ARC_L2P Product Guide

(Issue 1.3   01/09/2013)

Change Record

Issue	Date	Change
1.0	20/07/2012	Initial Release
1.1	17/08/2012	Minor corrections
1.2	10/01/2013	Updated for v1.1 of processor
1.3	01/09/2013	Add product guide section

Table of Contents

1 Introduction

This document describes the use and content of "ARC_L2P" Sea Surface Temperature (SST) data produced during the third reprocessing of the (A)ATSR multi-mission archive. Available files include both L2P and L3U data in netCDF format following GHRSST Data Specification (GDS) 2.0 [1]. The dataset was produced using the ARC_L2P processor which is based upon the processor used to produce the ARC SST dataset [2] and includes:

- Bayesian cloud detection
- ARC SST retrieval algorithm
- ARC SST uncertainty model

The L2P products provide the retrieved SSTs on the satellite projection: the 512 km wide swath that the ATSR instruments observe during their orbit. While the L3U products remap the SSTs onto a global 0.1° grid.

2 Basic Usage

All ARC_L2P data files are stored in netCDF4-classic format which is supported by data visualisation packages such as: BEAM, Panopoly, Matlab, and IDL. Alternatively the files can be manually read in any language supported by the netCDF libraries.

sea_surface_temperature

> The primary measurement of SST, in kelvin, corresponds to the radiometric temperature of the ocean surface at time of observation. The SST may be measured using a dual-view two-channel algorithm or a dual-view three-channel algorithm. The three-channel variant is more accurate but does not work during the day. In order to check which algorithm is in use for a particular pixel the l2p_flags variable should be checked.

sst_dtime

> Gives the number of seconds between the reference time of the file and when the satellite measured the SST for a given pixel. Hence the observation time for a pixel is given by: `time + sst_dtime`

probability_clear

> This is the probability that a given pixel is clear as calculated by the Bayesian cloud detection.

sses_standard_deviation

> This is the estimated uncertainty in the SST retrieval which comprises both correlated and uncorrelated components. The uncorrelated component is due to radiometric noise in the sensor and can be considered random error – it will reduce when multiple pixels are averaged together. It is stored in the variable: `radiometric_uncertainty`. The correlated component is due to systematic uncertainties in the SST retrieval and will not be reduced by averaging multiple pixels together, it is stored in the variable: `synoptically_correlated_uncertainty`

3 Filename convention

ARC_L2P products follow the GDS 2.0 filename convention which is:

```
{datetime}-{RDAC}-{level}_GHRSST-{SST type}-{product}-{extra info}-
v{GDS version}-fv{file version}.nc
```

Where the variable components denoted with braces, {...}, are summarised in the Table below. For ARC_L2P products several of these fields are fixed and the filenaming convention can be simplified to:

```
{datetime}-UPA-{level}_GHRSST-SSTskin-ARC-{extra info}-v02.0-fv01.0.nc
```

Element	Content	Description
{datetime}	*yyyymmddHHMMSS*	Identifying date and time for the file in UTC. The time corresponds to the first data in the file
{RDAC}	**UPA**	The RDAC where the file was created (United Kingdom Multi-Mission Processing and Archiving Facility)
{level}	**L2P** **L3U**	Processing level code for file
{SST type}	**SSTskin**	Type of SST data included in file
{product}	**ARC**	GHRSST product identifier
{extra info}	**ATSR1** **ATSR2** **AATSR**	Used to indicate the source instrument for the data
{GDS version}	**02.0**	GDS version number used to generate file
{file version}	**01.0**	File version number

4 File contents

ARC_L2P products use the netCDF-4 classic format with data compression to reduce filesize without the need for external compression. The files comply with both Climate and Forecast (CF) conventions v1.4 and GDS 2.0 for metadata allowing them to be interpreted with standard tools. Files include both global and variable metadata. Global metadata describes the whole file with information such as title, creation date, and the source instrument for the data. Variable metadata contain information on how a particular variable in the file should be interpreted. This includes both scale and offset values used by data reading software, and titles and comments for human interpretation of the data.

4.1 Global Metadata

Attribute	Content	Description
Conventions	CF-1.4	A text string identifying the netCDF conventions used for the file.
title	Sea Surface Temperature from {atsr}	The title of the dataset. {atsr} is one of ATSR1, ATSR2, or AATSR
summary	This netCDF file	A brief summary of the

	contains...	dataset.
references	Embury, O., Merchant...	Published references for the dataset.
institution	UPA	The GHRSST RDAC where the dataset was produced
history	Created using GBCS library $Rev: 1735 $	Information on the ARC_L2P software version used for processing
comment	These data were produced...	Miscellaneous information about the dataset
license	GHRSST protocol describes data use as free and open	Information on data use
id	ARC-UPA-L2P-AATSR-v2.1	
naming_authority	org.ghrsst	"org.ghrsst"
product_version	"2.1"	
uuid	91402d16-803b-11e2-adff-4f08fa4039dc	A Universally Unique IDentifier (UUID) for this file
gds_version_id	"2.0"	GDS version used to create this file
netcdf_version_id	"4.1.3"	Version of netCDF library used to generate this file
date_created	2013-02-26 17:40:10Z	Date and time this file was created
file_quality_level	0 1 2 3	unknown bad suspect good
spatial_resolution	1 km	Approximate resolution of product
start_time	2003-10-18 01:15:07Z	Time of the first data in the file
time_coverage_start	As start_time	As start_time
stop_time	2003-10-18 02:58:47Z	Time of the last data in the file
time_coverage_end	As stop_time	As stop_time
northernmost_latitude	90.0	Valid range of file
southernmost_latitude	-90.0	Valid range of file
easternmost_longitude	180.0	Valid range of file
westernmost_longitude	-180.0	Valid range of file
source	ATSR1-ESA-L1-v2.1 ATSR2-ESA-L1-v2.1 AATSR-ESA-L1-v2.1	Source data used to generate this product
platform	ERS-1 ERS-2 Envisat	Satellite used to generate this product
sensor	ATSR AATSR	Sensor used to generate this product. NB GHRSST does not distinguish ATSR1 and

		ATSR2 as different sensor types
Metadata_Conventions	Unidata Dataset Discovery v1.0	Metadata conventions used for product
metadata_link		Link to collection metadata record at archive
keywords	Oceans > Ocean Temperature > Sea Surface Temperature	GCMD Science Keyword categorising product
keywords_vocabulary	NASA Global change Master Directory (GCMD) Science Keywords	Vocabulary used for keywords attribute
standard_name_vocabulary	NetCDF Climate and Forecast (CF) Metadata Convention	Vocabulary used for standard_name attributes
geospatial_lat_units	degrees_north	Units of latitudinal resolution
geospatial_lat_resolution	0.01	Latitudinal resolution
geospatial_lon_units	degrees_east	Units of longitudinal resolution
geospatial_lon_resolution	0.01	Longitudinal resolution
acknowledgment	The ATSR sea surface temperature data in this project were developed by The University of Edinburgh within the ATSR Reprocessing for Climate, were processed at the UK Processing and Archive Facility and downloaded from the NERC Earth Observation Data Centre.	Information about funding source and citation of data.
creator_name		Contact information at the RDAC which produced the dataset
creator_email		
creator_url		
project	Group for High Resolution Sea Surface Temperature	
publisher_name	The GHRSST Project Office	
publisher_url	http://www.ghrsst.org	
publisher_email	ghrsst-po@nceo.ac.uk	
processing_level	L2P L3U	GHRSST processing level of file
cdm_data_type	swath grid	Grid type used for file

time_coverage_duration	PT1H43M40S	Period covered by this product

4.2 Variable Metadata

Attribute	Description
long_name	A free-text descriptive name for the variable
standard_name	The standard name for the variable as defined by CF conventions
references	Published or web-based reference describing the methods used to generate the variable
comment	Other information about the variable or methods used to generate it
units	Text description of the units the data is stored in.
_FillValue	A value used to indicate array elements which contain invalid or missing data
scale_factor add_offset	Used to pack data into a smaller datatype. The original data can be recovered using: `value = scale_factor * packed_data + add_offset`
valid_min	The minimum valid value for the variable
valid_max	The maximum valid value for the variable

4.3 L2P File Contents

L2P files contain SSTs on the 512 km wide swath used by the ATSR instruments. Each SST in the L2P files corresponds to a pixel in the source L1b file and is supplied with a probability of being clear as determined by the Bayesian cloud detection algorithm. The variables in a L2P file are:

time

Reference time of the file.

Gives the reference time of the file in seconds since 1981-01-01 00:00:00

sst_dtime

Time difference from reference time.

Observation time is calculated as `time+sst_dtime`.

lat

Latitude coordinates

lon

Longitude coordinates

sea_surface_temperature

Sea surface skin temperature

solar_zenith_angle

Solar zenith angle at SST observation

sses_bias

Unused

sses_standard_deviation

Estimated retrieval uncertainty

synoptically_correlated_uncertainty

Component of uncertainty that is correlated over synoptic scales.

radiometric_uncertainty

Component of uncertainty that is due to radiometric noise.

l2p_flags

GHRSST l2P flag variable.

Used to flag land pixels and use of D2/D3 retrieval

quality_level

GHRSST quality level indicator.

aerosol_dynamic_indicator

ATSR Saharan Dust Index

probability_clear

Probability of pixel being clear as estimated by Bayesian cloud detection

dt_analysis

Unused

wind_speed

ECMWF-interim wind speed at time of observation

sea_ice_fraction

ECMWF-interim sea-ice fraction at time of observation

4.4 L3U File Contents

L3U files contain SSTs on a global 0.1° grid: 3600x1800 cells. Each SST in the L3U file corresponds to average of several pixels in the source L1b file. The variables in a L3U file are:

time

Reference time of the file.

Gives the reference time of the file in seconds since 1981-01-01 00:00:00

sst_dtime

Time difference from reference time.

Observation time is calculated as `time+sst_dtime`.

lat

Latitude coordinates

lon

Longitude coordinates

sea_surface_temperature

Sea surface skin temperature

solar_zenith_angle

Solar zenith angle at SST observation

sses_bias

Unused

sses_standard_deviation

Estimated retrieval uncertainty

synoptically_correlated_uncertainty

Component of uncertainty that is correlated over synoptic scales.

radiometric_uncertainty

Component of uncertainty that is due to radiometric noise.

sampling_uncertainty

Component of uncertainty related to incomplete sampling of the grid cell.

l2p_flags

GHRSST l2P flag variable.

Used to flag land pixels and use of D2/D3 retrieval

quality_level

GHRSST quality level indicator. Only quality_level 5 pixels are included in L3U files.

aerosol_dynamic_indicator

ATSR Saharan Dust Index

probability_clear

Probability of pixel being clear as estimated by Bayesian cloud detection

dt_analysis

Unused

wind_speed

ECMWF-interim wind speed at time of observation

sea_ice_fraction

ECMWF-interim sea-ice fraction at time of observation

or_number_of_pixels

Original number of pixels from the L2P contributing to the SST value

5 References

[1] GHRSST Science Team (2012), The Recommended GHRSST Data Specification (GDS) 2.0 r5, GHRSST International Project Office, pp 123, https://www.ghrsst.org/documents/q/category/gds-documents/operational/

[2] Merchant, C. J., et al. (2012), A 20 year independent record of sea surface temperature for climate from Along-Track Scanning Radiometers, J. Geophys. Res., 117, C12013. http://dx.doi.org/10.1029/2012JC008400