(A)ATSR Expert Support Laboratory FAST Level 1b Product Definition

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Change Record

Issue	Date	Description
0.1	12-06-2015	First draft
0.2	23-09-2015	Added time dataset, updated introductory text, added blanking pulse flag to global flags confidence word.
0.3	25-09-2015	Moved all datasets to image grid and updated dataset list to suit.
1.0	25-01-2016	Updated acronym table, Applicable and Reference Documents tables, rewrote file naming section (Section 4.2) to bring it into line with [RD 10], revised Table 4-1 and Table 4-2, added manifest description (Section 5.4.1), added snow_albedo_tx variable description to meteorological parameters auxiliary dataset (), changed errant instances of “error” to “uncertainty”.
1.1	18-04-2016	Updated quality dataset variable names and orphan pixel indices. Added unfilled pixel flag to confidence word. Added missing variable descriptions. Deleted Section 5.6 (product size).
1.2	22-04-2016	Corrected text for TIR quality ADS.
1.3 draft	23-08-2016	Extended Section 5.5.1.2.6 (manifest measurement quality information), added Bayesian cloud probabilities to global flags ADS (Table 5-6). Added ATSR additional information ADS (Section 5.5.2.6). Increased number of levels in TOC.
1.3 draft 2	18-12-2017	Minor bug fixes. Reduced scope of orbitalReference content in manifest. Changed MDS “…_err_…” variable names to “…_uncert_…”
1.3	30-01-2018	Minor bug fixes. Changed met soil wetness details, added flag for missing Bayesian data, plus orphan probability fields.
1.4	19-03-2018	More minor bug fixes.

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1 Scope of document

This document describes the format of an (A)ATSR level 1 product following the design of the Sentinel-3 Core PDGS Instrument Processing Facility (IPF) implementation of the SLSTR Level 1 product [AD 2].

2 Terms, definitions and abbreviations

2.1 Acronyms

(A)ATSR	The (Advanced) Along Track Scanning Radiometer series (ATSR-1, ATSR-2 and AATSR)
AATSR	Advanced Along Track Scanning Radiometer
ATSR	Along Track Scanning Radiometer
DMD	Descriptive MetaData
ECMWF	European Centre for Medium range Weather Forecasting
ESL	Expert Support Laboratory
GML	Geographic Markup Language
IPF	Instrument Processing Facility
IR	Infrared
MERIS	MEdium Resolution Imaging Spectrometer
NIR	Near Infra-Red
OLCI	Ocean and Land Colour Instrument
PDGS	Product Data Format Specification
RAL	Rutherford Appleton Laboratory
SADIST	Synthesis of ATSR Data Into Sea surface Temperatures
SAFE	Standard Archive Format for Europe
SLSTR	Sea Land Surface Temperature Radiometer
SWIR	Short Wave Infra-Red
TBC	To Be Confirmed
TIR	Thermal IR
TOA	Top Of Atmosphere
VIS	Visible
VISCAL	Visible Calibration
XFDU	XML Formatted Data Unit
XML	eXtensible Markup Language

2.2 Terminology

In this document, ATSR (the Along Track Scanning Radiometer) refers to the first two ATSR instruments, ATSR-1 and ATSR-2. Together with the third instrument, AATSR (the Advanced Along track Scanning Radiometer), these are known as (A)ATSR. SLSTR (the Sea and Land Surface

Temperature Radiometer) refers to the entire series of SLSTR instruments, currently SLSTR-3A and SLSTR-3B.

Accuracy is defined as the difference between a result obtained and the 'true' value.

Channel – Spectral channel (S1 – S3, S5, S7 – S9). SLSTR terminology is maintained for the (A)ATSR spectral channel identifiers, but some channels are omitted (S4, S6, F1, F2) as there are no equivalents in the (A)ATSR instruments.

Chain – Analogue channel of the signal processing chain

Detector – Pixel array in a given spectral channel. The (A)ATSR instruments have one pixel only and the word "detector" can be used interchangeably with "pixel".

Calibration is the process of quantitatively defining the system response to known, controlled system inputs.

Field of view is the angular extent of a given scene that is viewed by the instrument.

Infrared (IR) radiation is electromagnetic radiation of wavelengths between about 750nm and 1mm. This is broken down into 4 wavelength regions

Near-IR – 0.75 µm – 1.4 µm

Short-Wave IR - 1.4 µm – 3 µm

Medium-Wave IR - 3 µm – 8 µm

Long-Wave IR – 8 µm – 15 µm

Image swath – Maximum distance on ground between the positions of two spatial samples belonging to the same row.

Image sample – image element containing radiance measurements of co-registered pixels for all bands

Pixel – Detector single element

Precision is defined as the difference between one result and the mean of several results obtained by the same method, i.e. reproducibility (includes random uncertainties only).

Traceability is the property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties.

Uncertainty parameter associated with the result of a measurement, that characterises the dispersion of the value that could reasonably be attributed to the measurand.

Type A evaluation (of uncertainty)
method of evaluation of uncertainty by the statistical analysis of series of observations. This is usually given by the standard deviation of a number of measurements of a random variable.

Type B evaluation (of uncertainty)
method of evaluation of uncertainty by means other than the statistical analysis of series of observations. This is usually based on existing knowledge, for example data provided in calibration and other certificates or an estimation of the uncertainty based on previous experience.

Visible light is electromagnetic radiation detectable by the human eye with a wavelength between approximately 400nm and 700nm.

Validation is the process of assessing by independent means the quality of the data products derived from the system outputs.

We define the following terminology to describe the instrument measurement and sampling cycle:

- A **scan** is defined as a complete rotation of the scan mirrors.
- A **scan cycle** This terminology is maintained for compatibility with the SLSTR instruments, which make two complete scans in one calibration cycle. The (A)ATSR completes a calibration cycle in a single scan, so an (A)ATSR scan cycle is identical to a scan.
- A **target** is either the Earth view or one of the internal calibration targets (the VISCAL and the two black bodies); in the context of the telemetry data it refers to a section of the scan during which valid data is obtained, when the detectors are viewing the earth view or one of the calibration targets.
- A **pixel** is the FOV of a single detector element; the projection of that detector element onto the ground at a given instant.
- A **scan trace**, or **scan locus** is the trace of a single detector element on the ground.

An (A)ATSR data packet is generated every scan. To uniquely identify a pixel in a given channel we may need the following indices:

S Scan number; a continuous count of scans, with an origin close to the start of the product.

p Pixel index; the pixel index relative to the scan sync pulse. The scan sync pulse is a hardware timing signal which defines the start of acquisition for pixel zero. As the scan mirror position is not perfectly controlled, there may be small variations in the corresponding angular position of this pixel from scan to scan.

k Detector index. This index is maintained for compatibility with the SLSTR instruments, which have multiple detectors in each spectral channel. (A)ATSR has one detector only and the value of k is always zero.

s Scan trace; This index is maintained for compatibility with the SLSTR instruments, which have multiple detectors, and therefore multiple traces per scan. As (A)ATSR has one detector only, the scan trace is identical to the scan number.

3 Documents

3.1 Applicable documents

Ref	Title	Document code	Version	Date
AD 1	Product Data Format Specification - Product Structures	S3IPF.PDS.002	i1r6	10/02/2015
AD 2	Product Data Format Specification - SLSTR Level 1 & Level 2 Instrument Products	S3IPF.PDS.005	i1r11	28/05/2015
AD 3	Metadata Specification	S3IPF.PDS.008	i3r6	
AD 4	(A)ATSR Expert Support Laboratory – FAST Processor (A)ATSR UBT Orbit Product Specification	AATSRESL.SPE.001		
AD 5	(A)ATSR Expert Support Laboratory – FAST Processor Input/Output Data Definition Document	AATSRESL.SPE.002		
AD 6	(A)ATSR Expert Support Laboratory – FAST Level 1b ATBD	PO-TN-RAL-AT-0567	1.0	11/12/2015

3.2 Reference documents

Ref	Title	Document code	Version	Date
RD 1	SADIST-2 Products	ER-TN-RAL-AT-2164	100	06/09/1995
RD 2	AATSR Product Handbook		2.2	27/02/2007
RD 3	AATSR Products Specifications	IDEAS-SER-IPF-SPE-0288	4/C	05/09/2013
RD 4	Standard Archive Format for Europe			
RD 5	Sentinel 3 Level 0, Level 1a/b/c Products Definition Part 2: Optical Products Volume 3: SLSTR products	S3-RS-RAL-SY-003	6.1	02/08/2012
RD 6	AATSR Level 1B Detailed Processing Model and Parameter Data List	PO-TN-RAL-GS-10005	1.10	14/10/2011
RD 7	Instrument Pixel Co-ordinates and Measurement Times from AATSR Products	DLFE-750	1.0	30/03/2010
RD 8	ACE2 DEM			
RD 9	S3 SLST mission – Auxiliary data for optical mission	S3-LE-TAF-00933/2009		
RD 10	Sentinel 3 PDGS File Naming Convention	GMES-S3GS-EOPG-TN-09-0009	1.3	07/11/2012

Ref	Title	Document code	Version	Date
RD 11	Data elements and interchange formats – Information interchange – Representation of dates and times	ISO 8601:2004(E)		19/06/2013
RD 12	NASA Space Science Data Coordinated Archive (NSSDC) Master Catalog			
RD 13	The EPSG Geodetic Parameter Dataset			
RD 14	The OpenGIS® Geography Markup Language Encoding Standard (GML)			

4 Overview

This product contains the calibrated and orthogeolocated TOA BTs (TIR channels) and radiances (VIS, SWIR channels), spatially re-sampled onto an evenly spaced grid in order to remove the conical scan lines. There is one MDS for each channel and each view. Quality flag annotation datasets are provided for each channel.

The scan, pixel and detector numbers of each of the MDS grid squares are provided in an ADS at the full product grid resolution, but are not channel dependent. This ADS is important in geolocating the image grid.

Other annotation datasets that are provided at the full measurement pixel resolution (but are not channel-dependent) include pixel time, pixel geodetic coordinates, pixel Cartesian coordinates and global flags.

Annotation datasets that are provided at reduced resolution on the tie point grid are the illumination and observation geometry, meteorological data. The geodetic and Cartesian coordinates are also given at reduced resolution to enable the easy conversion of the MDS between full and reduced resolution grids by the user.

4.1 Level 1b product grid

Level 1b processing calculates the geolocation. That is to say, for each instrument pixel, the latitude and longitude of the pixel are determined. Following AATSR practice, the X and Y co-ordinates of the instrument pixel are also calculated with respect to a quasi-cartesian product grid that is defined with respect to the satellite ground track and instrument swath. These values are then used to resample the data onto the product grid; a nearest neighbour algorithm is used.

The definition of the Level 1b product grid is as follows. Consider a point P in the (A)ATSR instrument swath. The X co-ordinate of the point is given by its distance from the instrument ground track, measured along the normal section PQ through P that intersects the satellite ground track at right angles; point Q is the intersection point of the normal curve with the ground track. The Y co-ordinate of P is then the distance of the intersection point Q measured along the ground track from an origin point. X and Y are then the co-ordinates of the point P in a quasi-Cartesian system whose Y axis is the local tangent to the ground track; we call it quasi-Cartesian because the ground track is curved (it is not a geodesic on the ellipsoid).

All (A)ATSR channels in both views are sampled onto a 512 km image grid at equal intervals of 1 km in the across-track direction, and at equal intervals corresponding to the interval between successive scans in the along-track direction. The full measured swath is significantly wider than 512 km and the

excess pixels, along with any others not allocated a position in the image grid by the regridding process, are collected in “orphaned” pixel containers.

All pixels, both on the image grid and in the orphaned pixel containers, are calibrated, orthogeolocated and have basic quality flag information. Only those pixels in the image grid have cloud flag information.

In addition to the L1b image grid, there is a lower resolution grid, the tie point grid, onto which the meteorological, illumination and viewing geometery data is mapped. The tie point grid is at a reduced resolution of 16km and is aligned with the 1km image grid. The grid is regular in distance across track (16km) and regular in time along-track (16 scans) which are approximately 16 km. The oblique and nadir tie point grids have the same dimensions.

The relationship between the image grid and tie point grid is illustrated in figures 6-2 and 6-3. Figure 6-2 shows the nadir tie point grid. The ground track of the satellite always has a full tie point grid square on each side. There are nominally 16x16 complete image grid squares (shown in orange) in each tie point grid square, except at the edges. The tie point grid has to be large enough to contain the entire nadir image and so at the edge of the swath, the first/last tie point grid square is not completely filled with image squares. In the oblique tie point grid, shown in figure 6-3, we see that there are many empty tie point grid squares at the edges of the grid due to the smaller swath width of the oblique view compared to the nadir view.

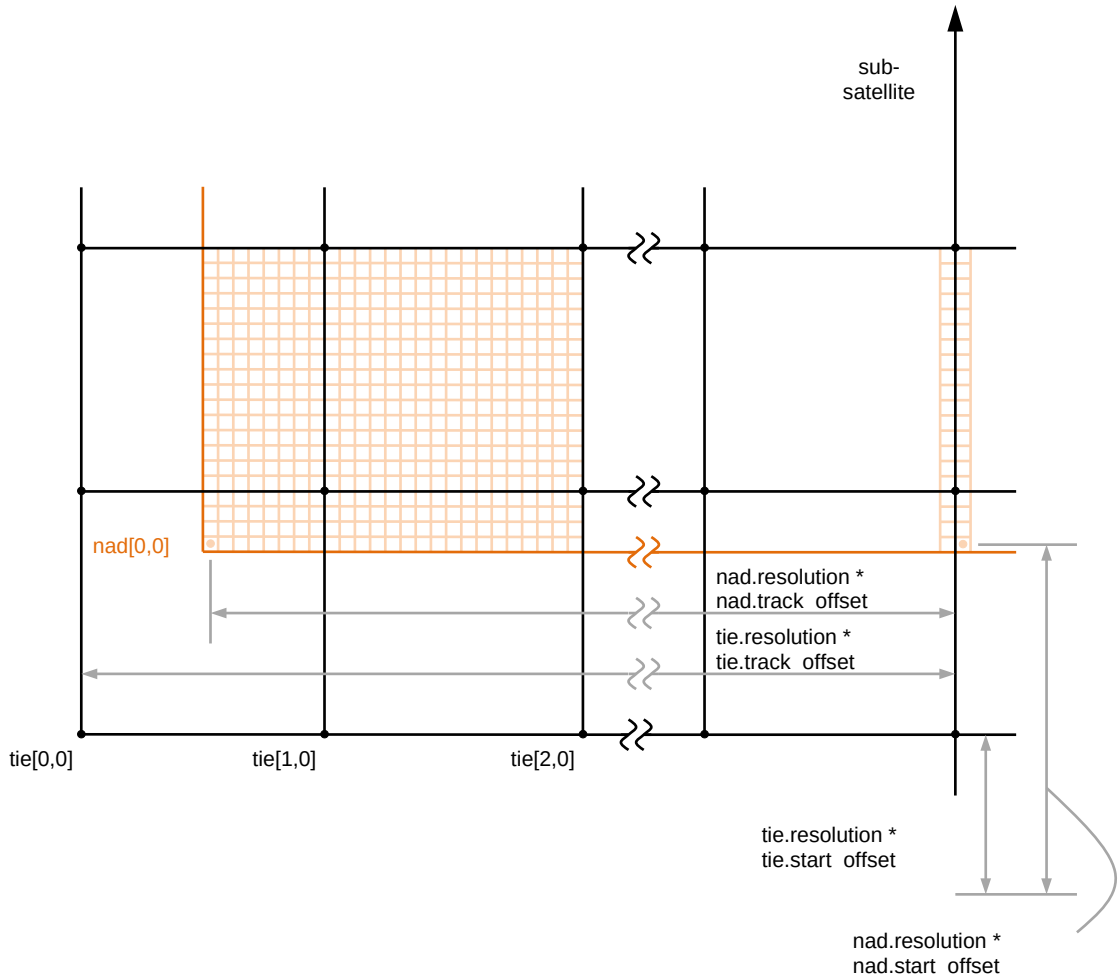

Figure 4-1: The relative alignments of generic 16km tie point and 1km nadir grids

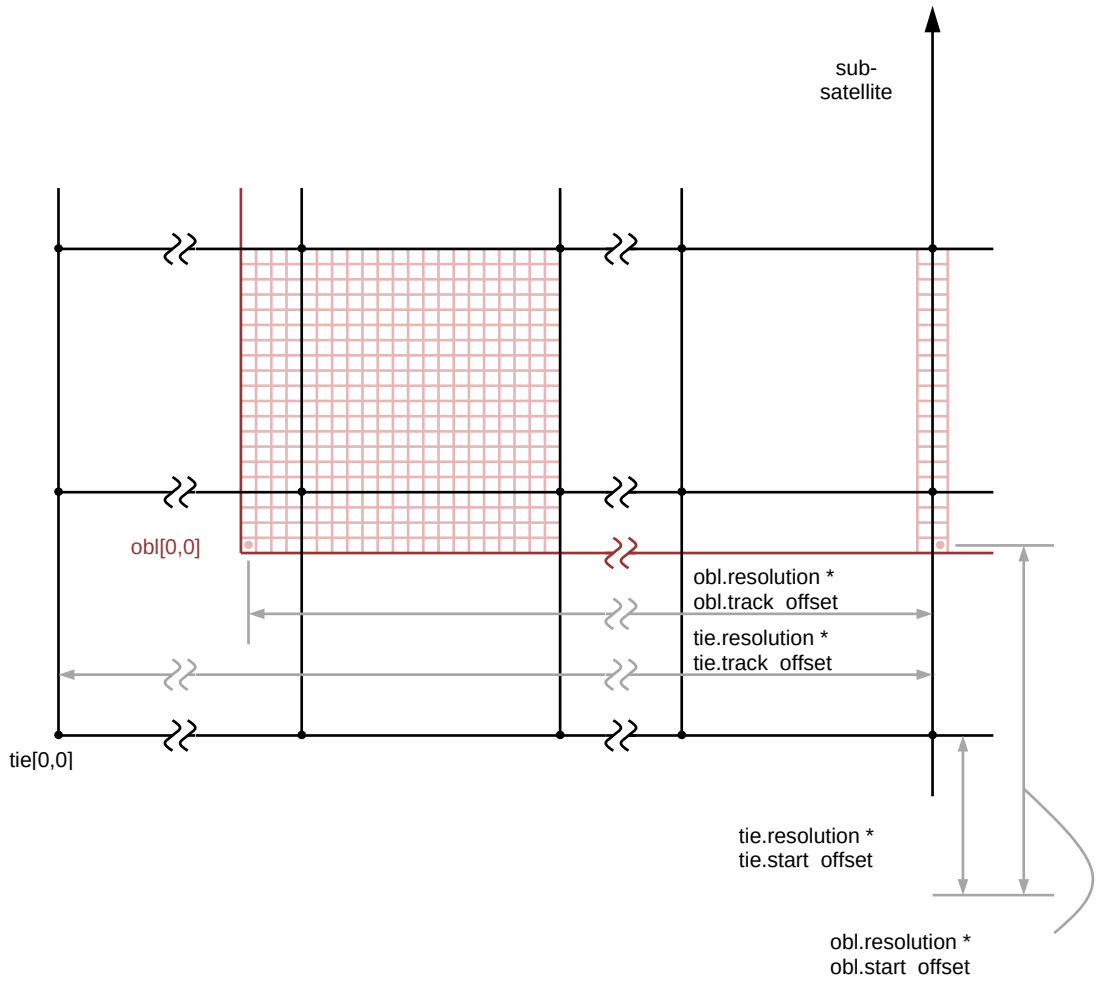

Figure 4-2: The relative alignments of generic tie point and 1km oblique grids

4.2 (A)ATSR level 1b product and file naming

Following the Sentinel 3 PDGS File Naming Convention [RD 10], the following file naming convention is recommended for (A)ATSR ("AT") level 1b TOA radiance and brightness temperature ("1_RBT___") products generated by Telespazio VEGA ("TLS") where the file is reprocessed and non-time critical ("R_NT____"):

MMM_AT_1_RBT____yyyymmddThhmmss_YYYYMMDDTHHMMSS_*YYYYMMDDTHHMMSS*_
DDDD_CCC_LLL_____TLS_R_NT____.SEN3

where:

MMM is the mission (one of "ER1", "ER2", "ENV")

yyyymmddThhmmss is the product start time

YYYYMMDDTHHMMSS is the product stop time

YYYYMMDDTHHMMSS is the product creation time

DDDD is the product duration in seconds

CCC is the cycle number

LLL is the relative orbit number

Dataset file names have the form:

<dataset ID>_rv.nc

The name components are described in

Code	Value	Description
Dataset identifier		
<dataset ID>	S1_radiance S2_radiance S3_radiance S5_radiance	Visible / SWIR radiance measurement dataset
	S7_BT S8_BT S9_BT	Brightness temperature measurement dataset
	S1_quality S2_quality S3_quality S5_quality	Visible/SWIR radiance quality annotation dataset
	S7_quality S8_quality S9_quality	Brightness temperature quality annotation dataset
	indices	Scan, pixel and detector number annotation dataset
	flags	Global flags annotation dataset
	atsr	(A)ATSR additional information dataset
	cartesian	Quasi-Cartesian ("x/y") coordinates annotation dataset
	geodetic	Latitude / longitude coordinates annotation dataset
	geometry	Solar and satellite geometry annotation dataset
	met	Meteorological parameters annotation dataset
Grid / resolution		
r	i	1km image grid
	t	16km tie-point grid
Swath / view		
v	n	Nadir view swath
	o	Oblique (forward) view swath
	x	Both / no distinction

Table 4-1 : Level 1b dataset file name components

File name	Description	Format
Manifest file		
xfdumanifest.xml	L1b EO manifest file	XML
Measurement datasets		
S1_radiance_in.nc	S1 nadir 1km radiance measurement dataset	netCDF4
S1_radiance_io.nc	S1 oblique 1km radiance measurement dataset	netCDF4
S2_radiance_in.nc	S2 nadir 1km radiance measurement dataset	netCDF4
S2_radiance_io.nc	S2 oblique 1km radiance measurement dataset	netCDF4
S3_radiance_in.nc	S3 nadir 1km radiance measurement dataset	netCDF4
S3_radiance_io.nc	S3 oblique 1km radiance measurement dataset	netCDF4
S5_radiance_in.nc	S5 nadir 1km radiance measurement dataset	netCDF4
S5_radiance_io.nc	S5 oblique 1km radiance measurement dataset	netCDF4
S7_BT_in.nc	S7 nadir 1km brightness temperature measurement dataset	netCDF4
S7_BT_io.nc	S7 oblique 1km brightness temperature measurement dataset	netCDF4
S8_BT_in.nc	S8 nadir 1km brightness temperature measurement dataset	netCDF4
S8_BT_io.nc	S8 oblique 1km brightness temperature measurement dataset	netCDF4
S9_BT_in.nc	S9 nadir 1km brightness temperature measurement dataset	netCDF4
S9_BT_io.nc	S9 oblique 1km brightness temperature measurement dataset	netCDF4
Quality annotation datasets		
S1_quality_in.nc	S1 nadir 1km quality annotation dataset	netCDF4
S1_quality_io.nc	S1 oblique 1km quality annotation dataset	netCDF4
S2_quality_in.nc	S2 nadir 1km quality annotation dataset	netCDF4
S2_quality_io.nc	S2 oblique 1km quality annotation dataset	netCDF4
S3_quality_in.nc	S3 nadir 1km quality annotation dataset	netCDF4
S3_quality_io.nc	S3 oblique 1km quality annotation dataset	netCDF4
S5_quality_in.nc	S5 nadir 1km quality annotation dataset	netCDF4
S5_quality_io.nc	S5 oblique 1km quality annotation dataset	netCDF4
S7_quality_in.nc	S7 nadir 1km quality annotation dataset	netCDF4
S7_quality_io.nc	S7 oblique 1km quality annotation dataset	netCDF4
S8_quality_in.nc	S8 nadir 1km quality annotation dataset	netCDF4
S8_quality_io.nc	S8 oblique 1km quality annotation dataset	netCDF4
S9_quality_in.nc	S9 nadir 1km quality annotation dataset	netCDF4
S9_quality_io.nc	S9 oblique 1km quality annotation dataset	netCDF4
Global flags annotation datasets		
flags_in.nc	Nadir 1km global flags annotation dataset	netCDF4
flags_io.nc	Oblique 1km global flags annotation dataset	netCDF4
ATSR additional information annotation datasets		
atsr_in.nc	Nadir 1km ATSR additional information annotation dataset	netCDF4
atsr_io.nc	Oblique 1km ATSR additional information annotation dataset	netCDF4
Coordinate annotation datasets		
indices_in.nc	Nadir 1km scan, pixel and detector number annotation dataset	netCDF4
indices_io.nc	Oblique 1km scan, pixel and detector number annotation dataset	netCDF4
geodetic_in.nc	Nadir 1km geodetic coordinates annotation dataset	netCDF4
geodetic_io.nc	Oblique 1km geodetic coordinates annotation dataset	netCDF4
geodetic_tx.nc	16km geodetic coordinates annotation dataset	netCDF4

File name	Description	Format
cartesian_in.nc	Nadir 1km Cartesian coordinates annotation dataset	netCDF4
cartesian_io.nc	Oblique 1km Cartesian coordinates annotation dataset	netCDF4
cartesian_tx.nc	16km Cartesian coordinates annotation dataset	netCDF4
time_in.nc	Nadir ***and oblique combined*** 1km time coordinate annotation dataset	netCDF4
Solar and satellite geometry annotation datasets		
geometry_tn.nc	Nadir 16km solar and satellite geometry annotation dataset	netCDF4
geometry_to.nc	Oblique 16km solar and satellite geometry annotation dataset	netCDF4
Meteorological parameters auxiliary dataset		
met_tx.nc	16km meteorological parameters auxiliary dataset	netCDF4

Table 4-2: Summary of (A)ATSR L1b products

5 (A)ATSR Level 1b Product

The ATSR-1 Level 1b product contains 8 (early mission) or 6 (late mission) measurement sets and the ATSR-2 and AATSR Level 1b products contain 14 measurement datasets representing the radiances or brightness temperatures (depending on the channel) from the nadir and oblique views. These values are mapped onto a 1km rectangular grid. These measurement datasets are supplemented by seven quality and two global flag annotation datasets, a further 12 annotation datasets providing geolocation and other geometric information and a meteorological parameters auxiliary dataset.

5.1 Input data

The inputs to Level 1 processing are the (A)ATSR Level 1 UBT and breakpoint products. The datasets are described in [AD 4].

5.2 Auxiliary data used

The auxiliary data sets required are described in [AD 5].

5.3 Processing performed

Processing from (A)ATSR Level 1 UBT and breakpoint products and is described in full in [AD 6].

5.4 Product contents

The outline Level 1 products structure is described in [AD 1]. The product consists of a manifest file that describes the product contents and contains the product metadata, and a number of data object files containing the product data. The data files contain either measurement datasets, which are derived directly from instrument observations, or annotation datasets, which contain supporting information.

5.4.1 Manifest

The manifest file is an XML file which describes the product contents. The (A)ATSR manifest file closely follows the SLSTR equivalent. The SLSTR manifest structure is described in [AD 1] and the detailed content is described in [AD 3]. The (A)ATSR manifest file contains:

- An information package map that describes the logical structure of the package,
- A metadata section that contains all of the product metadata. The Metadata section has two subsections:
    - A primary metadata subsection containing metadata common to all Sentinel-3 products, regardless of the instrument or the level of processing,
    - A secondary metadata subsection containing metadata specific for each instrument and/or level of processing,
- A data object section that describes the locations of the constituent files.

5.4.2 Measurement datasets

The 1km L1b datasets will be defined with respect to the sub-satellite track and the instrument swath projected onto the reference ellipsoid WGS84.

The Level 1b product includes 14 radiance and brightness temperature measurement datasets, seven each for the nadir and oblique instrument views. In each view there is:

- One radiance dataset for each of the VIS-NIR channels S1 – S3 and S5,
- One brightness temperature dataset for each of the thermal infrared channels S7 – S9,

All brightness temperature and radiance values are resampled onto a 1 km quasi-Cartesian grid.

5.4.3 Annotation datasets

There are 30 datasets containing annotation information:

- Fourteen quality datasets contain the channel performance data and instrument operating states.
- Two global flags datasets at 1 km resolution contain global cloud, pointing and confidence flags for each measurement pixel.
- Two ATSR additional information datasets which contain information specific to the (A)ATSR instruments.
- Two index datasets at 1 km resolution map the quasi-Cartesian grid to the instruments' natural measurement grid (scan and pixel number).
- Six navigation datasets contain the orthogeolocated pixel positions and true quasi-Cartesian pixel positions at 1 km resolution and the tie-point grid values at 16 km resolution.
- A single time dataset which contains information from which the pixel sampling times can be reconstructed.
- Two datasets on 16km tie point grids contain solar and satellite zenith and azimuth angles and path lengths for nadir and oblique viewing geometries.
- A single meteorology auxiliary dataset contains ECMWF analysis fields at 16 km resolution.

5.5 Product format

5.5.1 The manifest file

This subsection should be read in conjunction with the SAFE Sentinel-3 Metadata Specification [AD 3], which it follows closely.

The manifest file is regulated by a hierarchy of schemas and has three main sections:

- A package map containing a logical description of each measurement and annotation dataset contained in the product, including its relationship to other datasets,
- A metadata section containing information about auxiliary files, data processing, data grids, instrument characteristics, annotations and other summary metadata,
- A data object section that describes the physical characteristics of the dataset files, including their names, sizes and checksums.

The content of each of these sections can be controlled by more than one schema. Figure 5-1 illustrates a candidate outline level 1 manifest for the AATSR instrument that closely follows the SLSTR equivalent.

We note that the MERIS level 1 SAFE manifest file also closely follows the OLCI manifest design and adopts the sentinel and sentinel-3 schemas without modification. The MERIS schema closely follows the OLCI equivalent, but the schema content is updated where appropriate to refer to the MERIS instrument. We recommend that the (A)ATSR schemas and manifest follow the same plan. A common "`atsr`" schema is suggested for the ATSR-1 ("`atsr1`"), ATSR-2 ("`atsr2`") and AATSR ("`aatsr`") instruments.

```
<?xml version="1.0" encoding="UTF-8"?>
<xfdu:XFDU xmlns:xfdu="urn:ccsds:schema:xfdu:1"
    xmlns:sentinel-safe="http://www.esa.int/safe/sentinel/1.1"
    xmlns:gml="http://www.opengis.net/gml"
    xmlns:sentinel3="http://www.esa.int/safe/sentinel/sentinel-3/1.0"
    xmlns:envisat="http://www.esa.int/safe/sentinel/sentinel-3/1.0"
    xmlns:aatsr="http://www.esa.int/safe/sentinel/sentinel-3/atsr/1.0"
    version="esa/safe/sentinel/sentinel-3/atsr/level-1/1.0">

  <informationPackageMap>
    <xfdu:contentUnit ID="packageUnit" unitType="Information Package"
        textInfo="ENVISAT AATSR Level 1 Package" pdiID="processing"
        dmdID="acquisitionPeriod platform measurementOrbitReference
        measurementQualityInformation measurementFrameSet generalProductInformation
        slstrProductInformation">

<!-- This section describes the function and relationships of the product datasets -->

    </xfdu:contentUnit>
  </informationPackageMap>

  <metadataSection>

<!-- This section contains sundry instrument and product metadata -->

  </metadataSection>

  <dataObjectSection>

<!-- This section describes the physical product files -->

  </dataObjectSection>
</xfdu:XFDU>
```

Figure 5-1: A candidate outline manifest for the AATSR instrument

5.5.1.1 Package map content

The package map contains two types of content, one for measurement datasets and one for annotation datasets. Each content element contains a description of a dataset, its relationship to other datasets and a pointer to the dataset content. An example of each is shown in Figure 5-2. A description is required for every measurement dataset and annotation dataset in the product.

```
<xfdu:contentUnit ID="ATSR_S8_BT_IN_Unit" unitType="Measurement Data Unit"
    textInfo="TOA brightness temperature for channel S8 (1km grid, nadir view)"
    dmdID="ATSR_S8_QUALITY_IN_Annotation ATSR_FLAGS_IN_Annotation
    ATSR_INDICES_IN_Annotation ATSR_CARTESIAN_IN_Annotation
    ATSR_GEODETIC_IN_Annotation ATSR_TIME_IN_Annotation
    ATSR_GEOMETRY_TN_Annotation ATSR_MET_TX_Annotation
    ATSR_GEODETIC_TX_Annotation">
  <dataObjectPointer dataObjectID="ATSR_S8_BT_IN_Data"/>
</xfdu:contentUnit>

<xfdu:contentUnit ID="ATSR_MET_TX_Unit" unitType="Annotation Data Unit"
    textInfo="Meteorological parameters regridded onto 16km tie points">
  <dataObjectPointer dataObjectID="ATSR_MET_TX_Data"/>
</xfdu:contentUnit>
```

Figure 5-2: Examples of package map content describing the S8 brightness temperature measurement dataset and the meteorological parameters annotation dataset.

5.5.1.2 Metadata content

The metadata section is the most varied section of the manifest file. It contains a number of different types of information. These are:

- Processing resources including descriptions of the origin and provenance of the level 1 dataset; of external products used to generate the level 1 dataset, including auxiliary files and (A)ATSR product files; and of supporting documentation such as the product format (this document),
- The product acquisition period,
- A summary platform description,
- General product information,
- Orbit reference data, including orbit number and orbit ephemeris data,
- Quality information,
- A frame set containing the coordinates of a product outline,
- Summary instrument and product information, including surface classification statistics, data grid resolutions, image sizes (in pixels), detector temperatures and channel band descriptions,
- Annotation descriptors for each annotation dataset.

The information is held in a series of metadata objects.

5.5.1.2.1 Processing resources metadata object

The processing resources object contains descriptions of the processing software and hardware and the resources used by the processor. There are three types:

- A summary description of the processor software and hardware,
- A description for each source data file and auxiliary dataset file ingested by the processor,
- Descriptions of any directly relevant documentation.

An example of each is shown in Figure 5-3.

```
    <metadataObject ID="processing" classification="PROVENANCE" category="PDI">
      <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
          textInfo="Processing">
        <xmlData>
          <sentinel-safe:processing name="DataProcessing" outputLevel="1"
              start="9999-12-31T01:23:45.678901Z" stop="9999-12-31T12:34:56.789012Z">
            <sentinel-safe:facility name="FAST Processing and Archiving Centre"
                organisation=" Telespazio VEGA" site="Luton"
                country="United Kingdom">
              <sentinel-safe:hardware name="WWW"/>
              <sentinel-safe:software name="FAST" version="01.00"/>
            </sentinel-safe:facility>

            <sentinel-safe:resource name="My_ADF.dat" role="(A)ATSR info for doing stuff">
              <sentinel-safe:processing name="AdfProcessing">
                <sentinel-safe:facility name="XXX" organisation="My organisation"
                    site="My site" country="My country">
                  <sentinel-safe:hardware name="YYY"/>
                  <sentinel-safe:software name="ZZZ" version="1.0"/>
                </sentinel-safe:facility>
              </sentinel-safe:processing>
            </sentinel-safe:resource>

<!-- More resource file descriptions here -->

            <sentinel-safe:resource
                name="PO-TN-RAL-AT-0xxx FAST Level 1b Product Definition"
                role="Product Data Specification Document – (A)ASTR Level 1"/>

<!-- More documentation references here -->

          </sentinel-safe:processing>
        </xmlData>
      </metadataWrap>
    </metadataObject>
```

Figure 5-3: An example processing resources metadata object describing the FAST processor, a generic ADF and a document (this document).

5.5.1.2.2 Data acquisition metadata object

The data acquisition metadata object contains the data acquisition start and stop times, encoded in ISO 8601 extended format [RD 11]. A complete example is shown in Figure 5-4.

```
    <metadataObject ID="acquisitionPeriod" classification="DESCRIPTION" category="DMD">
      <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
          textInfo="Acquisition Period">
        <xmlData>
          <sentinel-safe:acquisitionPeriod>
            <sentinel-safe:startTime>2005-05-01T09:19:56.610539Z</sentinel-safe:startTime>
            <sentinel-safe:stopTime>2005-05-01T10:37:13.309739Z</sentinel-safe:stopTime>
          </sentinel-safe:acquisitionPeriod>
        </xmlData>
      </metadataWrap>
    </metadataObject>
```

Figure 5-4: An example data acquisition time metadata object.

5.5.1.2.3 Platform description metadata object

The platform description metadata object contains text strings, abbreviations and codes identifying the satellite platform and instrument [RD 12]. A complete example is shown in Figure 5-5.

```
    <metadataObject ID="platform" classification="DESCRIPTION" category="DMD">
      <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
          textInfo="Platform Description">
        <xmlData>
          <sentinel-safe:platform>
            <sentinel-safe:nssdcIdentifier>2002-009A</sentinel-safe:nssdcIdentifier>
            <sentinel-safe:familyName>Envisat</sentinel-safe:familyName>
            <sentinel-safe:number>1</sentinel-safe:number>
            <sentinel-safe:instrument>
              <sentinel-safe:familyName abbreviation="AATSR">Advanced Along Track
Scanning Radiometer</sentinel-safe:familyName>
              <sentinel-safe:mode identifier="EO">Earth Observation</sentinel-safe:mode>
            </sentinel-safe:instrument>
          </sentinel-safe:platform>
        </xmlData>
      </metadataWrap>
    </metadataObject>
```

Figure 5-5: An example platform metadata object for the AATSR instrument.

5.5.1.2.4 General product information metadata object

The general product information metadata object contains basic information about the level 1 product, including the product name, type, timeliness, creation time, size and details of the product reception. A complete example is shown in Figure 5-6.

```
    <metadataObject ID="generalProductInformation" classification="DESCRIPTION"
        category="DMD">
      <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
          textInfo="General Product Information">
        <xmlData>
          <envisat:generalProductInformation>
            <envisat:productName>ENV_AT_1_RBT____20050501T091956_20050501T103713_
20160113T170906_4637_040_107______TLS_R_NT____.SEN3</envisat:productName>
            <envisat:productType>SL_1_RBT___</envisat:productType>
            <envisat:timeliness>NT</envisat:timeliness>
            <envisat:baselineCollection>___</envisat:baselineCollection>
            <envisat:creationTime>21060113T170906</envisat:creationTime>
            <envisat:productSize>44547711740</envisat:productSize>
            <envisat:dumpInformation>
              <envisat:granuleNumber>0</envisat:granuleNumber>
              <envisat:granulePosition>NONE</envisat:granulePosition>
              <envisat:dumpStart>2005-05-01T10:37:13.000000Z</envisat:dumpStart>
              <envisat:receivingGroundStation>KIRUNA</envisat:receivingGroundStation>
              <envisat:receivingStartTime>2013-06-21T12:00:00:000000Z
              </envisat:receivingStartTime>
              <envisat:receivingStopTime>2013-06-21T12:00:10:000000Z
              </envisat:receivingStopTime>
            </envisat:dumpInformation>
          </envisat:generalProductInformation>
        </xmlData>
      </metadataWrap>
    </metadataObject>
```

Figure 5-6: An example general product information metadata object for the AATSR instrument.

5.5.1.2.5 Measurement orbit reference metadata object

The measurement orbit reference metadata object contains the following summary orbit information:

- The absolute orbit number and ground track direction at the beginning of the product,
- The relative orbit number and ground track direction at the beginning of the product,
- The cycle number,
- A phase identifier,
- The six-element orbit vector and reference time at the beginning of each orbit.

A complete example is shown in Figure 5-7.

```
<metadataObject ID="measurementOrbitReference" classification="DESCRIPTION"
    category="DMD">
  <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
      textInfo="Orbit Reference">
    <xmlData>
      <sentinel-safe:orbitReference>
        <sentinel-safe:orbitNumber groundTrackDirection="descending"
            type="start">14794</sentinel-safe:orbitNumber>
        <sentinel-safe:relativeOrbitNumber groundTrackDirection="descending"
            type="start">107</sentinel-safe:relativeOrbitNumber>
        <sentinel-safe:cycleNumber>40</sentinel-safe:cycleNumber>
        <sentinel-safe:phaseIdentifier>1</sentinel-safe:phaseIdentifier>
        <sentinel-safe:elementSet>
          <sentinel-safe:ephemeris>
            <sentinel-safe:epoch
                type="UTC">2005-05-01T08:22:09.277076Z</sentinel-safe:epoch>
            <sentinel-safe:epoch
                type="UT1">2005-05-01T08:22:08.659446</sentinel-safe:epoch>
            <sentinel-safe:epoch
                type="TAI">2005-05-01T08:22:44.277076</sentinel-safe:epoch>
            <sentinel-safe:position>
              <sentinel-safe:x>-6538505.632</sentinel-safe:x>
              <sentinel-safe:y>-2975527.735</sentinel-safe:y>
              <sentinel-safe:z>-0000004.974</sentinel-safe:z>
            </sentinel-safe:position>
            <sentinel-safe:velocity>
              <sentinel-safe:x>-0671.844274</sentinel-safe:x>
              <sentinel-safe:y>+1496.928021</sentinel-safe:y>
              <sentinel-safe:z>+7366.406009</sentinel-safe:z>
            </sentinel-safe:velocity>
          </sentinel-safe:ephemeris>
        </sentinel-safe:elementSet>
      </sentinel-safe:orbitReference>
    </xmlData>
  </metadataWrap>
</metadataObject>
```

Figure 5-7: An example measurement orbit reference metadata object for the AATSR instrument.

5.5.1.2.6 Measurement quality information metadata object

The measurement quality information metadata object contains an overall quality control flag and, when required, additional information describing non-nominal platform states. Example objects for nominal and non-nominal platform states are shown in Figure 5-8 and Figure 5-9.

```
<metadataObject ID="measurementQualityInformation" classification="DESCRIPTION"
    category="DMD">
  <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
      textInfo="Quality Information">
    <xmlData>
      <sentinel-safe:qualityInformation>
        <sentinel-safe:extension>
          <envisat:productQuality>
            <envisat:onlineQualityCheck>PASSED</envisat:onlineQualityCheck>
          </envisat:productQuality>
        </sentinel-safe:extension>
      </sentinel-safe:qualityInformation>
    </xmlData>
  </metadataWrap>
</metadataObject>
```

Figure 5-8: An example nominal measurement quality information metadata object for the AATSR instrument.

```
<metadataObject ID="measurementQualityInformation" classification="DESCRIPTION"
    category="DMD">
  <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
      textInfo="Quality Information">
    <xmlData>
      <sentinel-safe:qualityInformation>
        <sentinel-safe:extension>
          <envisat:productQuality>
            <envisat:onlineQualityCheck>DEGRADED</envisat:onlineQualityCheck>
            <envisat:satelliteManouevre>
              <envisat:startTime>2003-06-21T12:34:56:000000Z</envisat:startTime>
              <envisat:stopTime>2003-06-21T13:58:20:000000Z</envisat:stopTime>
              <envisat:type>in-plane</envisat:type>
              <envisat:thrust>
                <envisat:startTime>2003-06-21T12:34:56:000000Z</envisat:startTime>
                <envisat:stopTime>2003-06-21T12:36:27:000000Z</envisat:stopTime>
              </envisat:thrust>
              <envisat:thrust>
                <envisat:startTime>2003-06-21T13:57:10:000000Z</envisat:startTime>
                <envisat:stopTime>2003-06-21T13:58:20:000000Z</envisat:stopTime>
              </envisat:thrust>
            </envisat:satelliteManouevre>
            <degradationFlags>MANOEUVRES THRUSTS</degradationFlags>
          </envisat:productQuality>
        </sentinel-safe:extension>
      </sentinel-safe:qualityInformation>
    </xmlData>
  </metadataWrap>
</metadataObject>
```

Figure 5-9: An example non-nominal measurement quality information metadata object for the AATSR instrument.

5.5.1.2.7 Measurement frame metadata object

The measurement frame metadata object contains a geographic product outline and coordinate system. In example Figure 5-10, EPSG 4326 [RD 13] defines a coordinate reference system on the WGS 84 geoid. The outline consists of clockwise space-separated pairs of latitudes and longitudes at approximately 200 km intervals. The final coordinate pair is a repeat of the first pair. The innermost element is a GML position list [RD 14].

```
    <metadataObject ID="measurementFrameSet" classification="DESCRIPTION" category="DMD">
      <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE"
          textInfo="Frame Set">
        <xmlData>
          <sentinel-safe:frameSet>
            <sentinel-safe:footPrint srsName="http://www.opengis.net/def/crs/EPSG/0/4326">
              <gml:posList>-40.5229 -150.028 -38.7924 -150.944

<!-- [... more lat lon pairs here ...] -->

              -41.0104 -151.608 -40.5229 -150.028</gml:posList>
            </sentinel-safe:footPrint>
          </sentinel-safe:frameSet>
        </xmlData>
      </metadataWrap>
    </metadataObject>
```

Figure 5-10: An example measurement quality information metadata object for the AATSR instrument.

5.5.1.2.8 ATSR product information metadata object

The ATSR product information metadata object contains summary surface classification, gridding and instrument status information. For the ATSR instruments, gridding information is required for the 1 km image grid and, in some cases, the tie point grid. The object contains:

- Summary surface and cloud classification statistics for the 1 km grid (percent),
- The 1km and tie point grid resolutions (metres),
- The nadir and oblique (forward) view 1 km and tie point and grid indexing information. Note that the initial SLSTR manifest description is wrong in some details: the offset information should be floating point as the information must describe the positions of the centres of pixel [0, 0] and well as tie point [0, 0]; the track offsets (relative to the sub-satellite track) should be negative,
- A summary measurement accuracy string and accuracy reference,
- Summary pixel quality information (given both as a count and in percent),
- An ECMWF product classification, including a timeliness code,
- Minimum and maximum detector temperatures for each detector,
- Spectral band descriptions for each channel (microns).

An example is shown in Figure 5-11.

```
<metadataObject ID="atsrProductInformation" classification="DESCRIPTION"
    category="DMD">
  <metadataWrap mimeType="text/xml" vocabularyName="Sentinel-SAFE" textInfo="">
    <xmlData>
      <aatsr:atsrProductInformation>
        <aatsr:classificationSummary grid="1 km">
          <envisat:salineWaterPixels percentage="76.580795"/>
          <envisat:landPixels percentage="21.453197"/>
          <envisat:coastalPixels percentage="0.072865"/>
          <envisat:freshInlandWaterPixels percentage="0.333948"/>
          <envisat:tidalRegionPixels percentage="6.172949"/>
          <envisat:cloudyPixels percentage="53.952156"/>
        </aatsr:classificationSummary>

        <aatsr:resolution grid="1 km">
          <aatsr:spatialResolution>1000</aatsr:spatialResolution>
        </aatsr:resolution>
        <aatsr:resolution grid="Tie Points">
          <aatsr:spatialResolution>16000</aatsr:spatialResolution>
        </aatsr:resolution>

        <aatsr:nadirImageSize grid="1 km">
          <envisat:startOffset>0.5</envisat:startOffset>
          <envisat:trackOffset>-224.5</envisat:trackOffset>
          <envisat:rows>30916</envisat:rows>
          <envisat:columns>550</envisat:columns>
        </aatsr:nadirImageSize>
        <aatsr:nadirImageSize grid="Tie Points">
          <envisat:startOffset>0.0</envisat:startOffset>
          <envisat:trackOffset>-17.0</envisat:trackOffset>
          <envisat:rows>1933</envisat:rows>
          <envisat:columns>35</envisat:columns>
```

```
            </aatsr:nadirImageSize>
            <aatsr:obliqueImageSize grid="1 km">
              <envisat:startOffset>0.5</envisat:startOffset>
              <envisat:trackOffset>-224.5</envisat:trackOffset>
              <envisat:rows>30916</envisat:rows>
              <envisat:columns>550</envisat:columns>
            </aatsr:obliqueImageSize>
            <aatsr:obliqueImageSize grid="Tie Points">
              <envisat:startOffset>0.0</envisat:startOffset>
              <envisat:trackOffset>-17.0</envisat:trackOffset>
              <envisat:rows>1933</envisat:rows>
              <envisat:columns>35</envisat:columns>
            </aatsr:obliqueImageSize>

            <aatsr:measurementAccuracy>~2% S1-S3,S5; ~0.1K S7-S9</aatsr:measurementAccuracy>
            <aatsr:accuracyReference>[PDS-SL]</aatsr:accuracyReference>

            <aatsr:pixelQualitySummary grid="1 km">
              <aatsr:cosmeticPixels value="9718147" percentage="20.000000"/>
              <aatsr:duplicatedPixels value="1944789" percentage="4.000000"/>
              <aatsr:saturatedPixels value="0" percentage="0.000000"/>
              <aatsr:outOfRangePixels value="0" percentage="0.000000"/>
            </aatsr:pixelQualitySummary>
            <aatsr:ecmwfType timeRelevance="0">ANALYSIS</aatsr:ecmwfType>

            <aatsr:temperatureSummary>
              <aatsr:temperature element="S1_Detector">
                <aatsr:min>263.944118</aatsr:min>
                <aatsr:max>264.002941</aatsr:max>
              </aatsr:temperature>

<!—More detector temperatures here (one each for S1 – S3, S5, S7 – S9) -->

            </aatsr:temperatureSummary>

            <aatsr:bandDescriptions bands="9">
              <envisat:band name="S1">
                <envisat:centralWavelength>0.555000</envisat:centralWavelength>
                <envisat:bandwidth>0.020000</envisat:bandwidth>
              </envisat:band>

<!-- More spectral bands here (one each for S1 – S3, S5, S7 – S9) -->

            </aatsr:bandDescriptions>
          </aatsr:atsrProductInformation>
        </xmlData>
      </metadataWrap>
    </metadataObject>
```

Figure 5-11: An example product information metadata object for the AATSR instrument.

5.5.1.2.9 Annotation dataset Descriptive MetaData ID metadata objects

An annotation dataset Descriptive MetaData (DMD) ID metadata object associates a DMD ID with a data object. There is one object for each annotation dataset. The DMD IDs are referenced in the package map content (Section 5.5.1.1). An example object for the meteorological data annotation dataset is shown in Figure 5-12.

```
<metadataObject ID="SLSTR_MET_TX_Annotation" classification="DESCRIPTION"
    category="DMD">
  <dataObjectPointer dataObjectID="SLSTR_MET_TX_Data"/>
</metadataObject>
```

Figure 5-12: An example DMD ID metadata object for the AATSR meteorological data annotation dataset.

5.5.1.3 Data object content

The Data object section describes the physical characteristics of all measurement and annotation dataset files, including their names, sizes and checksums. Examples of each are shown in Figure 5-13. A description is required for every measurement dataset and annotation dataset in the product.

```
<dataObject ID="ATSR_S8_BT_IN_Data">
  <byteStream mimeType="application/x-netcdf" size="156478572">
  <fileLocation locatorType="URL" href="S8_BT_in.nc"/>
    <checksum checksumName="MD5">75514644c407614c75a46eb34d13bcc0</checksum>
  </byteStream>
</dataObject>

<dataObject ID="ATSR_MET_TX_Data">
  <byteStream mimeType="application/x-netcdf" size="34233">
    <fileLocation locatorType="URL" href="met_tx.nc"/>
    <checksum checksumName="MD5">d941a202efca63c1ce86c674b3a84c7e</checksum>
  </byteStream>
</dataObject>
```

Figure 5-13: Example physical descriptions of the S8 brightness temperature measurement dataset and the meteorological parameters annotation dataset.

5.5.2 Data objects

The Level 1b product will contain several data objects, each corresponding to the measurement dataset for one (A)ATSR channel and one view. There will be additional data objects for annotation datasets. Each data object will be stored as a separate netCDF 4 file.

In the data object description tables below, the choice of data type and units for brightness temperatures follows the AATSR model. The stored values are typically packed into integer arrays. A scaling factor and offset are provided for "unpacking" of the measurement values.

Unlike the classic (A)ATSR product measurement data fields, where most pixel exception conditions are specified by exception values in the measurement data fields, the new product implements an exception byte field and substitutes a "fill value" in the corresponding measurement data field entries.

5.5.2.1 Thermal infrared MDS

The thermal infrared MDS contains 1 km resolution pixel brightness temperatures, brightness temperature uncertainties and exception flags for the thermal infrared channels (S7, S8 and S9). There will be two netCDF files for each channel, one for the nadir view and one for the oblique view. The format for each is identical but the values of some attributes will differ, e.g. dataset name will be channel specific, along track array size will be dependent on the number of scans in the L0 data. It is always advisable to check the NetCDF attributes inside the MDS file.

Element Name	Description	Range or Value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Full resolution grid across-track array size	[1, 65535]	dl	(us)	1
rows	Full resolution grid along-track array size	[1, 65535]	dl	(us)	1
orphan_pixels	Un-regridded ("orphaned") pixel array size	[0, ...]	dl	(ul)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE package		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired				
attributes (global)	Close container				
variable	Open container				
<b>_BT_i<v>	Gridded pixel brightness temperatures	[0, 32767]	dl	ss	rows, columns
attributes	Open container				

Element Name	Description	Range or Value	Unit	T	D
standard_name	CF standard name	"toa_brightness_temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
scale_factor	Scale factor multiplying BT field	0.01	K	db	1
add_offset	Offset added to scaled BT field	0.0	K	db	1
_FillValue	Default value for missing BT entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_BT_uncert_i<v>	Gridded pixel brightness temperature uncertainty estimates	[0, 32767]	dl	ss	rows, columns
attributes	Open container				
standard_name	CF standard name	"toa_brightnes_temperature standard_error"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
scale_factor	Scale factor multiplying BT field	0.000125	K	db	1
add_offset	Offset added to scaled BT field	4.0	K	db	1
_FillValue	Default value for missing BT entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_exception_i<v>	Gridded pixel exception flags	[0, 255]	dl	uc	rows, columns
attributes	Open container				
standard_name	CF standard name	"toa_brightness_temperature status_flag"	–	st	1
flag_masks	Masks for each flag bit	See Table 5-2	–	st	1
flag_meanings	Text descriptions for each flag bit	See Table 5-2	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_BT_orphan_i<v>	Orphan pixel brightness temperatures	[0, 32767]	dl	ss	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"toa_brightness_temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
scale_factor	Scale factor multiplying BT field	0.01	K	db	1
add_offset	Offset added to scaled BT field	0.0	K	db	1
_FillValue	Default value for missing BT entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_BT_uncert_ orphan_i<v>	Orphan pixel brightness temperature uncertainty estimates	[0, 32767]	dl	ss	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"toa_brightness_temperature standard_error"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
scale_factor	Scale factor multiplying BT field	0.000125	K	db	1
add_offset	Offset added to scaled BT field	4.0	K	db	1
_FillValue	Default value for missing BT entry	-32768	dl	ss	1
attributes	Close container				

Element Name	Description	Range or Value	Unit	T	D
variable	Close container				
variable	Open container				
<b>_exception_ orphan_ i<v>	Orphan pixel exception flags	[0, 255]	dl	uc	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"toa_brightness _temperature status_flag"	–	st	1
flag_masks	Masks for each flag bit	See Table 5-2	–	st	1
flag_meanings	Text descriptions for each flag bit	See Table 5-2	–	st	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-1: Description table for thermal infrared MDS

The exception byte values are defined in the following table.

Bit Number	Text Code	Description
0	scan_absent	Scan absent
1	pixel_absent	Pixel absent
2	not_decompressed	Not decompressed
3	no_signal	No signal in channel
4	saturation	Saturation in channel
5	invalid_radiance	Derived radiance outside calibration
6	no_parameters	Calibration parameters unavailable
7	unfilled_pixel	Unfilled pixel

Table 5-2: Exception byte contents and meaning

5.5.2.2 Visible and shortwave infrared MDS

The visible and shortwave infrared MDS contains 1 km resolution pixel radiances, radiance uncertainties and exception flags for the visible and shortwave infrared channels (S1 – S3, S5). There will be two netCDF files for each channel, one each for the nadir and oblique views. The format for each is identical but the array sizes and the values of some attributes will differ. It is always advisable to check the NetCDF attributes inside the MDS file.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Full resolution grid across-track array size	[1, 65535]	dl	(us)	1
rows	Full resolution grid along-track array size	[1, 65535]	dl	(us)	1
orphans	Un-regridded ("orphaned") pixel array size	[0, ...]	dl	(ul)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1

Element name	Description	Range or value	Unit	T	D
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
<b>_radiance_i<v>	Gridded pixel radiances	[-100, 32767]	dl	ss	rows, columns
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_radiance_per_unit_wavelength"	–	st	1
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
scale_factor	Scale factor multiplying field	0.1	mW m^{-2} sr^{-1} nm^{-1}	db	1
add_offset	Offset added to scaled field	0.0	mW m^{-2} sr^{-1} nm^{-1}	db	1
_FillValue	Default value for missing radiance entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_radiance_uncert_i<v>	Gridded pixel radiance uncertainty estimates	[-100, 32767]	dl	ss	rows, columns
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_radiance_per_unit_wavelength standard_error"	–	st	1
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
scale_factor	Scale factor multiplying field	5e-4	mW m^{-2} sr^{-1} nm^{-1}	db	1
add_offset	Offset added to scaled field	16.0	mW m^{-2} sr^{-1} nm^{-1}	db	1
_FillValue	Default value for missing radiance entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_exception_i<v>	Pixel exception flags	[0, 255]	dl	uc	rows, columns
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_radiance_per_unit_wavelength	–	st	1

Element name	Description	Range or value	Unit	T	D
		status_flag"			
flag_masks	Masks for each flag bit	See Table 5-2	–	st	1
flag_meanings	Text descriptions for each flag bit	See Table 5-2	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_radiance_ orphan_ i<v>	Orphan pixel radiances	[-100, 32767]	Dl	ss	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_ radiance_per_ unit_ wavelength"	–	st	1
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
scale_factor	Scale factor multiplying field	0.1	mW m^{-2} $sr^{-1}nm^{-1}$	db	1
add_offset	Offset added to scaled field	0	mW m^{-2} $sr^{-1}nm^{-1}$	db	1
_FillValue	Default value for missing entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_radiance_ uncert_orphan_ i<v>	Orphan pixel radiance uncertainty estimates	[-100, 32767]	Dl	ss	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_ radiance_per_ unit_ wavelength"	–	st	1
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
scale_factor	Scale factor multiplying field	5e-4	mW m^{-2} $sr^{-1}nm^{-1}$	db	1
add_offset	Offset added to scaled field	16.0	mW m^{-2} $sr^{-1}nm^{-1}$	db	1
_FillValue	Default value for missing entry	-32768	dl	ss	1
attributes	Close container	1			
variable	Close container				
variable	Open container				
<b>_exception _orphan_ i<v>	Orphan pixel exception flags	[0, 255]	dl	uc	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_ radiance_per_ unit_ wavelength status_flag"	–	st	1
flag_masks	Masks for each flag bit	See Table 5-2	–	st	1
flag_meanings	Text descriptions for each flag bit	See Table 5-2	–	st	1
attributes	Close container				
variable	Close container				

Table 5-3: Description table for visible and shortwave infrared MDS

The visible and shortwave MDS exception byte content is identical to the thermal infrared MDS exception byte (Table 5-2).

5.5.2.3 Thermal infrared quality ADS

The thermal infrared quality ADS contains estimates of detector noise measured at the black bodies and the ancillary information required to scale this to estimates of NEΔT for each pixel sample for each thermal infrared channel (S7, S8 and S9). There will be two netCDF files for each channel, one each for the nadir and oblique views. The format for each is identical but the across-track array size and the values of some attributes may differ. Also the along track array size will be dependent on the number of scans in the L0 data.

The arrays are indexed by row and detector number.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
rows	Number of rows	[1, 65535]	dl	(us)	1
detectors	Number of detectors	1	dl	(us)	1
integrators	Odd or even integrator	2	dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
<b>_band_centre_i<v>	Detector filter band centre		m	db	detectors
attributes	Open container				
standard_name	CF standard name	"radiation_ wavelength"	–	st	1
units	UDUNITS unit name	"µm"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_bandwidth_i<v>	Detector filter bandwidth		m	db	detectors
attributes	Open container				
standard_name	CF standard name	"radiation_ wavelength"	–	st	1

Element name	Description	Range or value	Unit	T	D
units	UDUNITS unit name	"µm"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_scene_ temperature_i<v>	Scene temperature for IR channel uncertainty estimates	[200.0, 400.0]	K	db	uncertainties
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_radiometric_ uncertainty_i<v>	Radiometric calibration uncertainty estimates. These are provided as a tabulated function of scene brightness temperature. They are estimates of uncertainties due to systematic effects in the radiometric calibration, e.g. BB thermometry, BB emissivity, non-linearity	[0.0, 10.0]	K	db	detectors, uncertainties
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_dT_BB1_i<v>	Black body 1 noise equivalent brightness temperature	[0.0, 100.0]	K	db	rows, detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
_FillValue	Default value for missing dT_cold entry	-1.0	K	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_dT_BB2_i<v>	Black body 2 noise equivalent brightness temperature	[0.0, 100.0]	K	db	rows, detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
_FillValue	Default value for missing dT_hot entry	-1.0	K	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_T_BB1_i<v>	Black body temperature 1	[200.0, 400.0]	K	db	rows
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
_FillValue	Default value for missing T_BB1 entry	-1.0	K	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_T_BB2_i<v>	Blackbody temperature 2	[200.0, 400.0]	K	db	rows
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
_FillValue	Default value for missing T_BB2 entry	-1.0	K	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_T_detector_i<v>	Detector temperature	[50.0, 400.0]	K	db	rows

Element name	Description	Range or value	Unit	T	D
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
_FillValue	Default value for missing T_det entry	-1.0	K	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_cal_gain_i<v>	Scale factor multiplying detector count			db	rows, detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"1"	–	st	1
_FillValue	Default value for missing cal_gain entry	-1.0		db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_cal_offset_i<v>	Offset added to scaled detector count			db	rows, detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"1"	–	st	1
_FillValue	Default value for missing cal_offset entry	-1.0		db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_SCP_gain_i<v>	Electronic gain applied to detector signal	0	dl	ss	rows, detectors
attributes	Open container				
units	UDUNITS unit name	"1"	–	st	1
_FillValue	Default value for missing T_Start in entry	0	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_SCP_offset_i<v>	Electronic offset added to detector signal		dl	ss	rows, detectors
attributes	Open container				
units	UDUNITS unit name	"1"	–	st	1
_FillValue	Default value for missing FEE_offset entry	-32768	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_ADC_cal_i<v>	ADC reference measurement		V	db	rows
attributes	Open container				
units	UDUNITS unit name	"V"	–	st	1
_FillValue	Default value for missing T entry	-1.0	V	db	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-4: Description table for thermal infrared quality ADS

5.5.2.4 Visible and shortwave infrared quality ADS

The visible and shortwave infrared quality ADS contains estimates of detector noise measured at the black bodies and VISCAL, and the ancillary information required to scale these to estimates of radiance noise for each pixel in the visible and shortwave infrared channels (S1 – S3, S5). There will be two netCDF files for each channel, one each for the nadir and oblique views. The format for each is identical but the across-track array size and the values of some attributes may differ. Also the along track array size will be dependent on the number of scans in the L0 data.

The arrays are indexed by row and detector number.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
rows	Number of rows	[1, 65535]	dl	(us)	1
detectors	Number of detectors	1	dl	(us)	1
integrators	Number of integrators	2	dl	(us)	1
uncertainties	Number of radiance uncertainty entries in table		dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
<b>_scene_radiance_i<v>	Scene radiance for VIS-SWIR channel type B uncertainty estimate LUT		mW m^{-2} sr^{-1} nm^{-1}	db	uncertainties
attributes	Open container				
standard_name	CF standard name	"toa_outgoing_radiance_per_unit_wavelength"	–	st	1
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_band_centre_i<v>	Detector filter band centre		m	db	detectors
attributes	Open container				

Element name	Description	Range or value	Unit	T	D
standard_name	CF standard name	"radiation_ wavelength"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_bandwidth_i<v>	Detector filter bandwidth		m	db	detectors
attributes	Open container				
standard_name	CF standard name	"radiation_ wavelength"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_solar_irradiance_i<v>	Solar spectral irradiance at top of atmosphere		mW m^{-2} nm^{-1}	db	detectors
attributes	Open container				
standard_name	CF standard name	"toa_solar_ irradiance_per_ unit_wavelength"	–	st	1
units	UDUNITS unit name	"mW m-2 nm-1"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_radiometric_ uncertainty_i<v>	Radiometric calibration uncertainty estimates. These are provided as a tabulated function of scene radiance. They are estimates of uncertainties due to systematic effects in the radiometric calibration, e.g. VISCAL reflectance factor, degradation, non-linearity		mW m^{-2} $sr^{-1}nm^{-1}$	db	detectors, uncertainties
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_dL_BB_i<v>	Cold black body radiance noise		mW m^{-2} $sr^{-1}nm^{-1}$	db	rows, detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
_FillValue	Default value for missing dL_BB entry	-1.0	mW m^{-2} $sr^{-1}nm^{-1}$	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_dL_VISCAL_i<v>	VISCAL radiance noise		mW m^{-2} $sr^{-1}nm^{-1}$	db	detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
_FillValue	Default value for missing dL_VISCAL entry	-1.0	mW m^{-2} $sr^{-1}nm^{-1}$	db	1
attributes	Close container				
variable	Close container				
variable	Open container				

Element name	Description	Range or value	Unit	T	D
<b>_L_BB_i<v>	Black body radiance from cold BB	0.0	dl	db	rows, detectors
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1nm-1"	–	st	1
_FillValue	Default value for missing dL_BB entry	-1.0	mW m-2 sr-1nm-1	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_L_VISCAL_i<v>	VISCAL radiance		mW m-2 sr-1nm-1	db	detectors
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1nm-1"	–	st	1
_FillValue	Default value for missing dL_VISCAL entry	-1.0	mW m-2 sr-1nm-1	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_T_detector_i<v>	Detector temperature	[50.0, 400.0]	K	db	rows
attributes	Open container				
units	UDUNITS unit name	"K"	–	st	1
_FillValue	Default value for missing T_det entry	-1.0	K	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_cal_gain_i<v>	Scale factor multiplying detector count	-	dl	db	detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	–	st	1
_FillValue	Default value for missing cal_gain entry	-1.0	dl	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_cal_offset_i<v>	Offset added to scaled detector count		dl	db	rows, detectors, integrators
attributes	Open container				
units	UDUNITS unit name	"mW m-2 sr-1 nm-1"	dl	st	1
_FillValue	Default value for missing cal_offset entry	-32768	dl	db	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_SCP_gain_i<v>	Electronic gain applied to detector signal	0	"dl"	ss	rows, detectors
attributes	Open container				
units	UDUNITS unit name	"1"	–	st	1
_FillValue	Default value for missing SCP_offset in entry		dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
<b>_SCP_offset_i<v>	Electronic offset applied to detector signal	0	"dl"	ss	rows, detectors
attributes	Open container				
units	UDUNITS unit name	"V"	–	st	1

Element name	Description	Range or value	Unit	T	D
_FillValue	Default value for missing entry		dl	ss	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-5: Description table for visible and near-infrared quality ADS

5.5.2.5 Global flags ADS

The global flag ADS contains the product quality flags which are applicable across all measurement datasets sharing the same view and detector geometry. There are two global flag files at 1km resolution, one each for the nadir and oblique views. The format for each is identical but the array sizes and the values of some attributes will differ.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Full resolution grid across-track array size	[1, 65535]	dl	(us)	1
rows	Full resolution grid along-track array size	[1, 65535]	dl	(us)	1
orphan_pixels	Un-regridded ("orphaned") pixel array size	[0, ...]	dl	(ul)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
probability_cloud_single_i<v>	Probability of cloud in pixel as estimated by Bayesian cloud detection on a single view		dl	sc	rows, columns
attributes	Open container				
long_name	CF standard name	"probability of cloud in pixel"	–	st	1
units	UDUNITS unit name	"1"	1	st	1
scale_factor	Scale factor multiplying BT field	0.005	1	db	1

Element name	Description	Range or value	Unit	T	D
add_offset	Offset added to scaled BT field	0.5	1	db	1
valid_min	Minimum valid value of packed data	-100	dl	sc	1
valid_max	Maximum valid value of packed data	100	dl	sc	1
_FillValue	Default value for missing probability entry	-128	dl	sc	1
comment		"probability of cloud in pixel as estimated by Bayesian cloud detection on a single view"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
probability_cloud_dual_i<v>	Probability of cloud in pixel as estimated by Bayesian cloud detection on both views		dl	sc	rows, columns
attributes	Open container				
long_name	CF standard name	"probability of cloud in pixel"	–	st	1
units	UDUNITS unit name	"1"	1	st	1
scale_factor	Scale factor multiplying BT field	0.005	1	db	1
add_offset	Offset added to scaled BT field	0.5	1	db	1
valid_min	Minimum valid value of packed data	-100	dl	sc	1
valid_max	Maximum valid value of packed data	100	dl	sc	1
_FillValue	Default value for missing probability entry	-128	dl	sc	1
comment		"probability of cloud in pixel as estimated by Bayesian cloud detection on both views"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
cloud_i<v>	Global cloud flags		dl	us	rows, columns
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-7	–	us	16
flag_meanings	Text descriptions for each flag bit	See Table 5-7	–	us	16
attributes	Close container				
variable	Close container				
variable	Open container				
bayes_i<v>	Bayesian cloud flags		dl	uc	rows, columns
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-8	–	uc	8
flag_meanings	Text descriptions for each flag bit	See Table 5-8	–	uc	8
attributes	Close container				
variable	Close container				
variable	Open container				
pointing_i<v>	Global pointing flags		dl	uc	rows, columns
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-9	–	uc	8
flag_meanings	Text descriptions for each flag bit	See Table 5-9	–	uc	1
attributes	Close container				
variable	Close container				
variable	Open container				
confidence_i<v>	Global confidence flags		dl	us	rows, columns

Element name	Description	Range or value	Unit	T	D
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-10	–	us	16
flag_meanings	Text descriptions for each flag bit	See Table 5-10	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
probability_cloud_single_orphan_i<v>	Probability of cloud in orphan pixel as estimated by Bayesian cloud detection on a single view		dl	sc	rows, orphan_pixels
attributes	Open container				
long_name	Long name	"probability of cloud in pixel"	–	st	1
units	UDUNITS unit name	"1"	1	st	1
scale_factor	Scale factor multiplying BT field	0.005	1	db	1
add_offset	Offset added to scaled BT field	0.5	1	db	1
valid_min	Minimum valid value of packed data	-100	dl	sc	1
valid_max	Maximum valid value of packed data	100	dl	sc	1
_FillValue	Default value for missing probability entry	-128	dl	sc	1
comment		"probability of cloud in pixel as estimated by Bayesian cloud detection on a single view"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
probability_cloud_dual_orphan_i<v>	Probability of cloud in orphan pixel as estimated by Bayesian cloud detection on both views		dl	sc	rows, orphan_pixels
attributes	Open container				
long_name	Long name	"probability of cloud in pixel"	–	st	1
units	UDUNITS unit name	"1"	1	st	1
scale_factor	Scale factor multiplying BT field	0.005	1	db	1
add_offset	Offset added to scaled BT field	0.5	1	db	1
valid_min	Minimum valid value of packed data	-100	dl	sc	1
valid_max	Maximum valid value of packed data	100	dl	sc	1
_FillValue	Default value for missing probability entry	-128	dl	sc	1
comment		"probability of cloud in pixel as estimated by Bayesian cloud detection on both views"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
cloud_orphan_i<v>	Orphan pixel global cloud flags (subset)		dl	us	rows, orphan_pixels
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-7	–	us	16
flag_meanings	Text descriptions for each flag bit	See Table 5-7	–	st	16
attributes	Close container				
variable	Close container				
variable	Open container				
bayes_orphan_i<v>	Orphan pixel global cloud flags (subset)		dl	uc	rows, orphan_pixels

Element name	Description	Range or value	Unit	T	D
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-8	–	uc	8
flag_meanings	Text descriptions for each flag bit	See Table 5-8	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
pointing_orphan_i<v>	Orphan pixel global pointing flags		dl	uc	rows, orphan_pixels
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-9	–	uc	8
flag_meanings	Text descriptions for each flag bit	See Table 5-9	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
confidence_orphan_i<v>	Orphan pixel global confidence flags		dl	us	rows, orphan_pixels
attributes	Open container				
flag_masks	Masks for each flag bit	See Table 5-10	–	us	16
flag_meanings	Text descriptions for each flag bit	See Table 5-10	–	st	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-6: Description table for the global flags ADS

Bit	Text code	Meaning if set	Comment
0		Visible channels cloud test	Day time only
1		(not implemented)	Set to 0
2	1.6_small_histogram	1.6μm small-scale histogram test	Day time only
3	1.6_large_histogram	1.6μm large-scale histogram test	Day time only
4		(not implemented)	Set to 0
5		(not implemented)	Set to 0
6	11_spatial_coherence	11μm spatial coherence test	
7	gross_cloud	12μm gross cloud test	
8	thin_cirrus	11μm/12μm thin cirrus test	
9	medium_high	3.7μm/12μm medium/high level test	
10	fog_low_stratus	11μm/3.7μm fog/low stratus test	
11	11_12_view_difference	11μm/12μm view difference test	Uses both views
12	3.7_11_view_difference	3.7μm/11μm view difference test	Uses both views
13	thermal_histogram	11μm/12μm thermal histogram test	
14		spare	
15		spare	

Table 5-7: Cloud word definitions

Bit	Text code	Meaning if set	Comment
0		Single view low probability threshold	Climate-quality clearing
1		Single view moderate probability threshold	Operational-quality clearing
2		Dual view low probability threshold	Climate-quality clearing
3		Dual view moderate probability threshold	Operational-quality clearing
4		spare	
5		spare	
6		spare	
7		No Bayesian probabilities available	

Table 5-8: Bayesian cloud word definitions

Bit	Text code	Meaning if set	Comment
0		(not implemented)	Set to 0
1		(not implemented)	Set to 0
2		(not implemented)	Set to 0
3		(not implemented)	Set to 0
4	scan_mirror_integrated_error	Pixel counter not equal to 2000	
5		(not implemented)	Set to 0
6		(not implemented)	Set to 0
7	platform_mode	platform mode	0 if nominal, else 1

Table 5-9: Pointing word definitions

Bit	Text code	Meaning if set	Comment
0	coastline	coastline in field of view	
1	ocean	ocean in field of view	
2	tidal	tidal zone in field of view	
3	land	land in field of view	
4	inland_water	inland water in field of view	
5	unfilled	unfilled pixel	
6		(spare)	
7	blanking_pulse	RADAR active	(A)ATSR additional flag
8	cosmetic	cosmetic fill pixel	
9	duplicate	pixel has a duplicate	
10	day	pixel in daylight	
11	twilight	pixel in twilight	
12	sun_glint	sun glint in pixel	
13	snow	snow	
14	summary_cloud	summary cloud test	
15	summary_pointing	summary pointing	

Table 5-10: Confidence word definitions

5.5.2.6 ATSR additional information ADS

The ATSR additional information ADS contains additional information specific to the ATSR instruments. There are two datasets at 1km resolution, one each for the nadir and oblique views. The format for each is identical but the array sizes and the values of some attributes will differ.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
scans	Full resolution grid along-track array size	[1, 65535]	dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
TLM_rate_i<v>	Telemetry data rate		dl	us	scans
attributes	Open container				
long_name		"telemetry data rate"	–	st	1
flag_values	Data rate codes	See Table 5-12	–	us	3
flag_meanings	Text descriptions for each code	See Table 5-12	–	us	1
_FillValue	Default value for missing entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
PSM_ID_i<v>	Pixel selection map ID	[1, 14]	dl	uc	scans
attributes	Open container				
long_name		"pixel selection map"	–	st	1
_FillValue	Default value for missing entry	255	dl	uc	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-11: Description table for (A)ATSR-specific information

Code	Text Code	Description
0	fixed_rate	ATSR-1, AATSR – fixed rate data
2519	low_rate	ATSR-2 – low rate data
60304	high_rate	ATSR-2 – high rate data

Table 5-12: ATSR data rate

5.5.2.7 Scan, pixel and detector number ADS

The scan, pixel and detector number description table contains arrays of indices which map both gridded and orphaned pixels to their original positions in the instrument measurement frame. There are two scan, pixel and detector number datasets at 1km resolution, one each for the nadir and oblique views. The format for each is identical but the array sizes and the values of some attributes will differ.

Element name	Description	Range or value	Unit	T	D
Dataset	Open container				
Dimensions	Open container				
columns	Full resolution grid across-track array size	[1, 65535]	dl	(us)	1
rows	Full resolution grid along-track array size		dl	(us)	1
orphan_pixels	Number of un-regridded (“orphaned”) pixels		dl	(ul)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. “CF-1.6”)		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. “ESRIN”)		–	st	1
source	Platform and sensor (e.g. “ENVISAT AATSR”)		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
scan_i<v>	Pixel scan number	[0, 32767]	dl	us	rows, columns
attributes	Open container				
_FillValue	Default value for scan entry	65535	dl	us	1
attributes	Close container				
variable	Close container				

Element name	Description	Range or value	Unit	T	D
variable	Open container				
pixel_i<v>	Gridded pixel pixel number	[0, 32767]	dl	us	rows, columns
attributes	Open container				
_FillValue	Default value for missing pixel entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
detector_i<v>	Gridded pixel detector number	0	dl	uc	rows, columns
attributes	Open container				
_FillValue	Default value for missing detector entry	255	dl	uc	1
attributes	Close container				
variable	Close container				
variable	Open container				
scan_orphan_i<v>	Orphan pixel scan number	[0, 32767]	dl	us	rows, orphan_pixels
attributes	Open container				
_FillValue	Default value for scan_orphan entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
pixel_orphan_i<v>	Orphan pixel pixel number	[0, 32767]	dl	us	rows, orphan_pixels
attributes	Open container				
_FillValue	Default value for missing pixel_orphan entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
detector_orphan_i<v>	Orphan pixel detector number	0	dl	uc	rows, orphan_pixels
attributes	Open container				
_FillValue	Default value for missing detector_orphan entry	255	dl	uc	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-13: Description table for scan, pixel and detector number ADS

5.5.2.8 Full resolution Cartesian coordinates ADS

The Cartesian coordinates dataset contains the orthogeolocated quasi-Cartesian coordinates x and y of the centre of each pixel field of view on the earth's surface, determined from a digital elevation model, where x is the across track distance on the ellipsoid, locally perpendicular to the sub-satellite track and y is the distance along the sub-satellite track. The dataset is generated in the instrument frame. The dataset is encoded in netCDF. There two datasets at 1km resolution, one each for the nadir and oblique views. The format for each is identical but the array sizes and the values of some attributes will differ.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Full resolution grid across-track array size	[1, 65535]	dl	(us)	1
rows	Full resolution grid along-track array size		dl	(us)	1
orphan_pixels	Number of un-regridded ("orphaned") pixels		dl	(ul)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
x_i<v>	Geolocated x (across track) coordinate of detector FOV centre		dl	sl	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
scale_factor	Scale factor multiplying i field	0.01	m	db	1
add_offset	Offset added to scaled i field	0	m	db	1
_FillValue	Default value for entry	-1000000	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
y_i<v>	Geolocated y (along track) coordinate of detector FOV centre		dl	sl	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
scale_factor	Scale factor multiplying j field	0.01	m	db	1

Element name	Description	Range or value	Unit	T	D
add_offset	Offset added to scaled j field	0	m	db	1
_FillValue	Default value for entry	-50000000	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
x_orphan_i<v>	Geolocated x (across track) coordinate of detector FOV centre		dl	sl	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
scale_factor	Scale factor multiplying field	0.01	m	db	1
add_offset	Offset added to scaled field	0	m	db	1
_FillValue	Default value for entry	-1000000	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
y_orphan_i<v>	Geolocated y (along track) coordinate of detector FOV centre		dl	sl	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
scale_factor	Scale factor multiplying field	0.01	m	db	1
add_offset	Offset added to scaled field	0	m	db	1
_FillValue	Default value for entry	-50000000	dl	sl	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-14: Description table for the full resolution Cartesian orthogeolocation ADS

5.5.2.9 16km Cartesian coordinates ADS

The 16km Cartesian coordinates dataset contains the quasi-Cartesian swath coordinates of the tie-points on the ellipsoid. The dataset is encoded in netCDF.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Tie-point grid across-track array size	[1, 65536]	dl	(us)	1
rows	Tie-point grid along-track array size		dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
x_tx	Geolocated x (across track) coordinate of tie point		m	db	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
y_tx	Geolocated y (along track) coordinate of tie point		m	db	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-15: Description table for the 16km Cartesian coordinates dataset

5.5.2.10 Full resolution geodetic coordinates ADS

The geodetic coordinates dataset contains the orthogeolocated geodetic coordinates, in latitude and longitude, and the surface elevation of the centre of each pixel field of view on the earth's surface, determined from a digital elevation model. The dataset is encoded in netCDF. There are two datasets at 1km resolution, one each for the nadir and oblique views. The format for each is identical but the array sizes and the values of some attributes will differ.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Full resolution grid across-track array size	[1, 65535]	dl	(us)	1
rows	Full resolution grid along-track array size		dl	(us)	1
orphan_pixels	Number of un-regridded ("orphaned") pixels		dl	(ul)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
latitude_i<v>	Latitude of detector FOV centre on the earth's surface		dl	sl	rows, columns
attributes	Open container				
standard_name	CF standard name	"latitude"	–	st	1
units	UDUNITS unit name	"degrees_north"	–	st	1
scale_factor	Scale factor multiplying field	1e-6	°N	db	1
add_offset	Offset added to scaled field	0	°N	db	1
_FillValue	Default value for entry	-99999999	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
longitude_i<v>	Longitude of detector FOV centre on the earth's surface		dl	sl	rows, columns
attributes	Open container				
standard_name	CF standard name	"longitude"	–	st	1
units	UDUNITS unit name	"degrees_east"	–	st	1
scale_factor	Scale factor multiplying field	1e-6	°E	db	1

Element name	Description	Range or value	Unit	T	D
add_offset	Offset added to scaled field	0	°E	db	1
_FillValue	Default value for entry	-999999999	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
elevation_i<v>	Surface elevation of detector FOV above reference ellipsoid		dl	ss	rows, columns
attributes	Open container				
standard_name	CF standard name	"surface_altitude"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
scale_factor	Scale factor multiplying field	1.0	dl	db	1
add_offset	Offset added to scaled field	0	dl	db	1
_FillValue	Default value for entry	-999	dl	ss	1
attributes	Close container				
variable	Close container				
variable	Open container				
latitude_orphan_i<v>	Latitude of detector FOV centre on the earth's surface		dl	sl	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"latitude"	–	st	1
units	UDUNITS unit name	"degrees_north"	–	st	1
scale_factor	Scale factor multiplying field	1e-6	°N	db	1
add_offset	Offset added to scaled field	0	°N	db	1
_FillValue	Default value for entry	-999999999	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
longitude_orphan_i<v>	Longitude of detector FOV centre on the earth's surface		dl	sl	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"longitude"	–	st	1
units	UDUNITS unit name	"degrees_east"	–	st	1
scale_factor	Scale factor multiplying field	1e-6	°E	db	1
add_offset	Offset added to scaled field	0	°E	db	1
_FillValue	Default value for entry	-999999999	dl	sl	1
attributes	Close container				
variable	Close container				
variable	Open container				
elevation_orphan_i<v>	Surface elevation of detector FOV above reference ellipsoid		dl	ss	rows, orphan_pixels
attributes	Open container				
standard_name	CF standard name	"surface_altitude"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
scale_factor	Scale factor multiplying field	1.0	dl	db	1
add_offset	Offset added to scaled field	0	dl	db	1
_FillValue	Default value for entry	-999	dl	ss	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-16: Description table for the full resolution geodetic orthogeolocation ADS

5.5.2.11 16km geodetic coordinates ADS

The 16km geodetic coordinates dataset contains the geodetic coordinates, in latitude and longitude, of the tie-points on the ellipsoid. The dataset is encoded in netCDF.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Tie-point grid across-track array size	[1, 65536]	dl	(us)	1
rows	Tie-point grid along-track array size		dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
latitude_tx	Latitude on geoid		deg	db	rows, columns
attributes	Open container				
standard_name	CF standard name	"latitude"		st	1
units	UDUNITS unit name	"degrees_north"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
longitude_tx	Longitude on geoid		deg	db	rows, columns
attributes	Open container				
standard_name	CF standard name	"longitude"		st	1
units	UDUNITS unit name	"degrees_east"	–	st	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-17: Description table for the 16km geodetic ADS

5.5.2.12 Time ADS

The 1km time coordinate dataset contains the information from which the measurement times for each pixel can be derived.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
rows	Row number		dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
time_stamp_i	Acquisition time of the sub-satellite point included in this line		µs	sll	rows
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"microseconds since 2000-01-01T00:00:00Z"	–	st	1
_FillValue	Default value for time_stamp_i entry	$-(2^{63})$	µs	sll	1
attributes	Close container				
variable	Close container				
variable	Open container				
SCANSYNC	Scan period defined as a complete rotation of the scan mirrors		µs	sl	1
attributes	Open container				
units	UDUNITS unit name	"microseconds"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
PIXSYNC_i	Frequency at which the pixels are sampled on each scan		µs	sl	1
attributes	Open container				
units	UDUNITS unit name	"microseconds"	–	st	1

Element name	Description	Range or value	Unit	T	D
attributes	Close container				
variable	Close container				
variable	Open container				
Nadir_First_scan_i	Scan number of the first nadir scan contributing to each line	[0, 65534]	dl	us	rows
attributes	Open container				
_FillValue	Default value for * entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
Nadir_Last_scan_i	Scan number of the last nadir scan contributing to each line	[0, 65534]	dl	us	rows
attributes	Open container				
_FillValue	Default value for * entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
Oblique_First_scan_i	Scan number of the first oblique scan contributing to each line	[0, 65534]	dl	us	rows
attributes	Open container				
_FillValue	Default value for * entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
Oblique_Last_scan_i	Scan number of the last Oblique scan contributing to each line	[0, 65534]	dl	us	rows
attributes	Open container				
_FillValue	Default value for * entry	65535	dl	us	1
attributes	Close container				
variable	Close container				
variable	Open container				
Nadir_Minimal_ts_i	Acquisition time of the first nadir scan contributing to each line		µs	sll	rows
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"microseconds since 2000-01-01T00:00:00Z"	–	st	1
_FillValue	Default value for Nadir_Minimal_ts_i<v> entry	$-(2^{63})$	µs	sll	1
attributes	Close container				
variable	Close container				
variable	Open container				
Nadir_Maximal_ts_i	Acquisition time of the last nadir scan contributing to each line		µs	sll	rows
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"microseconds since 2000-01-01T00:00:00Z"	–	st	1
_FillValue	Default value for Nadir_Maximal_ts_i<v> entry	$-(2^{63})$	µs	sll	1
attributes	Close container				
variable	Close container				
variable	Open container				
Oblique_Minimal_ts_i	Acquisition time of the first oblique scan contributing to each line		µs	sll	rows

Element name	Description	Range or value	Unit	T	D
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"microseconds since 2000-01-01T00:00:00Z"	–	st	1
_FillValue	Default value for Oblique_Minimal_ts_i<v> entry	$-(2^{63})$	µs	sll	1
attributes	Close container				
variable	Close container				
variable	Open container				
Oblique_Maximal_ts_i	Acquisition time of the last oblique scan contributing to each line		µs	sll	rows
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"microseconds since 2000-01-01T00:00:00Z"	–	st	1
_FillValue	Default value for Oblique_Maximal_ts_i<v> entry	$-(2^{63})$	µs	sll	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-18: Description table for the full resolution time ADS

5.5.2.13 16km Solar and satellite geometry ADS

The solar and satellite geometry ADS contains the solar and satellite azimuth and zenith angles at earth's surface and the corresponding distances to the surface, on a tie point grid. There are two datasets, one each for nadir and oblique viewing geometries. The format for each is identical.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Tie-point grid across-track array size	[1, 65536]	dl	(us)	1
rows	Tie-point grid along-track array size		dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. "CF-1.6")		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. "ESRIN")		–	st	1
source	Platform and sensor (e.g. "ENVISAT AATSR")		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1

Element name	Description	Range or value	Unit	T	D
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
solar_zenith_t<v>	Solar zenith angle		deg	db	rows, columns
attributes	Open container				
standard_name	CF standard name	"solar_zenith_angle"	–	st	1
units	UDUNITS unit name	"degree"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
solar_azimuth_t<v>	Solar azimuth angle		deg	db	rows, columns
attributes	Open container				
standard_name	CF standard name	"solar_azimuth_angle"	–	st	1
units	UDUNITS unit name	"degree"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
solar_path_t<v>	Distance from sun to surface		m	db	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
sat_zenith_t<v>	Satellite zenith angle		deg	db	rows, columns
attributes	Open container				
standard_name	CF standard name	"sensor_zenith_angle"	–	st	1
units	UDUNITS unit name	"degree"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
sat_azimuth_t<v>	Satellite azimuth angle		deg	db	rows, columns
attributes	Open container				
standard_name	CF standard name	"sensor_azimuth_angle"	–	st	1
units	UDUNITS unit name	"degree"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
sat_path_t<v>	Distance from satellite to surface		m	db	rows, columns
attributes	Open container				
units	UDUNITS unit name	"m"	–	st	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-19: Description table for the 16km solar and satellite geometry ADS

5.5.2.14 Meteorological Parameters Auxiliary Dataset

The meteorological parameters dataset contains ECMWF forecast or analysis fields, regridded onto 16km tie points. The dataset contains three types of field:

- single surface or near-surface values,
- surface time series,
- profiles.

The preferred synoptic time is the time nearest to the product centre time. For near-real time products, ECMWF forecast input fields must be updated continuously, and in a timely fashion, to ensure that the data in the meteorology auxiliary dataset is valid for the L1b product. For these, the preferred analysis time is the nearest available time preceeding the synoptic time.

Element name	Description	Range or value	Unit	T	D
dataset	Open container				
dimensions	Open container				
columns	Tie-point grid across-track array size	[1, 65536]	dl	(us)	1
rows	Tie-point grid along-track array size		dl	(us)	1
n_bound	Start/stop bounds for integrated products	2	dl	(us)	1
t_single	Synoptic time of single time fields	1	dl	(us)	1
t_series	Synoptic times of time series fields	5	dl	(us)	1
z_wind	Wind field height coordinate	1	dl	(us)	1
z_atmos	Atmospheric field height coordinate	1	dl	(us)	1
z_soil	Soil depth coordinate	1	dl	(us)	1
p_atmos	Pressure levels of profile fields	25	dl	(us)	1
dimensions	Close container				
variables	Open container				
attributes (global)	Open container				
Conventions	Convention(s) used (e.g. “CF-1.6”)		–	st	1
title	Descriptive title		–	st	1
institution	Processing site where generated (e.g. “ESRIN”)		–	st	1
source	Platform and sensor (e.g. “ENVISAT AATSR”)		–	st	1
history	Audit trail for processing modifications		–	st	1
comment	Miscellaneous extra information		–	st	1
references	URI(s) of reference document(s)		–	st	1
contact	URI or email of supporting organisation		–	st	1
netCDF_version	netCDF version		–	st	1
product_name	Name of this SAFE product		–	st	1
creation_time	Date and time of creation (ISO 8601)		–	st	1
validity_start_time	Product start date and time (ISO 8601)		–	st	1
validity_stop_time	Product stop date and time (ISO 8601)		–	st	1
resolution	Dataset resolution (across- and along-track)		m	ss	2
start_offset	Position of element (0,*) wrt product start		dl	db	1
track_offset	Position of element (*,0) wrt sub-satellite track		dl	db	1
absolute_orbit_number	Absolute orbit number during which data contained within the product have been acquired		dl	ul	1
attributes (global)	Close container				
variable	Open container				
t_forecast	For forecast parameters, the time of the analysis from which the forecast was made	0		ss	1
attributes	Open container				

Element name	Description	Range or value	Unit	T	D
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"hours since…"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
t_single	Synoptic time of single time fields	0		ss	t_single
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"hours since…"	–	st	1
axis	Coordinate axis identifier	"T"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
t_series	Synoptic times of time series fields	[-18, 6]		ss	t_series
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"hours since…"	–	st	1
axis	Coordinate axis identifier	"T"	–	st	1
bounds	Reference to "t_bound"	"t_bound"	–	st	1
attributes	Close container				
variable	Close container				
t_bound	Start and stop times for integrated products	[-24, 6]		ss	t_series, n_bound
attributes	Open container				
standard_name	CF standard name	"time"	–	st	1
units	UDUNITS unit name	"hours since…"	–	st	1
axis	Coordinate axis identifier	"T"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
z_wind	Height of wind field above surface	10		ss	z_wind
attributes	Open container				
standard_name	CF standard name	"height"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
axis	Coordinate axis identifier	"Z"	–	st	1
positive	axis orientation	"up"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
z_atmos	Height of atmospheric field above surface	2		ss	z_atmos
attributes	Open container				
standard_name	CF standard name	"height"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
axis	Coordinate axis identifier	"Z"	–	st	1
positive	axis orientation	"up"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
z_soil	Depth of soil wetness level	7e-2		fl	z_soil
attributes	Open container				
standard_name	CF standard name	"height"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
axis	Coordinate axis identifier	"Z"	–	st	1

Element name	Description	Range or value	Unit	T	D
positive	axis orientation	"down"	–	st	1
bounds	Reference to "z_bound"	"z_bound"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
z_bound	Soil wetness level depth bounds	(0, 7e-2)		fl	z_soil, n_bound
attributes	Open container				
standard_name	CF standard name	"height"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
axis	Coordinate axis identifier	"Z"	–	st	1
positive	axis orientation	"down"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
p_atmos	Pressure level coordinates			ss	p_atmos
attributes	Open container				
standard_name	CF standard name	"air_pressure"	–	st	1
units	UDUNITS unit name	"Pa"	–	st	1
axis	Coordinate axis identifier	"Z"	–	st	1
attributes	Close container				
variable	Open container				
variable	Open container				
sea_surface_temperature_tx	Sea surface temperature		K	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"sea_surface_temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"34"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
sea_ice_fraction_tx	Sea ice fraction		dl	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"sea_ice_area_fraction"	–	st	1
units	UDUNITS unit name	"1"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"31"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
u_wind_tx	10m U wind component		$m\ s^{-1}$	fl	t_series, z_wind, rows, columns
attributes	Open container				
standard_name	CF standard name	"eastward_wind"	–	st	1
units	UDUNITS unit name	"m s-1"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"165"	–	st	1
attributes	Close container				
variable	Close container				

Element name	Description	Range or value	Unit	T	D
variable	Open container				
v_wind_tx	10m V wind component		m s^{-1}	fl	t_series, z_wind, rows, columns
attributes	Open container			2	
standard_name	CF standard name	"northward_ wind"	–	st	1
units	UDUNITS unit name	"m s-1"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"166"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
sensible_heat_tx	Integrated surface sensible heat flux		W m^{-2} s	fl	t_series, rows, columns
attributes	Open container				
standard_name	CF standard name	"integral_of_ surface_ downward_ sensible_heat_ flux_wrt_time"	–	st	1
units	UDUNITS unit name	"W m-2 s"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"146"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
latent_heat_tx	Integrated surface latent heat flux		W m^{-2} s	fl	t_series, rows, columns
attributes	Open container				
standard_name	CF standard name	"integral_of_ surface_ downward_ latent_heat_ flux_wrt_time"	–	st	1
units	UDUNITS unit name	"W m-2 s"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"147"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
solar_radiation_tx	Integrated surface solar radiation		W m^{-2} s	fl	t_series, nij columns
attributes	Open container				
standard_name	CF standard name	"integral_of_ surface_ net_downward_ shortwave_ flux_wrt_time"	–	st	1
units	UDUNITS unit name	"W m-2 s"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"176"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
thermal_radiation_tx	Integrated surface thermal radiation		W m^{-2} s	fl	t_series, rows, columns
attributes	Open container				

Element name	Description	Range or value	Unit	T	D
standard_name	CF standard name	"integral_of_ surface_ net_downward_ longwave_ flux_wrt_time"	–	st	1
units	UDUNITS unit name	"W m-2 s"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"177"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
temperature_profile_tx	Atmospheric temperature profile		K	fl	t_single, p_atmos, rows, columns
attributes	Open container				
standard_name	CF standard name	"air_temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"130"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
specific_humidity_tx	Specific humidity profile (kg/kg)		dl	fl	t_single, p_atmos, rows, columns
attributes	Open container				
standard_name	CF standard name	"specific_ humidity"	–	st	1
units	UDUNITS unit name	"kg/kg"	-	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"133"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
total_column_water_ vapour_tx	Total column water vapour		kg m^{-2}	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"atmosphere_ water_vapor_ content"	–	st	1
units	UDUNITS unit name	"kg m-2"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"137"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
total_column_ozone_tx	Total Column Ozone		kg m^{-2}	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"atmospheric_ mass_content_ of_ ozone"	–	st	1
units	UDUNITS unit name	"kg m-2"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"206"	–	st	1
attributes	Close container				

Element name	Description	Range or value	Unit	T	D
variable	Close container				
Variable	Open container				
surface_pressure_tx	Surface pressure		hPa	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"surface_air_pressure"	–	st	1
units	UDUNITS unit name	"hPa"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"134"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
east_west_stress_tx	East-west integrated surface wind stress		N m^{-2} s	fl	t_series, rows, columns
attributes	Open container				
standard_name	CF standard name	"integral_of_surface_downward_eastward_stress_wrt_time"	–	st	1
units	UDUNITS unit name	"N m-2 s"	–	st	1
model	Model identifier (e.g. interim era analysis)	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"180"	–	st	1
attributes	Close container				
attributes	Close container				
variable	Open container				
north_south_stress_tx	North-south integrated surface wind stress		N m^{-2} s	fl	t_series, rows, columns
attributes	Open container				
standard_name	CF standard name	"integral_of_surface_downward_northward_stress_wrt_time"	–	st	1
units	UDUNITS unit name	"N m-2 s"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"181"	–	st	1
attributes	Close container				
attributes	Close container				
variable	Open container				
cloud_fraction_tx	Fractional cloud cover		1	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"cloud_area_fraction"	–	st	1
units	UDUNITS unit name	"1"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"164"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
soil_wetness_tx	Soil wetness (level 1)		1	fl	t_single, z_soil, rows, columns
attributes	Open container				

Element name	Description	Range or value	Unit	T	D
standard_name	CF standard name	"volume_ fraction_of_ condensed_ water_in_soil"	–	st	1
units	UDUNITS unit name	"1"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"39"	–	st	1
attributes	Close container				
variable	Close container				
variable	Close container				
temperature_tx	2m air temperature		K	fl	t_single, z_atmos, rows, columns
attributes	Open container				
standard_name	CF standard name	"air_temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"167"	–	st	1
attributes	Close container				
variable	Close container				
variable	Close container				
dew_point_tx	2m dew point		K	fl	t_single, z_atmos, rows, columns
attributes	Open container				
standard_name	CF standard name	"dew_point_ temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"168"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				
skin_temperature_tx	Skin temperature		K	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"surface_ temperature"	–	st	1
units	UDUNITS unit name	"K"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"235"	–	st	1
attributes	Close container				
attributes	Close container				
variable	Open container				
snow_depth_tx	Snow liquid water equivalent depth		m	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"lwe_thickness_ of_surface_ snow_amount"	–	st	1
units	UDUNITS unit name	"m"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"141"	–	st	1
attributes	Close container				
variable	Close container				
variable	Open container				

Element name	Description	Range or value	Unit	T	D
snow_albedo_tx	Snow broadband albedo		1	fl	t_single, rows, columns
attributes	Open container				
standard_name	CF standard name	"surface_albedo_assuming_deep_snow"	–	st	1
units	UDUNITS unit name	"1"	–	st	1
model	Model identifier	(Note 1)	–	st	1
parameter	Parameter identifier (e.g. ECMWF GRIB code)	"32"	–	st	1
attributes	Close container				
variable	Close container				
variables	Close container				
dataset	Close container				

Table 5-20: Description table for meteorological fields auxiliary dataset

1) The model attribute should contain a code to identify the source (e.g. ECWMF) and type (forecast or analysis) of the met field. For ECMWF fields, it is recommended that these codes should be "ECMWF_F" or "ECMWF_A".

End of Document