

MEMORANDUM

From : IDEAS QA4EO AATSR QC Team
To : AATSR Users

Document Ref : QA4EO-VEG-OQC-REP-0225
Date : 25 November 2022
Issue : 4
File ID : QA4EO-VEG-OQC-REP-0225_AATSR IPF Change Log_v4

SUBJECT : AATSR IPF Change Log

This technical note summarises the changes made to AATSR processing software since launch.

The most recent available data is that from the fourth reprocessing, completed in 2022; this used AATSR IPF V6.06 or V6.07, and (A)ATSR FAST V2.0.5, due to the implementation of a new processing chain:

1. **AATSR IPF**: processes Level 0 to Level 1A.
 2. **(A)ATSR FAST**: processes Level 1A to Level 1B.
-

Note that updates after May 2012 were not implemented into AATSR *operations* due to the Envisat end of mission.

Periodic reprocessing of the AATSR dataset is undertaken, in order to serve the archive of data with the latest improvements. The first reprocessing was in 2004 with IPF version 5.58. A second reprocessing was completed in 2008 with IPF V6.01. The third AATSR reprocessing was completed in 2013 and used IPF V6.05 and ARC L2P V1.1.

After the change log itself, this document contains the following additional sections:

- [Appendix A](#) gives the date and orbit for each operational IPF processor change at each processing centre.
- [Appendix B](#) shows the date and orbit for each operational L2P processor change.
- [Appendix C](#) lists the auxiliary data files used in AATSR processing.
- [Appendix D](#) contains the glossary.

Changes for the Fourth Reprocessing

The fourth reprocessing generated L1B products only; Level 2 products are now under the auspices of the ESA CCI LST and SST projects.

Additional auxiliary data files that were used for the first time in the fourth reprocessing are listed in [Appendix C](#).

The software version of FAST used to generate a L1B product is given in the product's xfdumaniest XML file.

The software version of the IPF used to generate a L1A product is given in the product's MPH (this is not generally available to users).

23 February 2021 – FAST V2.0.5 (Level 1B) and auxiliary data update (CH1) and new files

The FAST processor was introduced primarily to align the AATSR product format with that of its successor instrument, SLSTR. The opportunity was also taken to implement some improvements, which are listed below. The date given above is that on which the installation of the processor in readiness for the AATSR reprocessing was accepted.

In summary, the specific improvements were:

- Generation of L1B products in Sentinel/SAFE-like format (NetCDF plus XML metadata);
- Colocation between forward and nadir views was improved (via update to ATS_CH1_AX);
- Surface classification was improved (via use of Sentinel LSM);
- Measurement uncertainty estimates were included for the first time (via improved L1A and new ATS_UNC);
- Orthogeolocation to a DEM was implemented (via use of DEM GETASSE30 and EO CFI);
- Geolocation was improved, via use of orthogeolocation and attitude files (AUX_FRA).

22 May 2018 – IPF V6.07 (Level 1A)

There were a relatively high number of processing failures with IPF V6.06. IPF V6.07 corrected the issue and allowed further successful reprocessing. The date given above is that on which the installation of the processor in readiness for the reprocessing was accepted.

The correction made was:

- Remove incorrect assumption regarding input products in order to allow successful processing of products that failed using IPF V6.06.

28 February 2017 – IPF V6.06 (Level 1A) and auxiliary data update (GC1)

IPF V6.06 was adapted in order to generate output in the necessary format for input to the FAST processor (see above). The date given above is that on which the installation of the processor in readiness for the reprocessing was accepted.

In summary, the main changes were:

- Process Level 0 products to Level 1A, in the required format;
- Incorporate previously disregarded Level 0 instrument information in order to feed through to the L1B products.

The correction made was:

- Incorporate the adjustment to the 12 μm (S9) channel, which showed evidence of a small temperature-dependent discrepancy. Previously, users had to apply the correction themselves (via update to ATS_GC1_AX).

Changes prior to the Fourth Reprocessing

The items below refer to processor and auxiliary data changes from launch of mission to the completion of the third AATSR reprocessing in 2013. Data were either in Envisat format or NetCDF.

The listing below includes the L2P processor, which was first introduced into the ESA operational processing chain on 01 December 2008.

The software version used in the processing of a particular Envisat-format product can be determined from that product's Main Product Header (MPH); please refer to the AATSR handbook for further details:

<https://earth.esa.int/eogateway/documents/20142/37627/AATSR-product-handbook.pdf/5c3e92c6-a8fd-7d16-b0a8-2fe07bd9f39e>.

28 February 2013 – ARC L2P V1.1

A complete change of L2P processor has taken place, and new ARC L2P (and L3U) products in GHRSSST Data Specification (GDS 2.0) NetCDF format will be produced. The ARC L2P products contain ARC SSTs generated from the reprocessed L1B products, i.e. the L2P SSTs are no longer extracted from the L2 NR products. The ARC L2P processor includes:

- Bayesian cloud detection;
- The ARC SST retrieval algorithm;
- The ARC SST uncertainty model.

The L3U product is an entirely new product for AATSR and contains the ARC L2P dataset remapped onto a regular lat/lon grid.

20 December 2012 – IPF V6.05 and auxiliary data updates (SST, CL1, CH1, PC1, VC1)

IPF V6.05 was in preparation for operational deployment when the Envisat end of mission was declared on 09 May 2012. Although it did not become operational, V6.05 is used in the third AATSR reprocessing in 2013; the date given above is that on which the installation of the processor in readiness for the reprocessing was accepted.

In summary, the specific improvements are:

- SST retrievals within the Envisat L2 product improved via the use of updated SST coefficients from the ARC project (update to ATS_SST_AX);
- Cloud test corrections, which may improve detection (update to ATS_CL1_AX);
- Colocation between forward and nadir views improved (update to ATS_CH1_AX);
- Absolute nadir geolocation accuracy improved (update to ATS_CH1_AX);
- Improved extraction of visible calibration data (update to algorithm and ATS_PC1_AX);
- A regenerated VC1 dataset containing the best-available measured long-term drift corrections was delivered (L1B headers contain the name of the drift table used in the viscal long-term drift correction).

The corrections made were:

- Reference document field in the MPH was corrected to indicate the right version;

- A debug option was removed when building the IPF (this had caused spurious processing failures);
- MPH/SPH fields mismatch in the identification of OSV files was corrected.

18 October 2010 – auxiliary data updates for mission extension: LST, CL1, PC1

An update of some auxiliary files was required for the new phase:

- ATS_LST_AX file: Phase MPH field set to X (in line with the other ADFs; contents unchanged);
- ATS_CL1_AX: validity range was extended to cover the whole mission (contents unchanged);
- ATS_PC1_AX: file contains the orbit period, so two versions were now required, one with the orbit period before the mission extension and one with the orbit period after the mission extension, with validity ranges set appropriately.

16 June 2010 – IPF V6.03

In preparation for the Envisat 2010+ mission extension, the IPF was updated to use the new Envisat CFI V5.8.1 (the CFI software is a set of pre-compiled libraries for timing, coordinate conversion, orbit propagation, satellite pointing and target visibility calculations). At the same time, the opportunity was taken to ensure that the AST confidence word was initialised correctly.

04 November 2009 – L2P V1.5.

This version of the processor changes the order of two records in the metadata (FR_Revision_History and FR_Last_Revision_Date are swapped); no changes were introduced to the L2P products themselves.

28 September 2009 – IPF V06.02L02

The AATSR processor platform was ported from AIX to Linux, changing the IPF version number to V06.02L02. Please note that this is NOT a change of algorithm and due to an extensive validation process the change should be transparent to users.

29 May 2009 – L2P V1.5

This version implemented the following changes:

- Inclusion of AOD information (field aerosol_optical_depth);
- Inclusion of satellite observation minus SST analysis (field DT_analysis);
- Latitude and longitude coordinates are now provided for the pixel centre;
- UTC keyword now contained in start_time and stop_time fields in MPH;
- The view difference dataset (atsr_dual_nadir_diff) has been masked so as to provide values only for pixels where the SST is provided.

26 February 2009 – L2P V1.1 (no change in processor version number)

The processor was updated to change the formatting of the xml files associated with the L2P product; no change was made to the content of the L2P product itself.

01 December 2008 – L2P V1.1

Initial version (for NRT data only).

Generation of the AATSR L2P product was initiated by the DUE Project Medspiration, as part of the European contribution to [GHRSSST](#). In December 2008 ESA took over the responsibility of producing L2P products as part of AATSR operations.

20 July 2007 – auxiliary data update: CH1, GC1, INS, LST, PC1

The validity range of several auxiliary files was updated to provide continued coverage in line with the validity range of other auxiliary files. The content of these files was unaffected.

02 July 2007 – IPF V6.01

The patch introduced with IPF V6.01 corrects for an erroneous calculation of the ANX during consolidated processing, leading to missing Visca GADS in the L1B products.

28 March 2007 – IPF V6.0 and auxiliary data update (ATS_CL1_AX)

IPF V6.0 includes improvements to the LST algorithm and cloud clearing tests. These changes affect both the Level 1 and Level 2 processing. In summary the specific improvements are:

- The improvement of the performance of the cloud clearing tests over land;
- An improved treatment of pixels in areas of marginal cloud;
- To enable the LST retrieval over inland lakes;
- To implement and test the spatially averaged LST retrieval.

To support the updated cloud regimes, a new ATS_CL1_AX file was delivered.

01 February 2007 – auxiliary data update: ATS_VC1_AX

Delivery of orbital ATS_VC1_AX files commenced, alongside delivery of daily files.

18 January 2007 – IPF V5.60

The patch was to correct for two previously identified problems in the software: inconsistent values in AST confidence word and cloud flagging errors leading to bands of missing data in AATSR consolidated data. Further information is contained in the AATSR Cyclic Report 54 (see

<https://gras.earth.esa.int/?mis=Envisat&ins=AATSR&vby=year&dts=2003-01-01&dot=Quality%20Control%20Report&slc=list&sho=100>)

18 December 2006 – auxiliary data update: ATS_VC1_AX

ATS_VC1_AX files were modified to include the updated behaviour model of the visible channel long-term drift.

15 June 2006 – processing configuration update

A configuration file governing the behaviour of the AATSR IPF was updated so that it used the averaged data cell size value (50 km) as given in the ATS_PC2_AX file rather

than overriding with a fixed value (48 km). This change did not require any modification to the IPF or auxiliary data.

07 December 2005 – auxiliary data update: ATS_SST_AX

Revised SST retrieval coefficients were introduced in the ATS_SST_AX file. The retrieval coefficients previously in use were based on the same atmospheric spectroscopy as was originally used for ATSR-1 and ATSR-2, which pre-dated more recent releases of the HITRAN molecular spectroscopy database. The new set of retrieval coefficients were based on the HITRAN 2000 database.

29 November 2005 – auxiliary data update: ATS_VC1_AX

Daily ATS_VC1_AX files were modified to account for long-term visible channel drift.

14 December 2004 – auxiliary data update: ATS_GC1_AX

New ATS_GC1_AX file supplied, to correct the application of the 1.6 micron non-linearity correction.

12 August 2004 – auxiliary data update: ATS_PC1_AX

A new ATS_PC1_AX file was supplied, updated with revised solar irradiance data (carried through into the output Viscal GADS in the L1B product).

July 2004 – IPF V5.59

Update containing:

- A change to the facility responsible for setting the REF_DOC field in the MPH (from PFHS to IPF);
- A change to the internal handling of CFI warning messages.

Neither of these changes have any impact on the delivered data.

March 2004 – IPF V5.58

Update containing:

- A new L2 LST retrieval algorithm (only applied within the ATS_NR__2P product, not available in ATS_AR__2P);
- A further modification to the Viscal search algorithm to allow it to search backwards from the time of the OSV in the MPH (required for NRT data which is not partitioned from ANX to ANX and where the Viscal peak may precede the OSV).

January 2003 – IPF V5.55

Update containing modifications to the Viscal algorithm, and associated ATS_PC1_AX auxiliary file. The original Viscal algorithm did not work with real AATSR data because of undocumented differences in Viscal monitor sampling between ATSR-2 (from which all test data were derived) and AATSR. The Viscal GADS in all L1B data generated prior to this date were missing.

November 2002 – auxiliary data update: ATS_CH1_AX

New ATS_CH1_AX file submitted to the PDS containing updated misalignment parameters, AOCS parameters and regridding tolerances. This improved the colocation between the forward and nadir views.

October 2002 – auxiliary data update: ATS_INS_AX

New ATS_INS_AX file supplied to prevent spurious BBU temperature validation warnings (internal issue, not visible in delivered data).

September 2002 – auxiliary data update: ATS_VC1_AX

New ATS_VC1_AX file supplied to correct scaling errors in pre-launch file (shortly after, replaced by daily VC1 files provided by the AATSR Flight Operations Support Team).

July 2002 – IPF V5.52

Internal change (i.e. not affecting the processing algorithms) applied to address an overflow problem with the variable SAT_BINARY_TIME.

June 2002 – IPF V5.02

Scan jitter error corrected. The IPF wrongly treated scans affected by scan mirror jitter as invalid, resulting in missing scans on images.

Browse algorithm modified to provide visual improvements. Histogram equalisation was removed from the daytime algorithm and the night-time algorithm concept was simplified.

February 2002 – IPF V5.01

Launch version.

Appendix A: Details of IPF Changes at AATSR Processing Facilities

The following table shows the dates (and orbits) of the first product processed with the new IPF version for each processing centre. As this Appendix was added to the change log after the second AATSR reprocessing, IPF changes prior to version 6.01 are not included here.

Please note that the dates given in the table refer to the acquisition date of the product in question and are not the dates of implementation at the processing centres (although this is generally the same for NRT processing but not for consolidated data). Processing time information is available from the product MPH.

Table 1 IPF Version Implementation Details

IPF Version	NRT		Consolidated
	ESRIN (PDHS-E)	Kiruna (PDHS-K)	UK-MM-PAF
6.05	Not implemented in operations; used in third AATSR reprocessing		
6.03	16/06/10 (orbit 43369)	16/06/10 (orbit 43361)	17/06/10 (orbit 43379)
6.02L02	28/09/09 (orbit 39623)	28/09/09 (orbit 39624)	28/09/09 (orbit 39632)
6.01	02/07/07 (orbit 27910)	02/07/07 (orbit 27902)	23/07/07 (orbit 27702)

The third AATSR reprocessing, with IPF V6.05, has been conducted after the end of the mission and so covers all available data. All archived AATSR data received by users should have been processed with IPF V6.05.

Appendix B: Details of L2P Processor Changes at UK-MM-PAF

The following table shows the dates (and orbits) of the first product processed with new L2P processor versions at UK-MM-PAF for both NRT and consolidated data.

Please note that the dates given in the table refer to the acquisition date of the product in question and are not the dates of implementation (although this is generally the same for NRT processing).

Table 2 L2P Processor Version Implementation Details

L2P Processor Version	UK-MM-PAF	
	NRT	Consolidated
ARC L2P V1.1	Not implemented in operations; used in third AATSR reprocessing	
L2P V1.5.	04/11/09 (orbit 40163)	All data
L2P V1.5	29/05/09 (orbit 37885)	(not used)
L2P V1.1	6/02/09 (orbit 36565)	(not used)
L2P V1.1 (Initial version)	01/12/08 (orbit 35316)	(not used)

Following the third AATSR reprocessing, all AATSR L2P and L3U archived products should have been processed with ARC L2P V1.1.

Appendix C: AATSR Auxiliary Data Files (ADFs)

The list of auxiliary files in use operationally at any particular time was included in the AATSR Cyclic Reports:

<https://gras.earth.esa.int/?mis=Envisat&ins=AATSR&vby=year&dts=2003-01-01&dot=Quality%20Control%20Report&slc=list&sho=100>.

AATSR processing uses the following instrument-specific auxiliary data files:

- Browse Product Lookup Data (ATS_BRW_AX)
- L1b Characterisation Data (ATS_CH1_AX)
- Cloud Lookup Table Data (ATS_CL1_AX)
- General Calibration Data (ATS_GC1_AX)
- AATSR Instrument Data (ATS_INS_AX)
- Visible Calibration Coefficients Data (ATS_VC1_AX)
- L1b Processing Configuration Data (ATS_PC1_AX)
- L2 Processing Configuration Data (ATS_PC2_AX)
- SST Retrieval Coefficients Data (ATS_SST_AX)
- LST Land Surface Temperature Coefficients Data (ATS_LST_AX)

Please be advised that because the PC1 file contains the orbit period, two versions need to be maintained following the execution of the mission extension orbit manoeuvres in October 2010 (Envisat 2010+).

AATSR processing also uses the following generic Envisat ADFs:

- Land/Sea Mask Data (AUX_LSM_AX)
- Digital Elevation Data (AUX_DEM_AX)
- Orbit State Vector Data (various, see below)

Several datasets are available for use as the Orbit State Vector data:

- DORIS Precise Orbit State Vectors (DOR_VOR)
- Envisat Restituted Orbit State Vectors (AUX_FRO)
- Envisat Predicted Orbit State Vectors (AUX_FPO)

The DOR_VOR files were used preferentially for the third reprocessing; the AUX_FPO files were used for the production of NRT data and the AUX_FRO for the operational processing of consolidated products.

Additional auxiliary datafiles were introduced for the fourth reprocessing:

- Envisat Restituted Attitude State Vectors (AUX_FRA)
- Sentinel Land/Sea Mask Data (replacing LSM specified above)

(coastline_bitmask_geo_bc.tif, land_water_bitmask_geo_bc.tif,
tidal_regions_bitmask_geo_bc.tif, open_ocean_bitmask_geo_bc.tif)

- DEM GETASSE files (replacing DEM specified above) (DEM_GETASSE30_V3)
- Quality Information LUT (ATS_QI_LUT)
- Channel-specific Uncertainty LUTs (ATS_UNC_S*_LUT)
- ERA-Interim Meteorological GRIB data (AUX_MET)

Appendix D: Glossary

The following terms and abbreviations have been used throughout this document:

AATSR	Advanced Along-Track Scanning Radiometer
AIX	IBM operating system based on Unix
ANX	Ascending Node Crossing (time when crossing the equator on the ascent)
ADF	Auxiliary Date File
AOCS	Attitude and Orbit Control System
ARC	(A)ATSR Reprocessing for Climate
AST	Averaged Surface Temperature
ATSR-1,-2	Along-Track Scanning Radiometer 1, 2
BBU	Black Body electronics Unit
CCI	Climate Change Initiative
CFI	The Envisat CFI software
Envisat 2010+	The Envisat mission extension project
EO CFI	ESA's Earth Observation CFI software for navigation
FAST	From AATSR to SLSTR-like Tool
GADS	Global Annotation Data Set
GHRSSST	Group for High Resolution SST
IPF	Instrument Processing Facility
LST	Land Surface Temperature
LUT	Look-Up Table
L1B	Level 1B products
L2	Level 2 products
L2P	L2 (full-resolution) products in netCDF, with ancillary data
OSV	Orbit State Vector
MPH	Main Product Header
NRT	Near Real Time
NWP	Numerical Weather Prediction
PDS	Payload Data Segment
PDHS	Payload Data Handling Station
PFHS	Processing Facility Host Structure
SLSTR	The Sea and Land Surface Temperature Radiometer
SST	Sea Surface Temperature
UK-MM-PAF	UK Multi-Mission Product Archive Facility
VC1	Visible Calibration auxiliary files
Viscal	Visible calibration (system)

A further list of acronyms and abbreviations is included in the AATSR handbook, available from:

<https://earth.esa.int/eogateway/documents/20142/37627/AATSR-product-handbook.pdf/5c3e92c6-a8fd-7d16-b0a8-2fe07bd9f39e>