



MEMORANDUM

From : Pauline Cocevar and Siân O'Hara
To : Philippe Goryl, ESA
CC : aatsr@eo-sppa.org, Nigel Houghton, UK-MM-PAF

Document Ref : IDEAS-VEG-OQC-REP-1261
Date : 24 May 2013
Issue : 1.0
File ID : IDEAS-VEG-OQC-REP-1261 AATSR Reprocessing Systematic QC Investigation v1.doc

SUBJECT : AATSR Reprocessing Systematic QC Investigation

This document is a short report on the investigations required after the AATSR third reprocessing data was analysed by the IDEAS systematic QC checks. IDEAS QC procedures for this reprocessing are outlined in the AATSR Third Reprocessing IDEAS QC Plan (IDEAS-VEG-OQC-PLN-1014).

Scope

AATSR reprocessed data from 20 May 2002 to 08 April 2012 were analysed by the IDEAS systematic checks. The checks were performed on all of the Level 1, Level 2 NR and AR, meteo and browse products, and included thorough inspection of the product headers for consistency and correct contents, processing the meteos to Level 3 using QUASAR as a means of verifying the product contents, and also verifying the completeness of the reprocessed dataset.

Results

Of the 250150 AATSR products that were analysed, there were three separate issues raised for investigation:

- 1) three orbits (15 products) were flagged for timing mismatches between the main product header (MPH) and the specific product header (SPH);
- 2) one L1 product had a product filesize mismatch between that listed in its MPH and the actual size of the file on the system;
- 3) one month of L3 SST data (September 2002) displayed a strip of seemingly anomalous cold temperatures in the equatorial Pacific.

The investigations into these issues are detailed in the following subsections.

The completeness checks conducted by IDEAS were based on the Master list of Level 0 products supplied to the UK-MM-PAF and the complementary list of products to be excluded. Referencing the reprocessed data against the Master list showed that higher level products had all been produced from each L0 product, except those L0 which had given rise to processing failures already deemed non-recoverable. No Level 0 products from the excluded list had been processed. There are therefore no open issues with the completeness of the AATSR reprocessed dataset.

MPH/SPH timing mismatch

Table 1 lists the products that had a mismatch in times between the MPH and the SPH. Note that there are three orbits involved: 01760 (which is a commissioning phase product), 04946 and 04948.

Table 1. Products with MPH/SPH timing mismatches

Product name
ATS_AR_2PUUPA20020702_021837_000062972007_00203_01760_5505.N1
ATS_AST_BPUUPA20020702_021837_000062972007_00203_01760_5505.N1
ATS_MET_2PUUPA20020702_021837_000062972007_00203_01760_5505.N1
ATS_NR_2PUUPA20020702_021837_000062972007_00203_01760_5505.N1
ATS_TOA_1PUUPA20020702_021837_000062972007_00203_01760_5505.N1
ATS_AR_2PUUPA20030209_160757_000060672013_00383_04946_8483.N1
ATS_AST_BPUUPA20030209_160757_000060662013_00383_04946_8483.N1
ATS_MET_2PUUPA20030209_160757_000060672013_00383_04946_8483.N1
ATS_NR_2PUUPA20030209_160757_000060672013_00383_04946_8483.N1
ATS_TOA_1PUUPA20030209_160757_000060672013_00383_04946_8483.N1
ATS_AR_2PUUPA20030209_180700_000005372013_00385_04948_8484.N1
ATS_AST_BPUUPA20030209_180700_000005362013_00385_04948_8484.N1
ATS_MET_2PUUPA20030209_180700_000005372013_00385_04948_8484.N1
ATS_NR_2PUUPA20030209_180700_000005372013_00385_04948_8484.N1
ATS_TOA_1PUUPA20030209_180700_000005372013_00385_04948_8484.N1

The current archive does not contain any data available at the times of the products listed in Table 1, and so it is not possible to say whether nominal data existed previously for these times.

Table 2 displays the timing information available for the affected L1 products. It gives the start and end times contained within the L1 MPH and SPH: the L1 MPH/SPH discrepancy in end time can be clearly seen (in bold). Times from the parent L0 MPH are also given. Since the L1 should inherit the MPH times from the L0, the mismatch in timings indicates a problem with processing the L0 to the L1.

Table 2. Timing information for the L1 and L0 MPH/SPH mismatch products

Source	Start time	End time
ATS_TOA_1PUUPA20020702_021837_000062972007_00203_01760_5505.N1		
From L1 MPH	02-JUL-2002 02:18:37.558518	02-JUL-2002 04:04:16.546439
From L1 SPH	02-JUL-2002 02:18:37.557999	02-JUL-2002 04:03:35.008000
From L0 MPH	02-JUL-2002 02:18:37.558519	02-JUL-2002 04:00:47.144108
ATS_TOA_1PUUPA20030209_160757_000060672013_00383_04946_8483.N1		
From L1 MPH	09-FEB-2003 16:07:57.454704	09-FEB-2003 17:49:31.930944
From L1 SPH	09-FEB-2003 16:07:57.453999	09-FEB-2003 17:49:04.503999
From L0 MPH	09-FEB-2003 16:07:57.454705	09-FEB-2003 17:45:55.927050
ATS_TOA_1PUUPA20030209_180700_000005372013_00385_04948_8484.N1		
From L1 MPH	09-FEB-2003 18:07:00.001201	09-FEB-2003 19:25:28.301733
From L1 SPH	09-FEB-2003 18:07:00.000999	09-FEB-2003 18:15:57.450999
From L0 MPH	09-FEB-2003 18:07:00.001202	09-FEB-2003 18:12:53.712121

All L1 products were opened using BEAM and EnviView, and the results of their inspections are shown in Table 3.

Table 3. Outcome of viewing the MPH/SPH mismatch products

Orbit	BEAM	EnviView
01760	TOA and NR products mostly nominal but many missing scan lines towards end of product	Data mostly nominal but with many radiance values at 0 towards end of product
04946	Empty bands	Radiance values mostly set to 0, -1, -2 or -3
04948	Empty bands	Radiance values mostly set to 0, -1, -2 or -3

The input L0 were requested from the PAF for further investigation and viewed in EnviView. Table 4 shows the number of records (source packets) found for each L0 compared with the L1, along with specific details of any anomalies in the L0. Each of the L0 products contained timestamp errors, and it is suspected that these are the cause of the anomalous lengths of the L1 products, with the processor attempting to pad the higher level products for the jump in timestamps of the L0 records. This would account for the large differences between the number of records in the L0 compared with the L1.

Table 4. L1 and L0 details from EnviView

Orbit	# L1 records	# L0 records	Anomaly details in L0
01760	41984	41335	Timestamp errors starting at record 40780 (05-Jul-2002 04:49:56, previous record had 02-Jul-2002 04:00:51)
04946	40448	3408	Very many timestamp errors, the first at record 197 (09-Mar-2003 13:15:09, previous record had 09-Feb-2003 16:08:53)
04948	33584	270	One timestamp error at record 201 (10-Feb-2003 00:14:25, previous record had 09-Feb-2003 18:49:08)

As the error is with the input Level 0 products, then regenerating the higher level products would not be expected to yield any improvement and so recovery of these data is not possible. (In all cases, there appear to be nominal data in the L0 before the timestamp problems, and so, if the L0 can be modified to exclude the problem records, it may be possible to generate nominal higher level data products. Any such recovery attempt will be for a future reprocessing.)

Filesize mismatch

Table 5 names the L1 product that had the discrepancy between the product size given its MPH and the actual size of the file. For reference, the names of the other products are also listed, although there were no errors found with these.

Table 5. Input product for filesize mismatch

Product name
ATS_TOA_1PUUPA20090714_013818_000065272080_00403_38533_2065.N1
ATS_AR__2PUUPA20090714_013818_000065272080_00403_38533_2065.N1
ATS_AST_BPUUPA20090714_013818_000065272080_00403_38533_2065.N1
ATS_MET_2PUUPA20090714_013818_000065272080_00403_38533_2065.N1
ATS_NR__2PUUPA20090714_013818_000065272080_00403_38533_2065.N1

As well as the mismatch in file size values, the md5 checksum value generated for the L1 file did not match the expected value from the accompanying md5 file. This indicated that the product as supplied on the NAS was not the proper file. Attempts to view the L1 product in BEAM and EnviView were not successful and error messages implied the product was truncated. (Note that as the current archive contains nominal data for orbit 38533, we would expect the data to be processed successfully. Also, the L2 products that were generated from this L1 were not flagged for a filesize mismatch and appeared to be nominal.)

The PAF re-processed all higher-level products from the original L0; Table 6 displays the product names of the newly generated products.

Table 6. Re-processed products for orbit 38533

Product name
ATS_AR__2PUUPA20090714_013818_000065272080_00403_38533_7191.N1
ATS_AST_BPUUPA20090714_013818_000065272080_00403_38533_7191.N1
ATS_MET_2PUUPA20090714_013818_000065272080_00403_38533_7191.N1
ATS_NR__2PUUPA20090714_013818_000065272080_00403_38533_7191.N1
ATS_TOA_1PUUPA20090714_013818_000065272080_00403_38533_7191.N1

Table 7 shows the recorded size of the original L1, its total size as given in the MPH and the size of the regenerated L1.

Table 7. Filesizes for orbit 38533

Filesize	Filesize (bytes)
Original L1 on NAS	306118656
L1 MPH	826014101
Re-processed L1	826014101

The re-processed L1 filesize is now in agreement with the value in its MPH. All the re-processed products were visually inspected using BEAM and QUASAR, and no anomalous issues were detected.

September 2002 cold temperatures

Figure 1 shows a part of the L3 SST for September 2002, generated in QUASAR from the meteo products. A band of cold temperatures can be seen in the equatorial Pacific off the coast of Ecuador (circled). This band appeared to be at quite a different temperature to the surrounding SSTs, and so it was decided to investigate this region in more detail.

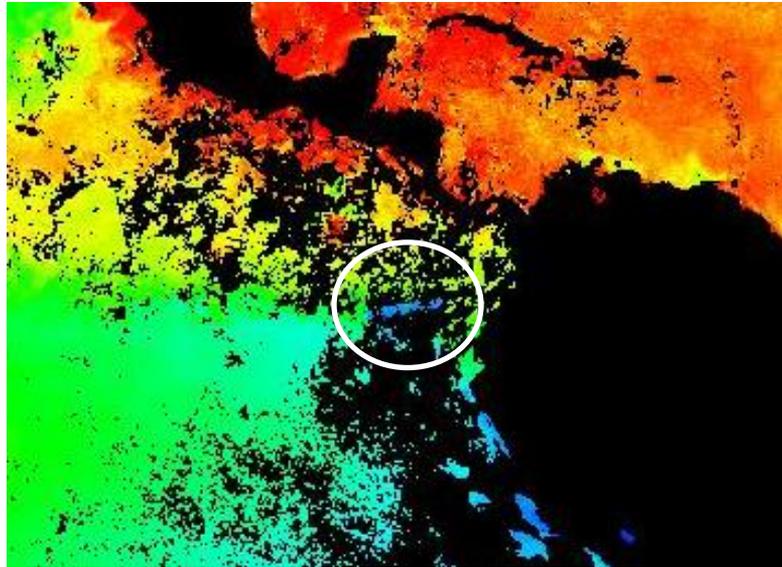


Figure 1. L3 SST for September 2002; the cold strip of data is circled.

Further investigation was carried out into the individual meteo products that had gone into the Level 3 product; data for orbit 02862 on 17 September 2002 was particularly anomalous in the region concerned, although there were orbits on other days around that time that exhibited the same signal. For the month as a whole, there were significant gaps in the data (at least four full days) that would allow a strong signal from just a few products to have a significant effect on the monthly L3 SST product.

Figure 2 shows the SST anomaly from a seasonal (GOSTA) average for 17 September 2002, where the red and blue pixels span the range +10/-10 K, respectively. The region of interest is circled and displays anomalous values as great as -10.6 K.

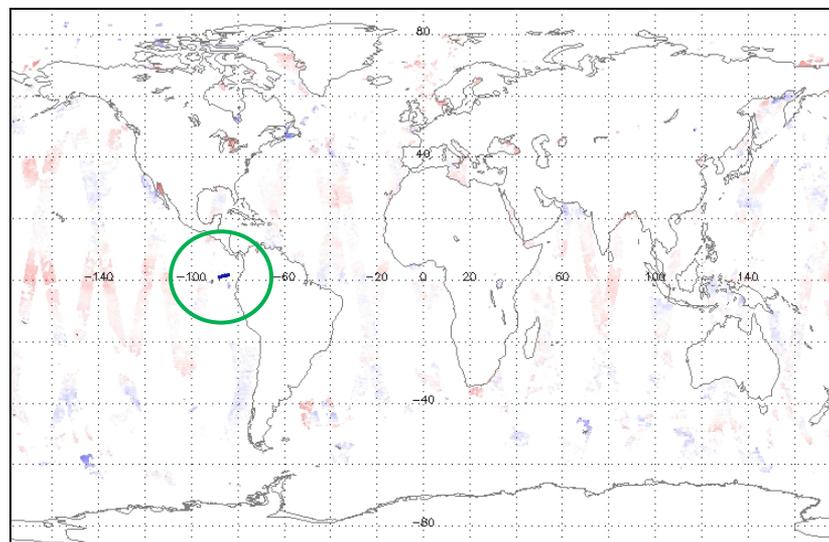


Figure 2. Global SST anomaly map for 17 September 2002.

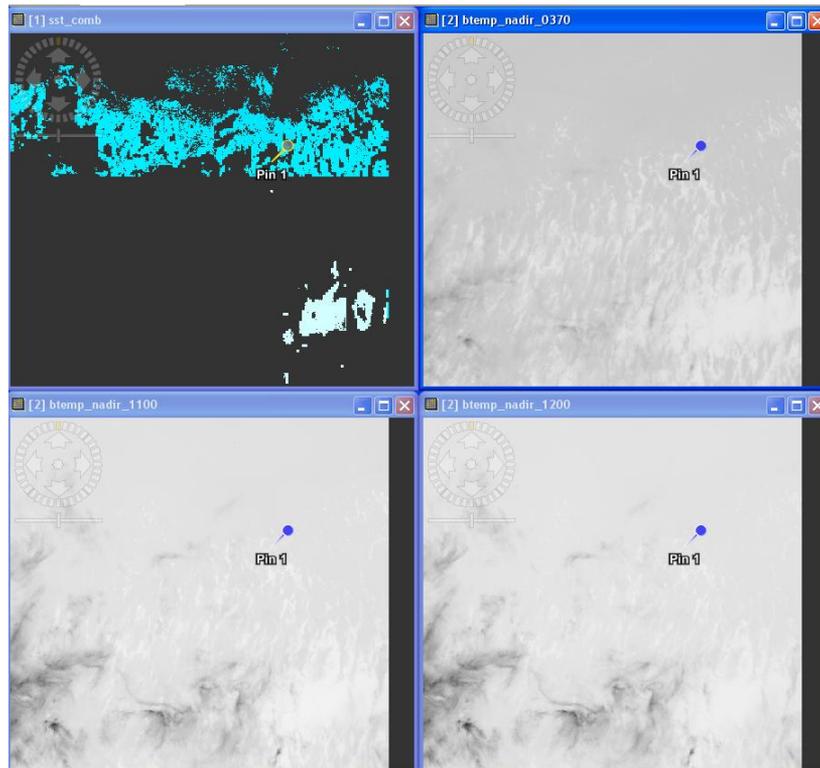


Figure 3. Data from orbit 02862, for the region of interest circled in Figure 2. Clockwise from top left: SST from the NR product, brightness temperatures from the 3.7, 12 and 11 μm bands.

Figure 3 displays data from the products for orbit 02862 (night-time). The strip of cold SST is clearly seen at the top of the top-left image: the SSTs here are ~ 288 K. The patch of SST below the strip has values ~ 300 K. Inspection of the IR bands shows there to be no brightness temperature change in the area of the generated SSTs compared with those pixels in the same region where no SST was generated. This leads to the conclusion that the cold strip of data is due to a failure in the cloud-clearing algorithm.

Conclusions

The L1/L2 products involved in the MPH/SPH times investigation are not nominal, and the problem was traced to the input L0 products from which they were generated (which displayed intermittent timestamp errors). Therefore it is not possible to generate nominal higher level products from these L0.

The original reprocessed L1 product in Table 5 was truncated at some point, but was successfully generated later from the L0. The re-reprocessed L1 is nominal.

The anomalous SST region in September 2002 is due to a failure in cloud clearing. As such, it is an artefact of the current processor and no further investigation will be carried out.

Actions

On the basis of the investigations that followed from the results of the systematic QC, the following actions are requested:

- 1) From the MPH/SPH timings investigation: The products in Table 1 should be removed from the AATSR reprocessed dataset.
- 2) From the file size investigation: The products in Table 5 should be removed from the AATSR reprocessed dataset. (Although only the L1 was truncated, its associated products should also be removed.) They should be replaced in all instances by the re-reprocessed data as listed in Table 6.

In addition to these actions requested for the PAF to complete, IDEAS will:

- Issue a warning to users about the September 2002 cloud clearing failures – this will be included in the final report to be compiled from all QWG results.