GOMOS ALGOM2s v1.0 Ozone Profiles using Two-step approach

Input Output Data Definition

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CONTENTS

1   Introduction

1.1   Scope of the document

This document is the Input Output Data Definition (IODD) for the GOMOS ALGOM2s v.1.0 ozone profile processor developed in the framework of the ESA ALGOM project (GOMOS Level 2 evolution studies). It relies on the two-step retrieval approach and has improved data quality in the UTLS region.

IODD provides a complete description of the input/output data format of the files read and written by the ALGOM2s v 1.0 breadboard processor.

The details of the algorithm, data processing, validation and assessment can be found in the dedicated technical note [RD1].

1.2   Structure of the document

This document is split into several chapters:

❖   This chapter introduces the document;

❖   Section 2 describes the inputs of the ALGOM2s processor

❖   Section 3 describes the outputs of the ALGOM2s processor

1.3   Applicable and Reference Documents

1.3.1   Applicable document

[AD-1]	ALGOM: GOMOS algorithm improvements in the UTLS using two-step approach – Contract	Contract № 0166L68540

1.3.2   Reference documents

[RD-1]	ALGOM: Aerosol-insensitive ozone retrievals in the UTLS – Technical Note	FMI-ALGOM-TN-TWOSTEP-201, March 2016
[RD-2]	GOMOS: Global Ozone Monitoring by Occultation of Stars ENVISAT-1 Ground Segment Input / Output Data Definition	PO-RS-ACR-GS-0003 Version 7.0
[RD-3]	Product Quality Readme File for GOMOS ALGOM2s v1.0 Ozone Profiles using Two-step approach	FMI-ALGOM-README-TWOSTEP-202, June 2016

1.3.3   Acronyms

GOMOS   Global Ozone Monitoring by Occultation of Stars

IODD   Input Output Data Definition

UTLS   Upper troposphere and lower stratosphere

2 Input

2.1 Input files

The GOMOS input files required by the ALGOM2s processor are GOM_TRA and GOM_NL products of the processed occultation. The GOM_TRA product is the output of the GOMOS Level-1b processor (IPF or GOPR). The GOM_NL products are the outputs of the GOMOS Level-2 processor (IPF or GOPR).

The format of these products is an ESA binary format dedicated to the ENVISAT products. GOM_ products from IPF v5 or v6 or GOPR v6 or v7 are compatible with the ALGOM2s scientific processor.

The full description of the ESA GOMOS products is provided in [RD2].

2.2 Input parameters

The following parameters from GOM_TRA and GOM_NL files are used in ALGOM2s v 1.0 processor.

General parameters

- Date and time
- Star id, its visual magnitude and effective temperature
- Obliquity of occultation
- Location of the occultation: latitude, longitude
- Solar zenith angle
- Illumination condition flag

Transmittance spectra

- Tangent altitude
- wavelengths
- Level 1 b transmittances
- Uncertainty of transmittances
- Quality flag for transmittances

Level 2 profiles

- Ozone line(horizontal column) density profile
- Uncertainty of ozone line density profiles
- Profiles of χ^2
- ECMWF/MSIS90 profiles of air density, temperature and pressure

Other input information

The ALGOM2s processor uses ozone cross-sections from the GOMOS database.

3 Output

The ALGOM2s processor is written in MATLAB. The occultations are processed one by one on the tangent altitude grid. For convenience of users, the processed dataset of ozone profiles is screened for outliers and invalid values as described in [RD-1] and [RD-3] and interpolated to a fixed altitude grid with 1 km spacing.

3.1 Output files

The ozone data on 1 km grid from 10 km to 105 km are stored in netcdf-4 format, in monthly data files. For example, the file "ESA_ALGOM-L2-GOMOS-FMI_twostep_O3-200208-fv001.nc" contains the altitude-gridded data for August 2002.

3.2 Output parameters

Table 1 presents all parameters in ESA ALGOM2s v1.0 files. The SI units are used. The conversion factors to other widely used units are written as attributes of the ozone-related parameters. The ALGOM2s v1.0 files include also information about the tropopause height, which can be useful for data analyses in the UTLS.

Table 1: Parameters in the GOMOS ESA ALGOM2s v1.0 files.

Parameter and unit	Dimensions	Description
time (days since 1900-01-01 00:00:00)	$N_{prof} \times 1$	The parameter to index the profiles
altitude (km)	$N_{alt} \times 1$	The geometric altitude above the mean sea-level
pressure (hPa)	$N_{alt} \times N_{prof}$	Air pressure profiles
latitude (degree_north)	$N_{prof} \times 1$	Latitude of each profile
longitude (degree_east)	$N_{prof} \times 1$	Longitude of each profile
ozone_concentration (mol/m^3)	$N_{alt} \times N_{prof}$	Mole concentration or number of moles per unit volume (molarity) of ozone. Multiplication factor to convert to molecules/cm^3 is 6.022140857E+17
ozone_concentration_standard_error (mol/m^3)	$N_{alt} \times N_{prof}$	Uncertainty (random error) associated with the ozone profiles. Multiplication factor to convert to molecules/cm^3 is 6.022140857E+17.
vertical_resolution (km)	$N_{alt} \times 1$	FWHM of the averaging kernel
temperature (K)	$N_{alt} \times N_{prof}$	Air temperature profiles at the locations of measurements, for conversion from concentration to mixing ratio
tropopause_altitude (km)	$N_{prof} \times 2$	Single or double tropopause height based on the WMO lapse-rate tropopause definition. If tropopause is single, the second field is set to NaN
orbit_number	$N_{prof} \times 1$	Envisat orbit number
star_number	$N_{prof} \times 1$	Star number in GOMOS catalogue
star_magnitude	$N_{prof} \times 1$	Star visual magnitude
star_temperature (K)	$N_{prof} \times 1$	Star effective temperature
obliquity (deg)	$N_{prof} \times 1$	Obliquity of occultation: the angle between the orbital plane and the line of sight
sza (deg)	$N_{prof} \times 1$	solar zenith angle at tangent point

chi2	$N_{alt} \times N_{prof}$	Profiles of normalized χ^2- statistics. Usually close to 1. Large values indicate problems with retrievals
illumination_condition _flag	$N_{prof} \times 1$	0-full dark, 3-straylight, 2- twilight, 4- straylight&twilight.
SAA_flag	$N_{prof} \times 1$	The indicator showing that the data might be affected by the Southern Atlantic Anomaly (cosmic rays); 0- no, 1- yes