computation of BOA vegetation index

Current baseline: 9

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

6.18.4.12 Near-infrared wavelength band #2 for BOA-VI computation

Reference: BOAVI_NIR_band2_N, LUT459

[AD-8] Section 6.18.4, GADS field 12

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_NIR_band2_N*
NIR band #2 used in BOA vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band#2 in the NIR region used for computation of BOA vegetation index

Current baseline: 10

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

6.18.4.13 Near-infrared wavelength band #3 for BOA-VI computation

Reference: BOAVI_NIR_band3_N, LUT460

[AD-8] Section 6.18.4, GADS field 13

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_NIR_band3_N*
NIR band #3 used in BOA vegetation index computation

units: [*dl*]

Step: User specified.

Scientific content:

MERIS band#3 in the NIR region used for computation of BOA vegetation index

Current baseline: 13

Resources:

Estimated CPU time: -
Output disk space: 1 × 1 byte/uc = 1 byte

6.18.4.14 BOA-VI acceptable range

Reference: BOAVI_min, BOAVI_max, LUT398

[AD-8] Section 6.18.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *BOAVI_min, BOAVI_max*
Acceptable range for BOA vegetation index (*min* & *max* values)

units: [*dl*]

Step: User specified.

Scientific content:

Acceptable range for BOA vegetation index

Current baseline: {0., 5.5}

Resources:

Estimated CPU time: -
Output disk space: 2 × 4 bytes/fl = 8 bytes

6.18.4.15 Maximum value of top of aerosol reflectance in red band to allow the MTCI computation

Reference: rhoaer_red_max, LUT461

[AD-8] Section 6.18.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhoaer_red_max*
Maximum top of aerosol reflectance in red band

units: [*dl*]

Step: User specified.

Scientific content:

Maximum value of top of aerosol reflectance in the red band to allow the computation of the MERIS terrestrial chlorophyll index

Current baseline: 0.3

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

6.18.4.16 Minimum value of top of aerosol reflextance in NIR band#2 for MTCI

Reference: rhoaer_NIR_b2_min, LUT462

[AD-8] Section 6.18.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhoaer_NIR_b2_min*
Minimum top of aerosol reflectance in NIR band#2

units: [*dl*]

Step: User specified.

Scientific content:

Minimum value of top of aerosol reflectance in the red band to allow the computation of the MERIS terrestrial chlorophyll index

Current baseline: 0.1

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

6.18.4.17 Minimum value of top of aerosol reflectance difference between NIR#1 and red bands to allow the MTCI computation

Reference: rhoaer_NIR1_red_min, LUT463

[AD-8] Section 6.18.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhoaer_NIR1_red_min*
Minimum of top of aerosol reflectance difference between NIR#1 and red bands

units: [*dl*]

Step: User specified.

Scientific content:

Minimum value of top of aerosol reflectance difference between NIR #1 and red bands to allow the computation of the MERIS terrestrial chlorophyll index

Current baseline: 10^{-6}

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

6.18.4.18 Minimum value of top of aerosol reflectance difference between NIR#3 and red bands to allow the MTCI computation

Reference: rhoaer_NIR3_red_min, LUT464

[AD-8] Section 6.18.4, GADS field 14

ACRI provided

Dependencies:

None

Tool:

None

Procedure:

Input: none

Output: *rhoaer_NIR3_red_min*
Minimum of top of aerosol reflectance difference between NIR#3 and red bands

units: [*dl*]

Step: User specified.

Scientific content:

Minimum value of top of aerosol reflectance difference between NIR #3 and red bands to allow the computation of the MERIS terrestrial chlorophyll index

Current baseline: 0.05

Resources:

Estimated CPU time: -
Output disk space: 1 × 4 bytes/fl = 4 bytes

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