

ENVISAT Post-Launch Products

AATSR

1. Product Summary

The AATSR products included in this package are itemised in the following table. Section 1.1 of this document provides a general summary of the AATSR product set and Sections 1.2 and 1.3 address the source and contents of these particular sample products.

Filename	PDS Name	Product Name
L1B Product		
ATS_TOA_1PTRAL20020729_070738_000000002008_0092_02150_0000.N1	ATS_TOA_1P	Gridded Brightness Temperature/Reflectance (GBTR)
ATS_AST_BPNETB20020729_070738_000058362008_0092_02150_0873.N1	ATS_AST_BP	Browse Product
L2 Products		
ATS_NR_2PTRAL20020729_070738_000000002008_0092_02150_0000.N1	ATS_NR_2P	Gridded Surface Temperature (GST)
ATS_AR_2PTRAL20020729_070738_000000002008_0092_02150_0000.N1	ATS_AR_2P	Averaged Surface temperature (AST)
ATS_MET_2PNETB20020729_070738_000058362008_0092_02150_0873.N1	ATS_MET_2P	Meteo Product
L1B Auxiliary Files		
ATS_PC1_AXVRAL20010308_161409_20010308_161409_20020801_235959	ATS_PC1_AX	L1B Processor Config. Data File
ATS_INS_AXVRAL20020412_163948_20020301_000000_20020801_235959	ATS_INS_AX	AATSR Instrument Date File
ATS_VC1_AXVRAL20020430_131417_20020428_141828_20020505_141828	ATS_VC1_AX	Visible Calibration Data File
ATS_GC1_AXVRAL20010306_195519_20010306_195519_20020801_235959	ATS_GC1_AX	General Calibration Data File
ATS_CH1_AXVRAL20010617_151544_20010617_151544_20020801_235959	ATS_CH1_AX	L1B Characterisation Data File
ATS_CL1_AXVRAL20010308_120446_20010308_120446_20020801_235959	ATS_CL1_AX	Cloud LUT Data File
L2 Auxiliary Files		
ATS_PC2_AXVRAL20010308_163803_20010308_163803_20020801_235959	ATS_PC2_AX	L2 Processor Config. Data File
ATS_SST_AXVRAL20010308_163803_20010308_163803_20020801_235959	ATS_SST_AX	SST Retrieval Coefficients Data File

1.1 Product Summary

Instrument overview

The Advanced Along Track Scanning Radiometer (AATSR) is the advanced version of the ATSR system provided on board ERS-1 and ERS-2. The AATSR is a passive imaging instrument at 1km resolution, able to collect reflected and emitted electromagnetic radiation in 7 different spectral regions, spanning from the visible to the thermal infrared. The AATSR conical scanning mechanism allows the same area to be imaged twice at different viewing angles (nadir and 47 degrees forward) thus giving the possibility to estimate and correct for atmospheric effects and to improve the retrieval of Earth surface parameters.

The major objective of the AATSR instrument, whose characteristics are basically the same as ATSR-2, is to provide continuity of Sea Surface Temperature (SST) measurements with the levels of accuracy required

for climate research, and for the community of operational and scientific users that has developed through the ERS-1 and ERS-2 missions.

Products overview

The ENVISAT AATSR products consist of two Level 1b products and three Level 2 products. One example of each product type is included in this package. All products have been generated from real AATSR L0 data acquired during the Commissioning Phase.

The AATSR products follow the ENVISAT products structure including a Main Product Header, a Specific Product Header, and a number of Measurements and Annotation Data Sets.

This package also contains examples of the auxiliary data files used in the ground segment to generate the AATSR L1b and L2 products.

Level 1b products:

The AATSR Level 1b products provided on this CD are the Gridded Brightness Temperature/Reflectance (GBTR) product, and the AATSR Browse product.

Gridded Brightness Temperature/Reflectance

The GBTR contains full resolution, calibrated instrument data, rectified from the AASTR conical scan view onto an approximately 1km grid aligned to the satellite along track and across track directions. In the L1b GBTR data from all channels from the two instrument views (nadir and forward) are spatially collocated to the same grid. The AATSR instrument mid and thermal infrared channel data (3.7, 11, 12 micron) are calibrated into Top of Atmosphere Brightness Temperature, while the Visible and Near Infrared channel data (0.55, 0.67, 0.87, 1.6 micron) are calibrated into Top of Atmosphere Reflectance. The calibration from instrument counts to physical values is performed using the coefficients derived from the on-board calibration system which includes both an infrared and a visible calibration unit.

Together with the calibrated instrument data, the GBTR provides the complete set of auxiliary information required to generate the AATSR L2 products and to allow the computation of any additional geophysical parameter the user might need.

The GBTR is systematically generated from the L0 product and it can be disseminated, upon user demand, in either fixed scenes (512.x 512 km), as child products (data segments with length and contents defined by the user) or as full orbit products.

Browse

The Browse product provides the user with a quick-look illustrating the contents of the data from which it is derived, to assist users with product selection. It is a sub-sampled image at 4 km x 4 km resolution, based on the L1b GBTR nadir view Brightness Temperature and Reflectance data and associated cloud flags. Different bands from the GBTR product are chosen to form a colour composite image showing the key features of the data over land, sea and cloud. The product is partitioned into a day form that exploits the visible channel data available on the illuminated part of the orbit, and a night form derived using the 11 micron channel Brightness Temperatures.

Level 2 products:

The AATSR Level 2 products provided on this CD are the Gridded Surface Temperature (GST) product, the Averaged Surface Temperature (AST) product and the Meteo product.

Gridded Surface Temperature product

The GST is the full resolution geophysical product, generated from the GBTR. The GST has the same spatial characteristics as the GBTR and contains a mixture of geophysical parameters derived from the AATSR nadir view and from combined nadir-forward view channel data.

Currently, the Sea Surface Temperature (SST) and Normalized Difference Vegetation Index (NDVI) are the geophysical parameters provided in the product. They are computed at pixel level and are distributed according to the Earth surface type and cloud cover status as resulting from the L1b GBTR classification. All parameters are organised into one Measurements Data Set containing two fields, the Nadir Field and the Combined Field. A table is provided in Section 1.4 showing the contents of a GST pixel versus the classification flags associated with it for the two MDS fields.

The SST is calculated using a predefined set of retrieval coefficients that are depending on the scene latitude and viewing angles. The computation of nadir only SST and combined nadir-forward view SST uses the 11 and 12 micron channel brightness temperatures for daytime conditions and the 3.7, 11 and 12 micron channels at night.

The NDVI is derived from the nadir 0.67 and 0.87 micron channels.

This product is aimed at users interested in land and ocean applications that require high precision of measurements at 1km spatial resolution. Similarly to the GBTR, the GST can be disseminated, upon user demand, in either fixed scenes (512.x 512 km), as child products (data segments with length and contents defined by the user) or as full orbit products.

Averaged Geophysical product

The Averaged Surface Temperature (AST) product is the spatially averaged version of the geophysical parameters derived from the GBTR.

The product offers several types of averaged measurements, organised into fixed length grid cells (50km x 50 km, 17km x 17 km) taken along the swath or fixed latitude/longitude grid cells (10 arcminutes x 10 arcminutes or 30 arcminutes x 30 arcminutes). The measurements for these different cell grids are all provided within the same product, allowing the user to select the most suitable to his need.

Averages are performed for the nadir and forward views separately and a separate average is also performed for each surface type (land and sea) and cloud status.

The averaged geophysical parameters provided in the AST product are organised according to the surface types and include:

- Averaged dual view and nadir only SST from cloud free sea pixels.
- Averaged NDVI from cloud-free land pixels.
- Averaged Top of Atmosphere Reflectance and Brightness Temperatures for all instrument channels and views.
- Mean Brightness Temperature of coldest 25% cloudy pixels in a cell, and Cloud Cover Percentage within the cell.

The AST product is disseminated on a full orbit basis and is intended for global monitoring activities.

Meteo

The AATSR Meteo product contains spatially averaged SST and Brightness Temperature data in 10 arc minute cells over clear sea, extracted from the AST product. It is intended for near real time use by meteorological agencies.

The key features of the GBTR, GST and AST products are summarised in the following tables.



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Further information on the AATSR products and processing algorithms can be found in PO-TN-ESA-GS-1013, Introduction to AATSR Data Processing, also included in this package.

Additional background information on the ATSR-1 and ATSR-2 missions can be found at:
<http://www.atsr.rl.ac.uk/>



Name	AATSR Gridded Brightness Temperature and Reflectance
Identifier	ATS_TOA_1P
Description	The product contains AATSR channel data from nadir and forward view, geolocated and rectified to across/along track grid, calibrated to Top of Atmosphere Reflectance and Brightness Temperature.
Image Size	512 pixels x 2272 lines
Pixel Sampling	1000 m x 1006 m (across track and averaged along track distance) Nearest neighbour sampling method applied to cosmetically fill the grid
Coverage	512 km x 2288 km
Bits / Pixel	16 bits used for coding calibrated channels data
Unit	Temperature in K/100 Reflectance in (dimensionless) %/100
Format	<ul style="list-style-type: none">▪ MPH: Main Product Header identifies the product and its main characteristics▪ SPH: Specific Product Header includes Product Confidence Data applying to the whole product, and/or relevant processing parameters▪ SQ ADS: Summary Quality Annotation Data Set contains summarised information useful for the evaluation of the overall quality of the product▪ LADS: Grid pixel location and topographic correction Annotation Data Set includes information on tie point latitude/longitude coordinates, topographic corrections and altitude,▪ ADSs: Annotation Data Sets containing various auxiliary information:<ul style="list-style-type: none">Scan pixel x and y location at each tie pointTie points grid of nadir/forward view elevation and azimuth solar anglesTie points grid of nadir/forward view elevation and azimuth satellite anglesVisible calibration coefficientsOriginal scan and pixel numbers for nadir/forward views▪ MDS (1-7): Measurement Data Sets containing NADIR TOA calibrated channel data▪ MDS (8-14): Measurement Data Sets containing FORWARD TOA calibrated channel data▪ Confidence MDS: Two confidence Measurement Data Sets, one each for nadir and forward view , providing quality information at the individual pixel level.▪ Cloud Flag MDS: Two cloud flag Measurement Data Sets, one for the nadir and one for the forward view , providing cloud test information and results at pixel level.



Name	AATSR Gridded Surface Temperature
Identifier	ATS_NR_2P
Description	The product contains the values of various geophysical parameters provided at full resolution for each pixel according to the classification results.
Image Size	512 pixels x 2272 lines
Pixel Sampling	1000 m x 1006 m (across track and averaged along track) Nearest neighbour sampling method applied to cosmetically fill the grid
Coverage	512 km x 2288 km
Bits / Pixel	16 bits used for coding geophysical data
Unit	Temperature in K/100 NDVI in (dimensionless)/10000
Format	<ul style="list-style-type: none">▪ MPH: Main Product Header identifies the product and its main characteristics▪ SPH: Specific Product Header includes Product Data Set descriptors applied to the whole product, and/or relevant processing parameters▪ SQ ADS: Summary Quality Annotation Data Set contains summarised information useful for the evaluation of the overall quality of the product▪ LADS: Grid pixel location and topographic correction Annotation Data Set includes information on tie points grid of latitude/longitude coordinates, topographic correction and altitude▪ ADS : Annotation data set containing various auxiliary information<ul style="list-style-type: none">Scan pixel x and y location at each tie pointTie points grid of Nadir/Forward view elevation and azimuth solar anglesTie points grid of Nadir/Forward view elevation and azimuth satellite anglesOriginal scan and pixel coordinates for nadir/forward views▪ MDS: Measurement Data Set containing distributed geophysical parameters and confidence information.



Name	AATSR Averaged Surface Temperature
Identifier	ATS_AR_2P
Description	This is the global monitoring product for climatological applications and contains averaged surface parameters organised in fixed size cells at different resolutions for angles and lengths.
Product Size	The product covers a whole orbit consisting of approximately 100 minutes of data
Geometrical Sampling	Fixed length grid: 50 km x 50km, 17 km x 17 km Fixed latitude/longitude grid: 30 arc minute x 30 arc minute, 10 arc minute x 10 arc minute
Bits / Pixel	16 bits used for coding geophysical data
Unit	Temperature in K/100 NDVI in (dimensionless)/10000 BT (K/100)/Reflectance ((dimensionless) %/100)
Format	<ul style="list-style-type: none"> ▪ MPH: Main Product Header identifies the product and its main characteristics ▪ SPH: Specific Product Header includes Product Data set Descriptors applying to the whole product, and/or the relevant processing parameters ▪ SST MDS for each cell type, containing Averaged Sea Surface Temperature from single and combined instrument views, statistical parameters computed over the cell, cloud (50 km and 30 arc minute cells only) and confidence information. ▪ LST MDS for each cell type containing Averaged NDVI, statistical parameters computed over the cell, cloud (50 km and 30 arc minute cells only) and confidence information. ▪ BT/TOA MDS Land, for each cell type containing: <ul style="list-style-type: none"> Averaged AATSR channels reflectance and brightness temperature for both nadir and forward views, computed over land for cloud free pixels. Averaged AATSR channels reflectance and brightness temperature for both nadir and forward views, computed over land for cloudy pixels. Statistical parameters computed over the cell for the different channels and views. Confidence information. ▪ BT/TOA MDS Sea, for each cell type and containing: <ul style="list-style-type: none"> Averaged AATSR channels reflectance and brightness temperature for both nadir and forward views, computed over sea for cloud free pixels. Averaged AATSR channels reflectance and brightness temperature for both nadir and forward views, computed over sea for cloudy pixels. Statistical parameters computed over the cell for the different channels and views. Confidence information.

1.2 Data Source

The main AATSR products (GBTR, GST and AST) in this package have been generated using the AATSR Prototype Processor developed by the Rutherford Appleton Laboratory (RAL). Products from the Prototype Processor are identical to those from the Operational Processor within the ENVISAT Payload Data Segment (PDS), with the minor exceptions detailed in section 1.3.

The Meteo and Browse products in this package have been generated using a copy of the Operational Processor, as the Prototype Processor does not support these products. The particular copy of the OP used in this instance is a “stand-alone” version, operated by ESRIN.

The input Level 0 data used to produce all of these products comes from ENVISAT orbit number 02150, acquired on 29 July 2002.

The auxiliary data files included in this package reflect those operating within the PDS at this time (August 2002). All AATSR auxiliary files originate from RAL, and it is the RAL version of these files (with filename `ATS_XXX_AXVRAL.....`) which are included here. When these products are passed on to the PDS (via the IECF), this part of the filename is changed to “IEC”. The generation date, and the validity start and stop times are also modified at this point. It is the IECF version of the auxiliary files which are referenced in the product SPH. However, in the case of AATSR, the IECF does not modify the content of the incoming files, therefore auxiliary files from RAL and from the IECF are equally representative.

The algorithms in the ATSR-2 SADIST processor have been re-used in the AATSR processors wherever possible, to maintain consistency across the missions. The most significant change between ATSR-2 and AATSR has been the introduction of a new geolocation and regridding scheme to make use of the ENVISAT CFIs developed by ESA for time correlation, orbit propagation and geolocation. New features also include operational calibration of the visible channels, the calculation of topographic correction for latitude and longitude and the introduction of NDVI over land.

1.3 Limitations of the Simulated Products

Coverage

AATSR products will be available from the PDS covering up to one complete orbit. However, these sample GBTR, GST and AST products have been generated using a segment (4000 source packets) of orbit 2150, over the Caspian Sea region. The Browse and Meteo products represent the complete orbit.

Format

There are no limitations associated with the format of these AATSR products. The formats are correct with respect to the latest version of the Products Specification.

Contents

The AATSR AST product (`ATS_AR_2P`) from the PDS contains spatially averaged data over both 10 and 30 arc minute cells and 17 and 50 km cells. However, the latter Measurement Data Sets (MDS) are missing in the product provided in this package, as the Prototype Processor does not support 17 and 50 km cell generation.

The GBTR and AST sample products (`ATS_TOA_1P` and `ATS_AR_2P`) from the Prototype Processor also exclude latitude and longitude topographic corrections, although these are available in PDS products. The fields containing the topographic corrections are currently set to zero.

Note that in this particular data set, the sun glint flag is set over approx. half of the Caspian Sea.

1.4 Foreseen Evolutions of the Products

The following placeholders remain in the AATSR products to allow for the development of new or improved algorithms over a longer timescale:

GST Product (ATS_NR_2P)

Parameter	Current Field Contents
Land Surface Temperature	11 micron Brightness Temperature
Cloud Top Temperature	11 micron Brightness Temperature
Cloud Top Height	zero

AST Product (ATS_AR_2P)

Parameter	Current Field Contents
Averaged Land Surface Temperature	11 micron average Brightness Temperature
Averaged Cloud Top Temperature	mean BT of coldest 25% of cloud pixels in cell

1.5 EnviView Special Instructions for AATSR

GST product

The GST product is switchable, meaning that the contents of the MDS depends on the settings of the land/cloud flags. The MDS also contains 2 image fields, the Nadir Field and the Combined Field. The contents of these fields, as reflected in the current version of AATSR sample GST product, are defined as follows:

Nadir View	Forward View	Surface Type	Nadir Field	Combined Field
Clear	Clear	Sea	Nadir only SST	Combined View SST
Clear	Cloudy	Sea	Nadir only SST	11 micron BT
Cloudy	Cloudy or Clear	Land or Sea	CTT (currently 11 micron BT)	CTH (currently set to zero)
Clear	Cloudy or Clear	Land	LST (currently 11 micron BT)	NDVI

The mechanism for viewing these image fields within EnviView is currently as follows:

- Open the GST product.
- Select the **New Image View** menu item from the **View** menu. The Distributed Product MDS will open by default.
- Under **Quantity**, select the required field from the drop down box. Note that the individual flags from the confidence word field can also be viewed in this way.
- Navigate around the image and adjust the colour settings as per the standard EnviView procedures.

AST product

The Measurement Data Sets in the AST product represent images constructed from 10 and 30 arc minute cells, referenced by cell latitude and longitude, rather than pixels in a scan line. These images are therefore displayed on a world map using the EnviView 2-D Map View function, rather than using the Image

Viewer. In this function, each cell is represented by a symbol (a solid box). The symbol size approximates the data sampling area and scales with the axis ranges of the map plot.

Taking the SST record 10 arc minute cell MDS as an example:

- Open the AST product.
- From the **View** menu, select the **New 2-D Map View** menu item.
- Select the data set of interest from the **Data Set** drop-down box, which in this case is **SEA_ST_10_MIN_CELL_MDS** (as this is the first MDS in the set, SEA_ST_10_MIN_CELL_MDS is the default here, so no action is required).
- Select the required field within the MDS under **Value Field** (in this case either the mean dual view SST (**m_dual_vw**) of the mean nadir SST (**m_nad**)) using the drop-down box.
- Enter the start record and the number of records per plot and press enter.
- Zoom in on the area of interest by defining a box starting in the top left hand corner and dragging to the bottom right hand corner. Do not drag select in any other direction as this will reset the map (i.e. revert to a map of the whole world). You can also set the x and/or y scales (latitude and longitude limits) of the display by double-clicking on the relevant axis. Alternatively, you can let EnviView maximise the area of the plotted data by double-clicking the x-axis to activate the Axis Parameters dialogue box, and selecting the Auto radio button.
- Adjust the colour settings/reset the zoom as per the standard EnviView procedures.

Similar instructions apply for the Meteo product.

An example of an AST MDS (10 arc minute SST) displayed in this way is given below. (**NB** this was taken from a previous version of EnviView and the features surrounding the image, and the window itself, has since been redesigned).

