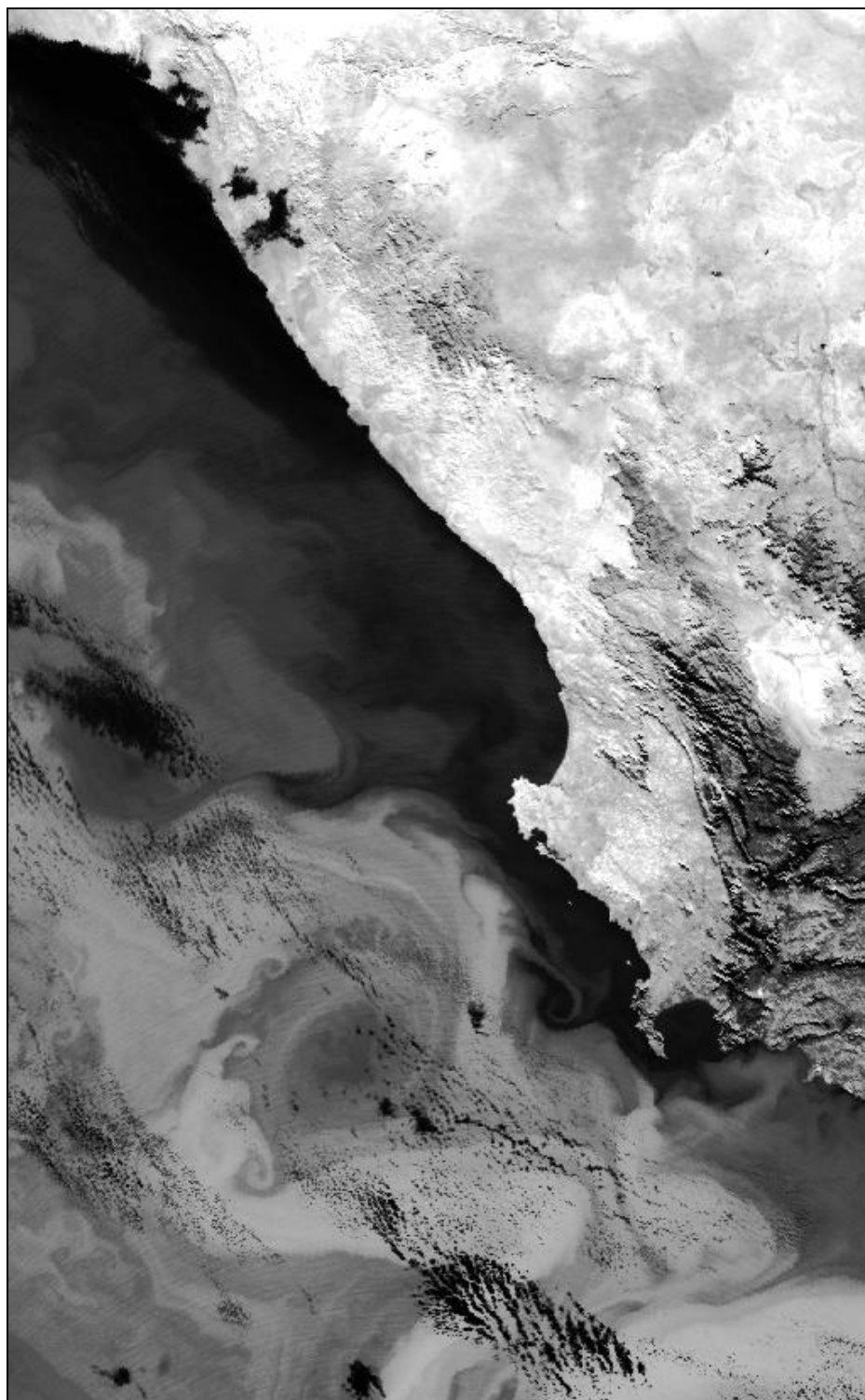
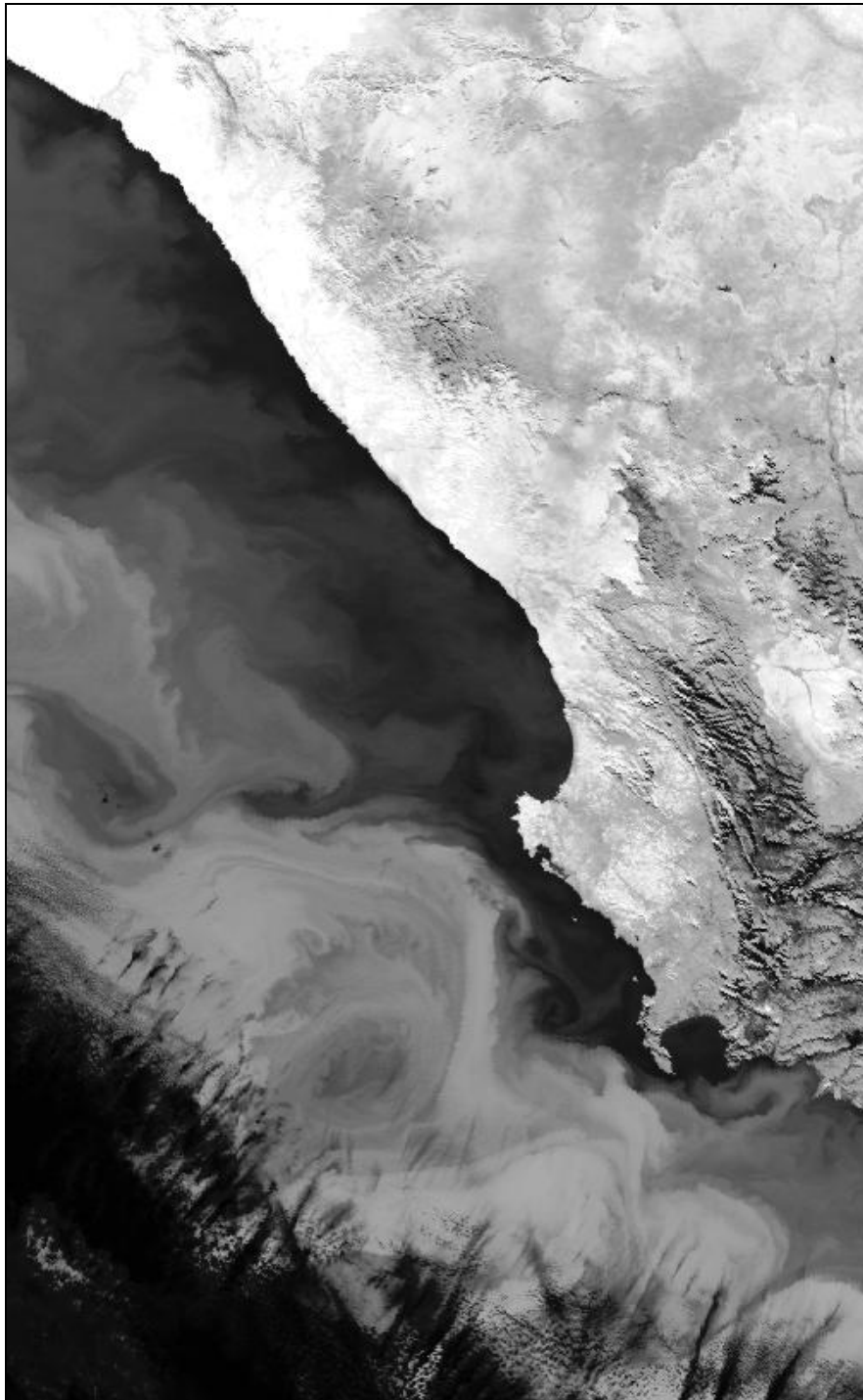


Envisat-style products for ATSR-1 and ATSR-2 data

APP-TN-005
(Issue 3.0, 29th January, 2014)



The cover picture shows the 11 μ m brightness temperature around the south-west coast of South-Africa as acquired by ATSR-1 on the first of June 1995. Note the complex thermal structure resolved in the sea-surface temperature. The image below was acquired on the following day by ATSR-2 and shows how the major thermal structures persist but also shows development in the fine structure. Both images were created from Envisat-format ATS_TOA_IP products read by and displayed with the Brockmann Consult BEAM (VISAT) software.



Document Change Record

Issue 1.0	24 Nov, 2005	Level_1B products only, first issue
Issue 1.1	06 June, 2006	Updated with corrections, still L1B only
Issue 2.0 (Draft for comment)		L2 products included
Issue 2.0	01 June, 2007	Updated following comments received.
Issue 3.0 (Draft for comment)		Updated to match 3 rd reprocessing
Issue 3.0	29 January, 2014	Updated as per recommended amendments

Note: Changes with respect to Issue 2.0 are indicated with a change bar on the right-hand side (as here). A change bar next to blank space indicates text has been removed as it no longer applies in the case of ATSR products from the 3rd reprocessing.

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1 Purpose

The purpose of this document is to identify differences between AATSR data products generated by the Envisat PDS and the corresponding ATSR-1/ATSR-2 products generated by the (A)ATSR Archive Product Processor (APP). The latter are designed to match the former. This match is very close, but, owing to instrument and/or mission differences, it is not exact. Indeed, in order to distinguish between the instruments during periods of mission overlap, some content difference is essential.

This version of the document relates specifically to the content of ATSR-1 and ATSR-2 products from the third reprocessing.

N.B. This document does not attempt to describe the Envisat format - readers are assumed to be familiar with it. Anyone unfamiliar with this format should study the general and AATSR-specific sections of:

Envisat-1 Products Specifications PO-RS-MDA-GS-2009 [R1]

2 Generic Issues

2.1 Approach

Until the advent of the (A)ATSR series Archive¹, only AATSR products were available in the Envisat standard format [R1]. Now, ATSR-1 and ATSR-2 data are also available from this archive in Envisat format. These products adhere precisely to the Envisat *format* definition for AATSR ATS_TOA_1P, ATS_NR__2P and ATS_AR__2P products [R1]. In general, the *content* also matches the expected content for such products. There are exceptions, however, where mission limitations (wrt AATSR) do not allow exact content matching. These exceptions are dealt with in this document.

In the rest of this document, whenever ATSR is used, it means both ATSR-1 and ATSR-2. If ATSR-1 is used it means only ATSR-1. If ATSR-2 is used, it means only ATSR-2.

2.2 Product Naming Convention

The generic Envisat name form is defined in [R1]. ATSR products adhere to this form, as follows, for L1B, L2/NR, L2/AR and L2/MET respectively:

```

ATn_TOA_1PURALYYMMDD_HHMMSS_00000000NMMM_RRR_AAAAA_0000.En
ATn_NR__2PURALYYMMDD_HHMMSS_00000000NMMM_RRR_AAAAA_0000.En
ATn_AR__2PURALYYMMDD_HHMMSS_00000000NMMM_RRR_AAAAA_0000.En
ATn_MET_2PSRALYYMMDD_HHMMSS_00000000NMMM_RRR_AAAAA_0000.En

```

Note:

1. **AT1** for ATSR-1 and **AT2** for ATSR-2 replaces the ATS used for AATSR products.
2. The **YYMMDD_HHMMSS** date string shows the sensing start.
3. The **00000000** is an unused field for ATSR.
4. The **NMMM** field is the mission phase (**N**) and cycle (**MMM**). For ERS-2 the cycle duration was fixed throughout the mission (as for Envisat). For ERS, the phases are defined below (3.6).
5. The **RRR** field is the relative orbit number and **AAAAA** is the absolute orbit number.
6. For ERS/ATSR-1, if ever the relative orbit number, cycle or phase are undefined or unknown, the exception values 999, 999 and 9 (respectively) will be used.
7. The **0000** field is the Envisat “product type file counter” and is not used for ATSR.
8. The extensions **.E1** and **.E2** are used to distinguish ATSR-1 (ERS) and ATSR-2 (ERS-2) from AATSR (ENVISAT) products, where the extension **.N1** is used.

¹ Hosted by the NEODC at RAL and funded by DECC, with a copy hosted by ESA at the UK-PAC.

2.3 The Main Product Header (MPH)

All Envisat-style products have a common MPH format [R1]. ATSR products match this format but the content differs from the AATSR MPH (3rd reprocessing) as follows:

1. The ACQUISITION_CENTER field is set to "ERS Stations" ² as more than one ground station may have been used in the L0 data acquisition.
2. The PROC_CENTER field is set to "RALxyz" where xyz is used to flag when specific, additional ERS-related processing stages/conditions were applied/met during generation of the product. E.g. "RAL " (i.e. xyz is three space characters) indicates no additional processing stage has been used in the generation of this product. In particular, in the case of ATSR-2, and after the ERS-2 platform lost all gyro control (January 2001), an attitude correction, if available, improves geolocation and co-location of the two ATSR-2 views. This correction information is not always available. Where a correction is possible, and has been applied to the orbit in question, the letters Y, F or B are used in the x position of this field:
 - a. "RALY " indicates a yaw correction was applied to that orbit during the processing run.
 - b. "RALF " indicates that a fine-pointing correction was applied to that orbit during the processing run.
 - c. "RALB " indicates that both corrections were applied³.

Occasionally, the PROC_CENTER field will be set to "RALxyU", and this can occur for both ATSR-1 and ATSR-2. The U indicates that during at least one frame (512 scan rows) of the input data, the ERS platform was in an unknown attitude mode. Note, unknown means just that, and not that it was (necessarily) in a poor attitude mode.

3. For L1B products, the SOFTWARE_VER field is set to "STEP/1.4", where STEP is the L1 → L1B component of the APP and 1.4 is the version number. For L2 products, the SOFTWARE_VER field is set to "Prt2-L/0.7".
4. All times appearing in an Envisat MPH are given to 6 places of decimals in the "seconds" part of the time field. This is also the case for ERS/ATSR, but note that for these missions, some of the times are available to three places of decimals only, and so, in these cases, zero-padding is used.
5. The PHASE field is used in the following way:
 - a. For ERS-2/ATSR-2 set to 1 for the entire mission
 - b. For ERS/ATSR-1 set as follows:
 - i. 1 – Commissioning Phase (3-day repeat starts 25-Jul-91)

² The spaces within quotation marks here and elsewhere appear as they would in the actual products.

³ Note that B does not necessarily imply better correction!

AATSR has all its seven channels available continuously while it is in “measurement mode”.

ATSR-1 has only 4 of these channels – the four longest wavelength infrared channels.

- The failure of the 3.7 μm channel on May 27, 1992, means that only 4-channel SST retrievals are available from that date up to the nominal end-of-mission in June 1996.
- After the 3.7 μm channel failure, the 1.6 μm data are available continuously.
- NDVI information is unavailable as the 3 shorter wavelength reflectance channels on ATSR-2 and AATSR were not fitted. Exception values fill the NDVI fields [R1].

ATSR-2 has all seven of the AATSR channels, but they are not all continuously available.

- The four reflectance channels are not continuously available for ATSR-2 [R3]. Exception values are used to flag unavailable data [R1].
- ATSR-2 switches telemetry-rate between H-Rate and L-Rate [R3]. There is nothing defined in the Envisat/AATSR L1b product to flag these events.
- ATSR-2 switches between Pixel Selection Maps (PSM) [R3]. There is nothing defined in the Envisat/AATSR L1b product to flag these events.
- While the instrument is in H-Rate, the 3.7 μm and 1.6 μm channels are both available. When in L-Rate and on the dayside, the 3.7 μm or 1.6 μm channel data are available, but not both [R3].

Although the Envisat-format product headers give no direct insight into which ATSR-2 pixel-map and telemetry-rates were used during acquisition, the L1B products processing logs are available in the Archive and these do list pixel-map and telemetry rates in use during each product.

Note also:

- For AATSR the number of jittered scans is detected in the L0 \rightarrow L1 processing and recorded in the Summary Quality ADS (SQADS). This jitter-flagging is not available in the SADIST-2 input products and consequently cannot be flagged for ATSR
- The reflectance channels’ calibration coefficients Global Annotation Data Set (GADS) is not available for the ATSR data products. For ATSR-1, this is not possible as there is no VISICAL unit and so an equivalent calibration of its 1.6 μm channel is not possible. For ATSR-2 a logically different approach is adopted, with respect to that for AATSR, and although this approach is algorithmically equivalent, no GADS is produced.

4.3 *The Measurement Data Sets (MDS)*

The format of the MDS is defined in [R1]. ATSR products adhere to this format. The following lists ATSR specific points of which users should be aware:

1. For ATSR-1, there is only one reflectance channel - at 1.6 μ m. Prior to the 3.7 μ m channel failure, data from this reflectance channel were acquired only during the day-side part of the orbit. After the failure, the 1.6 μ m data were also acquired during the night-side part of the orbit.
2. For ATSR-1, the 3.7 μ m channel MDS is filled with the appropriate exception value [R1] for products generated from data acquired after its failure.
3. For ATSR-1 the three absent short wavelength channels' MDS are filled with the appropriate exception value [R1].
4. For ATSR-2, the reflectance channels data were not acquired during the night-side of the orbit. During these periods, the MDS measurement fields are filled with the appropriate exception value [R1].
5. For ATSR-2, during the day-side of the orbit, as the instrument switches between telemetry rates and PSM's, some reflectance channels data are unavailable [R3]. During these periods, the MDS measurement fields hold the appropriate exception value [R1].
6. For ATSR, the Record Quality Indicator field (REC_QLTY_INDIC) is unused and always set to zero. Product users should inspect the Confidence Words MDS to assess data quality.

5 The ATS_NR__2P Product (Level 2 Gridded)

5.1 The SPH

Most of the content of the SPH of these products is copied from the corresponding ATS_TOA_1P product and so the comments in section 4.1 apply here also. In addition:

- In the “DISTRIB_SST_CLOUD_LAND_MDS” DSD, the FILENAME field is filled for ATSR whereas it is empty for AATSR. The filename given should be ignored.

5.2 The ADS

The seven ADS in these products are copied over from the corresponding L1B products. See section 4.2 for any differences between the AATSR and ATSR cases.

5.3 The MDS

1. The REC_QLTY_INDIC field is unused in ATSR products and set to zero.
2. The three SPARE fields following the REC_QLTY_INDIC field are all set to zero in the case of ATSR, but all set to 32 in the case of AATSR.

There are no other known differences, but remember the ATSR-1, ATSR-2 and AATSR instrument differences mentioned in section 3 regarding the availability of any given channel in ATSR products. Where the channel is unavailable, this can impact the possibility of deriving, or the method of deriving, retrieved quantities. So:

- The NDVI cannot be derived in the absence of the 0.67 μ m or 0.86 μ m channels.
- SST retrieval approach is affected by the absence of the 3.7 μ m channel.

The appropriate Envisat/AATSR product exception values are used whenever retrieved quantities cannot be derived [R1].

6 The ATS_AR__2P Product (Level 2 Averaged)

6.1 *The SPH*

In the DSD for all equi-angular grids MDS, the FILENAME field is space-filled in the AATSR case but contains the [APP] name of the parent product in the ATSR case. This name is of no consequence and may be safely ignored⁵.

6.2 *The ADS*

There are no ADS in the ATS_AR__2P product.

6.3 *The MDS*

Only 2 of the 4 AATSR grids are present in the ATSR case. The 10 and 30 arc-minute grids are present, the 17 and 50 kilometre grids are not. This is reflected in the SPH and its DSD.

There are no other known differences, but remember the ATSR-1, ATSR-2 and AATSR instrument differences mentioned in section 3 regarding the availability of a given channel in ATSR products. Where the channel is unavailable, this can impact the possibility of deriving, or the method of deriving, retrieved quantities. So:

- The NDVI cannot be derived in the absence of the 0.67 μ m or 0.86 μ m channels.
- SST retrieval approach is affected by the absence of the 3.7 μ m channel

The appropriate Envisat/AATSR product exception values are used whenever retrieved quantities cannot be derived [R1].

⁵ The occurrence of this name is a relic from the Level 2 prototype processor, the precursor of the APP's Level 2 processor.

7 The ATS_MET_2P Product (Level 2 METEO)

7.1 *The ADS*

There are no ADS in the ATS_MET_2P product

7.2 *The MDS*

There are no other known differences, but remember the ATSR-1, ATSR-2 and AATSR instrument differences mentioned in section 2 regarding the availability of a given channel in ATSR products. Where the channel is unavailable, this can impact the possibility of deriving, or the method of deriving, retrieved quantities. So, in the case of the METEO product:

- SST retrieval approach is affected by the absence of the 3.7 μ m channel

8 References

R1	Envisat-1 Products Specifications	PO-RS-MDA-GS-2009
R2	ATS_TOA_UP Definition Document	APP-TN-002
R3	ATSR-1/-2 User Guide	C.T. Mutlow et al

9 Glossary

AATSR	Advanced Along-Track Scanning Radiometer
ADS	Annotation Data Set(s)
APP	[(A)ATSR] Archive Product Processor for Level 1B
APP2	[(A)ATSR] Archive Product Processor for Level 2
ATSR	Along-Track Scanning Radiometer
DEFRA	Department for Environment, Food and Rural Affairs
DS	Data Set
DSD	Data Set Descriptor(s)
GADS	Global Annotation Data Set
H-Rate	High Rate [telemetry]
L-Rate	Low Rate [telemetry]
L0	Level 0 [product]
L1	Level 1 [product]
L1B	Level 1B [product]
MDS	Measurement Data Set(s)
MPH	Main Product Header(s)
NEODC	NERC Earth Observation Data Centre
NERC	Natural Environment Research Council
PP	Prototype Processor
PSM	Pixel Selection Map
RAL	Rutherford Appleton Laboratory
SPH	Specific Product Header(s)
SQADS	Summary Quality Annotation Data Set
wrt	with respect to