



ATSR-1 and ATSR-2 Corrupted Products

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AMENDMENT RECORD SHEET

The Amendment Record Sheet below records the history and issue status of this document.

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1. ATSR-1 FATAL-ERROR PRODUCTS

1.1 Statement of problem

The Validation Team had problems processing a small subset of ATSR-1 NR products from the third reprocessing dataset. The issue was that the products contain one less granule of data in the MDS than indicated by the number of times the attachment flag is set in the ADS. This resulted in problems in the batch processing of ATSR-1 NR products.

Investigations by RAL revealed that the NR log files contained the following:

```

Initial value for instrument scan number (s0) 32
Drift_interpolate: Time of scan greater than orbit temperature file
ERROR NUMBER 4:1
FATAL ERROR: Unable to interpolate SST coefficients in module derive_gridded_products.c,
line 890

```

The associated AR log files contained the following:

```

Incomplete granule found at image row 27649 whilst initializing ten arc minute cell
107127:0
length scale of 31 used in instrument scan time interpolation

```



ERROR NUMBER 4:1

FATAL ERROR: scan number 27650 ads number 864 or record_number 865 out of range for SCAN_PIXEL_X_AND_Y_ADS

module get_aarp_gbtr_and_position.c, line 508

Both NR and AR logs contained the final line:

Abnormal program termination

The TOA log file for these cases did not reveal a fatal error but showed:

WARNING: End of processing not found in input data

Scans by RAL of all ATSR-1 and ATSR-2 NR processing logs revealed 146 ATSR-1 cases and 0 ATSR-2 cases of this fatal error.

1.2 Systematic QC

The IDEAS systematic QC report¹ on ATSR-1 and ATSR-2 third reprocessing data revealed a number of minor quality issues with the datasets, including products with invalid last longitudes and latitudes in the SPH (originating in the TOA and cascading down to the Level 2 products). All quality issues were referred to RAL. A visual examination of the contents of a few of these products appeared to show that the MDS contents were of acceptable quality, so the decision was taken to keep all products in the archive. A check of a small number of products showed them to be available in v2.0.

Comparison of the 243 ATSR-1 NR products affected by invalid last latitudes/longitudes with the 146 fatal-error NR products revealed that the fatal-error NR products are a subset of the invalid latitude/longitude products. Table 1 shows the number of products affected, for all Envisat-format products and NR products only. For context, the total number of Envisat-format products is ~112,000 for ATSR-1 and ~186,000 for ATSR-2.

Table 1. Number of ATSR-1 and ATSR-2 products affected by noted quality issues

		ATSR-1	ATSR-2
Invalid last latitudes/longitudes (all Envisat-format products)		1156	344
Invalid last latitudes/longitudes (NR products only)		243	70
NR products with fatal error		146	0
<u>Length of products:</u>	Nominal	0	0
	Short*	1151	334
	Long*	5	10
*Short and long if the product length differs from the nominal length of 6038 seconds (from SPH first and last line times) by more than two granules (11 seconds).			

Further investigations revealed that none of the invalid last longitude/latitude products were of nominal length, i.e. they did not cover ANX–ANX, as nominal operations. The range of product lengths was 81–6091 s. Table 1 also displays the number of products that were short or long.

¹ ATSR-1 and ATSR-2 Reprocessing Systematic QC Investigation (IDEAS-VEG-OQC-REP-1331, v1.0, 4th September 2013)

1.3 Comparison between fatal-error and non-fatal-error products

A visual inspection of selected fatal-error and non-fatal-error products was undertaken. The non-fatal-error products were those that had invalid last latitude/longitude values in the SPH but no fatal error in the NR processing logs. Comparisons were made between products that were matched in terms of relative orbit and phase. Table 2 shows the two example sets of data.

Table 2. Two sets of data for comparison with matching relative orbit and phase

Fatal-error	Non-fatal-error
AT1_TOA_1PURAL19930629_053846_000000004014_00047_10212_0000.E1	AT1_TOA_1PURAL19930525_053846_000000004013_00047_09711_0000.E1
AT1_NR_2PURAL19930629_053846_000000004014_00047_10212_0000.E1	AT1_NR_2PURAL19930525_053846_000000004013_00047_09711_0000.E1
AT1_TOA_1PURAL19951212_101955_000000008009_00021_23055_0000.E1	AT1_TOA_1PURAL19961231_101959_000000008020_00021_28566_0000.E1
AT1_NR_2PURAL19951212_101955_000000008009_00021_23055_0000.E1	AT1_NR_2PURAL19961231_101959_000000008020_00021_28566_0000.E1

The following characteristics were found in the examples above:

- All products begin after (instead of at) the ANX;
- The fatal-error products end before the ANX;
- The non-fatal-error products run slightly beyond the ANX;
- The last granule of the TOA MDS for both fatal-error and non-fatal-error products are corrupted and the flags are not filled correctly. This causes the ends of the NR combined field to be corrupted also. Figure 1 displays the ends of the 11 and 12 micron channels, both views, for fatal-error orbit number 23055, with the land flag in green. The corruption of the data can be seen, and it can be noted that the nadir land flag is not filled correctly. An example of a nominal product ending at the ANX is given in Figure 2.

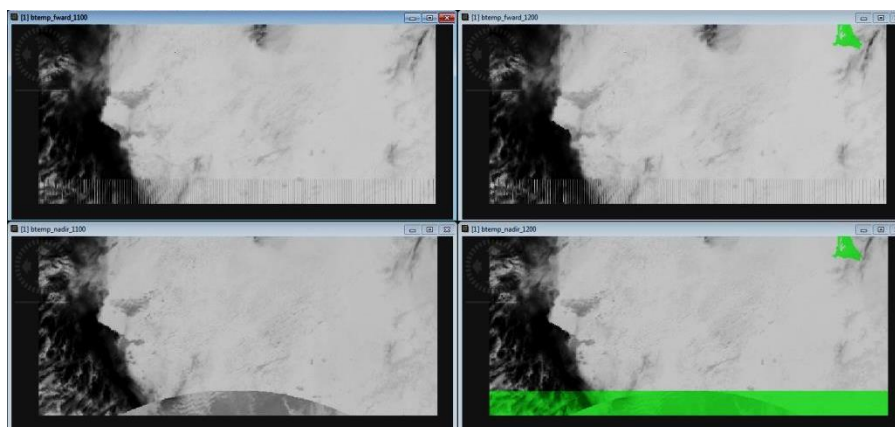


Figure 1. TOA fatal-error product for orbit number 23055. Top left: 11 micron channel, forward view; top right: 12 micron channel, forward view with forward land flag in green. Bottom left: 11 micron channel, nadir view; bottom right: 12 micron channel, nadir view with nadir land flag in green.

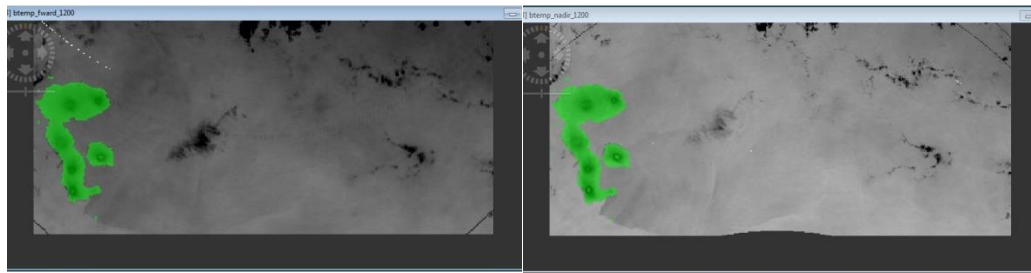


Figure 2. The end of a nominal product at the ANX: 12 micron channel (forward view (left), nadir view (right) for ATSR-1 orbit number 08951. Forward and nadir land flags are displayed in green in the relevant view.

- Figure 3 displays the LST and SST values at the ends of both types of product (fatal error and non-fatal-error). The anomaly at the end of the LST values in the non-fatal-error product 28566 in Figure 3 (third image from the left) also appears in the non-fatal-error product 09711, but does not appear in either of the fatal-error products.

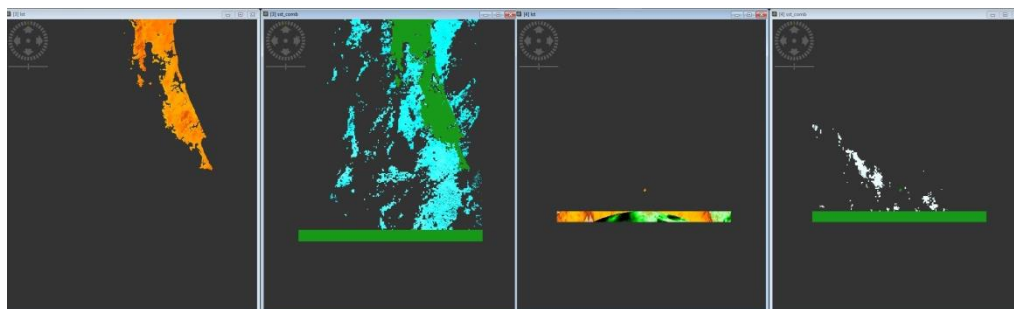


Figure 3. LST and dual-view SST for orbits 23055 (fatal-error, left two panels) and 28566 (non-fatal-error, right two panels). The land flag is displayed in green on the SST views only.

We can fairly assume that the corruption in the last granule of the MDS and the incorrectly applied flags applies to the whole set of ATSR-1 products with invalid last latitudes/longitudes, at all product levels (TOA, Browse, NR, AR, and Meteo). The impact on the separate netCDF L2P SST products is discussed in Section 3.

1.4 NR products in the Version 2.0 dataset

Inspection of the ATSR-1 NR v2.0 dataset took place in order to determine how these products had been treated previously. It was found that only 6 of the 146 fatal-error NR products were not available in the v2.0 (second reprocessing) dataset.

Of the 243 invalid last latitude/longitude NR products, only 16 were not available in the v2.0 dataset (6 of which were the already identified unavailable fatal-error NR products).

2. ATSR-2 INVALID LAST LATITUDES/LONGITUDES

Systematic QC on the third reprocessing dataset found 70 ATSR-2 NR products that had invalid last latitudes/longitudes. No ATSR-2 fatal-error products were found by RAL.

An examination of ATSR-2 orbit number 21832, which was flagged as having invalid last latitudes and longitudes, showed that it started at the ANX, but ended before the ANX. Figure 4 displays the ends of the L2 and L1 products. The last granule of the L2 and L1 products is again corrupted and the land flag is incorrectly filled, but this time for both nadir and forward views in the L1 product. A striking difference in the incorrect land flag

settings for ATSR-2 is that they are sporadic, whereas for ATSR-1 they appear to be set in bulk for the last granule of the nadir view (cf. Figure 1).

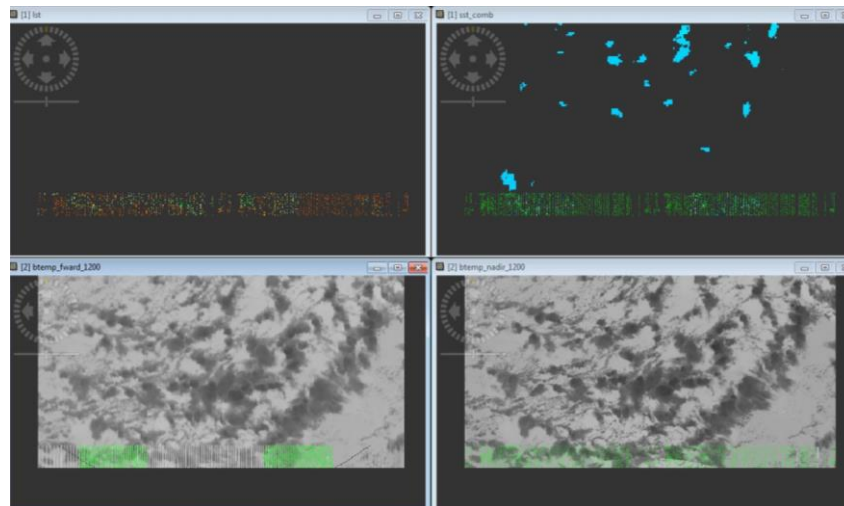


Figure 4. ATSR-2 orbit number 21832. Top left: NR LST (no land flag indicated); top right: NR dual-view SST with land flag in green. Bottom left: TOA 12 micron channel, forward view, with forward land flag in green; bottom right: TOA 12 micron channel, nadir view, with nadir land flag in green.

Although there are no ATSR-2 products with fatal errors, the MDS is still corrupted in the last granule for a non-fatal-error product. We can fairly assume that, as for ATSR-1 (Section 1.3), this finding applies to the whole set of ATSR-2 products with invalid last latitudes/longitudes.

3. L2P SST PRODUCTS

Since the third reprocessing, users are being encouraged to access SST fields from the L2P SST netCDF products, rather than from within the NR products. With this in mind, a visual inspection of the L2P SST products corresponding to previously viewed products was undertaken. (Note: the University of Leicester LST netCDF products are not yet available for ATSR-1 and ATSR-2.)

3.1 ATSR-1 comparison

The ATSR-1 products that were compared are given below.

Fatal error products:

```
AT1_TOA_1PURAL19930629_053846_000000004014_00047_10212_0000.E1
AT1_NR__2PURAL19930629_053846_000000004014_00047_10212_0000.E1
19930629053846-UPA-L2P_GHRSST-SSTskin-ARC-ATSR1-v02.0-fv01.0.nc
```

Non-fatal-error products:

```
AT1_TOA_1PURAL19930525_053846_000000004013_00047_09711_0000.E1
AT1_NR__2PURAL19930525_053846_000000004013_00047_09711_0000.E1
19930525053846-UPA-L2P_GHRSST-SSTskin-ARC-ATSR1-v02.0-fv01.0.nc
```

Figure 5 shows the ground track for the fatal-error products (orbit 10212). Figure 6 shows detail from the end of these products. It can be seen from the mostly incorrect nadir-view land flag settings (note a couple of pixels with nadir land flag not set), that no SST is generated in the last granule. Because of this, the L2P SST product largely escapes the corruption noted in the Envisat-format products.

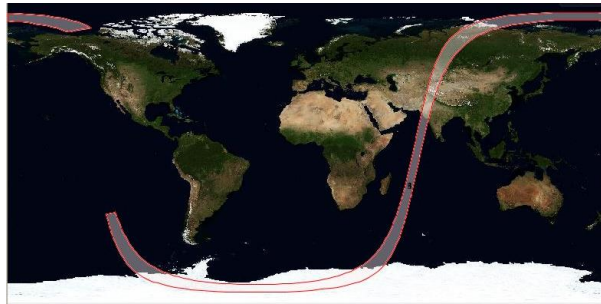


Figure 5. Ground track for ATSR-1 product orbit number 10212.

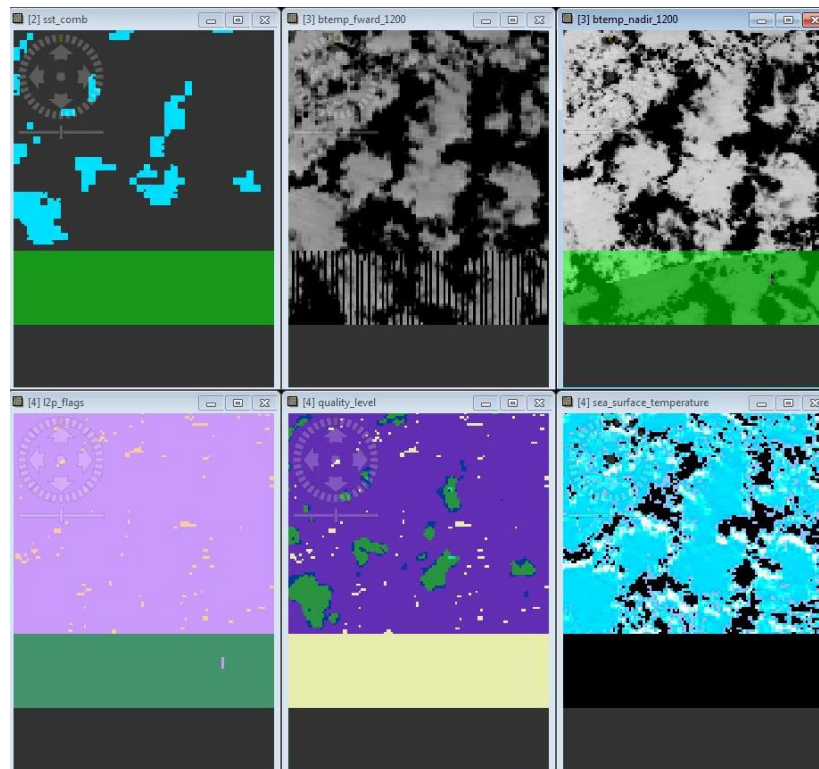


Figure 6. Detail from the end of ATSR-1 orbit number 10212 products.

Top row: left: dual-view SST from the NR product, with land flag in green; middle: 12 micron channel forward view from the TOA products, with forward-view land flag in green; right: 12 micron channel nadir view from the TOA products, with nadir-view land flag in green.

Bottom row: all images from the L2P SST product. Left: flag settings with the land flag in green; middle: quality level information, with yellow being no data, purple low-quality SST values and dark green high-quality SST values; right: SST values.

Figure 7 shows the ground track for the non-fatal-error products (orbit 09711). Figure 8 shows detail from the end of these products. The corruption in Figure 8 corresponds with that seen in Figure 6 for the fatal-error products. Therefore, as long as the nadir land flag is incorrectly set in the last granule, no SST values are generated. However, it would be a mistake to rely on the incorrect setting of flags in the TOA as the key to avoiding corruption in the L2P SST products.

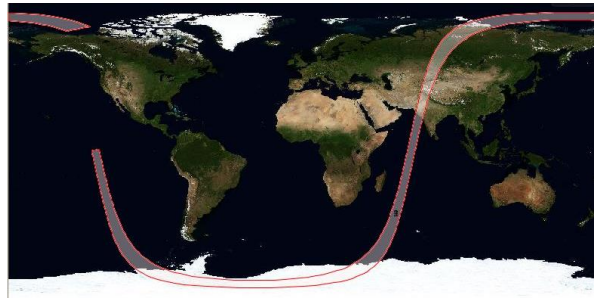


Figure 7. Ground track for ATSR-1 product orbit number 09711.

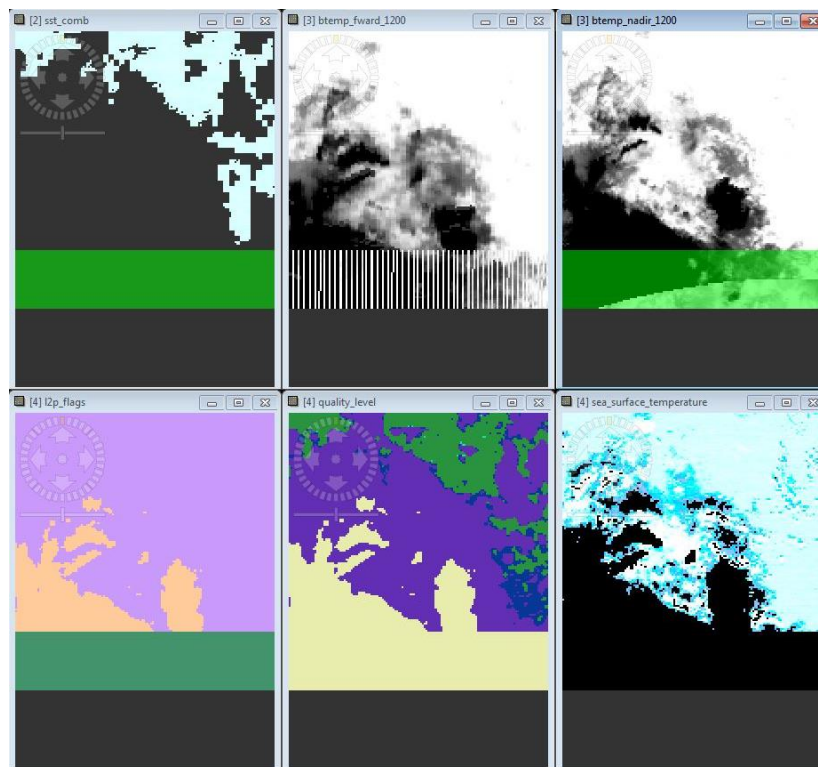


Figure 8. Detail from the end of orbit ATSR-1 number 09711 products. Images are as outlined in Figure 6.

3.2 ATSR-2 comparison

The ATSR-2 invalid latitude/longitude products that were compared are:

AT2_TOA_1PURAL19990624_074959_000000001043_00435_21832_0000.E2
 AT2_NR__2PURAL19990624_074959_000000001043_00435_21832_0000.E2
 19990624074959-UPA-L2P_GHRSSST-SSTskin-ARC-ATSR2-v02.0-fv01.0.nc

Figure 9 shows the orbit for these products. Figure 10 shows detail from the end of these products.



Figure 9. Ground track for ATSR-2 product orbit number 21832.

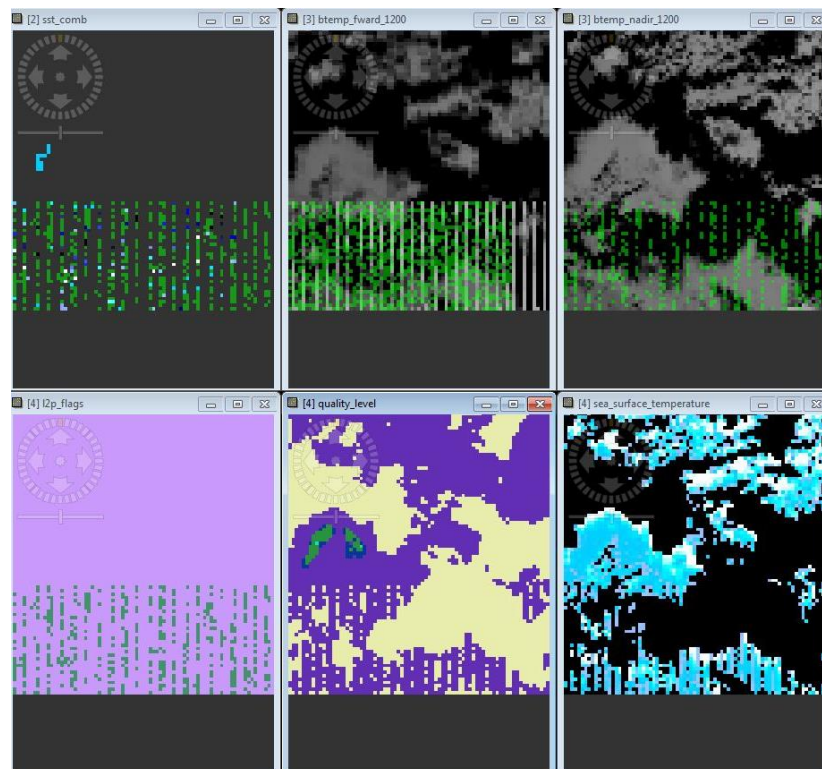


Figure 10. Detail from the ends of ATSR-2 orbit number 21832 products. Images are as outlined in Figure 6.

As shown in Section 2, corrupted land flag settings in the last granule apply sporadically to both views for ATSR-2, as can also be seen in Figure 10. This setting feeds into the L2P SST products. At least where the land flag is set, no SST is produced. If the land flag is not set, SST values can still be generated in the last granule in areas where the TOA is corrupt. This is shown in close-up in Figure 11, where the top-right image contains part of the ‘alien’ segment in the nadir-view TOA product. It can be seen that the L2P SST (bottom right) has generated values in this segment, albeit of low quality (bottom left: purple quality level pixels).

Therefore, for ATSR-2, the L2P SST products still contain an aspect of the corruption in the last granule, with SST values being generated from invalid data.

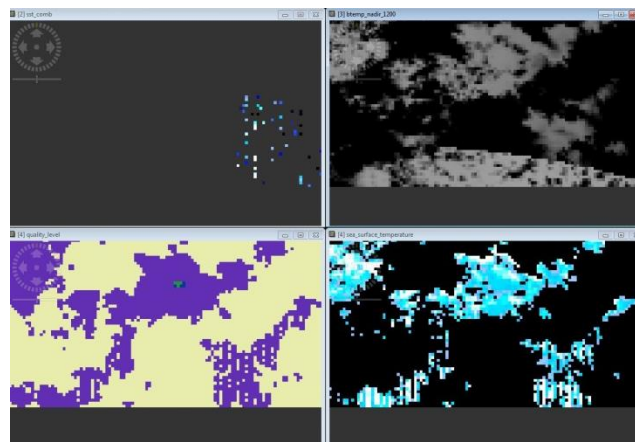


Figure 11. Detail from the last granule of orbit number 21832 products. Top left: dual-view SST from the NR; top right: 12 micron channel nadir-view from the TOA; bottom left: quality level from the L2P SST; bottom right, SST from the L2P SST.

4. SUMMARY

The following considerations summarise the status of the affected products:

1. Processing from Level 1 to Level 2 did not terminate normally for 146 ATSR-1 NR products, recording a fatal error in their processing logs. Automated batch processing on these products will likely fail due to the inconsistency in the number of MDS granules when compared with the ADS record.
2. 140 of these 146 NR products were previously available in v2.0.
3. The 146 products are a subset of products that were flagged within systematic QC as having invalid last latitudes and/or longitudes for both ATSR-1 and ATSR-2. Table 1 displays the number of products that were affected.
4. The MDS of all these products is largely unaffected except for the last granule, which is corrupted. Therefore, these ATSR-1 and ATSR-2 Envisat-format products are not of the highest quality.
5. Users are being encouraged to access the L2P SST and UOL LST netCDF product datasets for highest-quality SST and LST values (rather than the NR products). However, the L2P SST products are also affected by the corruption in varying degrees: the ATSR-1 SST L2P products are largely unaffected, whereas there is more potential for corruption in the ATSR-2 SST L2P products. (At present there are no UOL LST products readily available for ATSR-1 and ATSR-2.)
6. Because the problem stems from corruption in the TOA products, we can assume that all higher-level products are affected.
7. There were no occurrences of invalid last longitude/latitude SPH values in the AATSR dataset, therefore these data are assumed to be unaffected by this particular issue.

4.1 Options

This section sets out options for treatment of all the ATSR-1 and ATSR-2 affected products. It is assumed that all products can be considered corrupted, even if there was no fatal error in the processing log. Therefore, it would be advisable that, whichever option is selected, it applies to all Envisat-format and L2P SST products (and any subsequently available LST netCDF products), otherwise there is a risk of confusion if one product format is available in the main archive and the other is not.



The options to be considered are:

1. All corrupted product sets to remain in the main archive, with information on the affected products to be provided within the User Summary.
2. All corrupted product sets to be moved to the segregated section of the archive, with the ftp README files to be edited with appropriate information.

The option preferred by IDEAS+ would be option 2, given that there is a degree of corruption in all products, but the matter is referred to the AATSR QWG for discussion.