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# ENVISAT CYCLIC ALTIMETRIC REPORT

## CYCLE 20

## Quality Assessment Report

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# TABLE OF CONTENTS

**1 INTRODUCTION ..... 1**

**2 DISTRIBUTION LIST ..... 1**

**3 ACRONYMS ..... 1**

**4 REFERENCE DOCUMENTS ..... 2**

**5 GENERAL QUALITY ASSESSMENT ..... 2**
5.1 Instruments status ..... 2
5.2 Cycle quality ..... 3
5.3 Orbit quality ..... 3
5.4 Ground Segment Processing Chain Status ..... 3
5.4.1 IPF Processing Chain ..... 3
5.4.2 F-PAC Processing Chain ..... 3
5.4.3 Auxiliary Data File ..... 4
5.4.4 Planned upgrades ..... 4

**6 ENVISAT PAYLOAD STATUS ..... 5**
6.1 Altimeter Events ..... 5
6.1.1 RA-2 instrument planning ..... 5
6.2 MWR Events ..... 5
6.3 DORIS Events ..... 6

**7 INSTRUMENT PERFORMANCES ..... 6**
7.1 RA-2 Calibration performances ..... 6
7.1.1 IF Filter Shape ..... 6
7.1.2 USO ..... 7
7.1.3 Tracking capability ..... 8
7.1.4 Sigma0 Transponder ..... 10
7.1.5 Datation ..... 10
7.1.6 Mispointing ..... 10
7.1.7 S-Band anomaly ..... 11
7.2 RA-2 Altimeter Parameters ..... 12
7.2.1 Altimeter range ..... 12
7.2.2 Significant Wave Height ..... 13
7.2.3 Backscatter coefficient – Wind Speed ..... 14
7.3 MWR Performances ..... 16

7.4 DORIS Performances ..... 16

**8 PRODUCT PERFORMANCES ..... 17**
8.1 Availability of data ..... 17
8.2 Edited measurements ..... 24
8.3 Product Disclaimer ..... 24
8.4 Geophysical quality assessment ..... 24

**9 INSTRUMENT LONG TERM MONITORING ..... 24**

**10 PARTICULAR INVESTIGATIONS ..... 24**

# 1 INTRODUCTION

This documents aims at reporting on the performances of the EnviSat Radar Altimeter, Microwave Radiometer and DORIS sensors, on the data quality of the corresponding Fast Delivery products as well as on the main events occurred during cycle 20.

This reports covers the period from the 16th of September to the 20th of October 2003.

# 2 DISTRIBUTION LIST

This report is available in PDF format at the internet address http://earth.esa.int/pcs/envisat

# 3 ACRONYMS

| | |
|---|---|
| AGC | Automatic Gain Control |
| DORIS | Doppler Orbitography and Radiopositioning Integrated by Satellite |
| DSR | Data Set Record |
| ERS | European Remote Sensing satellite |
| ESRIN | European Space Research Institute |
| ESOC | European Space Operations Centre |
| FD | Fast Delivery products |
| GS | Ground Segment |
| GTS | Global Telecommunication System |
| HTL | Height Tracking Loop |
| ICU | Instrument Control Unit |
| IECF | Instrument Engineering Calibration Facility |
| IF | Intermediate Frequency |
| IE | Individual Echoes |
| IPF | Instrument Processing Facility |
| LUT | Look Up Table |
| MCMD | MacroCommand |
| MPH | Main Product Header |
| MSS | Mean Sea Surface |
| MWR | MicroWave Radiometer |
| MPS | Mission Planning System |
| PCS | ERS Products Control Service |
| PCF | EnviSat Product Control Facility |
| PDHS-E | ESRIN Processing and Data Handling Station |
| PDHS-K | Kiruna Processing and Data Handling Station |
| PMC | Payload Main Computer |
| PTR | Point Target Response |
| RA-2 | EnviSat Radar Altimeter bi-frequency |
| RSL | Resolution Selection Logic |

| | |
|---|---|
| SEU | Single Event |
| SFCM | Stellar Fine Control Mode |
| SPH | Specific Product header |
| SPSA | Signal Processing Sub-Assembly |
| S/W | Software |
| TM | Telemetry |
| TRP | Transponder |

# 4 REFERENCE DOCUMENTS

[R – 1] F-PAC MONTHLY REPORT, SALP-RP-M-OP-15085-CN, September 2003
[R – 2] ENVISAT Microwave Radiometer Assessment Report Cycle 020, CLS.DOS/03.857,http://earth.esa.int/pcs/envisat
[R – 3] Envisat RA-2 IF Mask weird behavior: Investigation Report
[R – 4] Instrument Performance Evaluation and Analysis Summary, PO-TR-ALS-RA-0042
[R – 5] Instrument Corrections Applied on RA-2 Level 1b products, Paper presented at the ENVISAT Calibration Review in September 2002
[R – 6] ENVISAT Phase E Cal/Val Acquisition Plan, ENVI-SPPA-EOPG-TN-03-0008
[R – 7] RA-2 S-Band Anomaly Investigation, PO-TN-ESA-RA-1331
[R – 8] RA-2 Performance Results, Paper presented at the ENVISAT Calibration Review in September 2002
[R – 9] ECMWF Report on ENVISAT RA- 2 for September/October 2003, Report on ENVISAT Radar Altimeter - 2 (RA- 2), Wind/ Wave Product with Height Information (RA2_ WWV_ 2P), http://earth.esa.int/pcs/envisat
[R – 10] Envisat GDR Quality Assessment Report, SALP-RP-P2-EX-21121-CLS015
[R – 11] Envisat RA-2 Range Instrumental correction: USO clock period variations and associated auxiliary file, ENVI-GSEG-EOPG-TN-03-0009
[R – 12] Defining a Rain flag for the Envisat altimeter, G. Quartly, study presented to the final CCVT plenary meeting, http://earth.esa.int/pcs/envisat/ra2/articles/
[R – 13] ENVISAT Weekly Mission Operations Reports # 69-73, ENVI-ESOC-OPS-RP-1011-TOS-OF

# 5 GENERAL QUALITY ASSESSMENT

## *5.1 Instruments status*

The RA-2 instrument has been victim of two instrument anomalies during this cycle, as given in par. 6.1. In particular, after the second anomaly and for about three days, no CTI tables have been up-loaded on-board, with a relative big impact on the data quality.

The two known causes of random on-board anomalies are still present. In particular we refer to the so-called S-Band anomaly and the IF mask weird behavior described respectively in [R – 7] and [R

– 3]. Only the S-Band anomaly partially affects a low number of Envisat data products as given in par. 7.1.7.

MWR sensor assessment report: refer to [R – 2].

DORIS sensor assessment report: refer to [R – 1].

## *5.2 Cycle quality*

The summary of the RA-2 data products availability for this cycle is given in Table 1.

| Start orbit | Stop orbit | Time instrum. unavailability | Time L0 gaps | Time L1b gaps | Time L2 (FGD) gaps | % instrum. avail. | % L0 avail. | % L1b avail. | % L2 (FGD) avail. |
|---|---|---|---|---|---|---|---|---|---|
| 8071 | 8171.2 | 7848.83 | 4642.908 | 28610.635 | 41326.27 | 98.70224 | 97.93456 | 93.97164 | 91.86918 |
| 8171.2 | 8271.4 | 45718.7 | 621.768 | 12757.972 | 12904.31 | 92.44066 | 92.33786 | 90.3312 | 90.30701 |
| 8271.4 | 8371.6 | 1066.43 | 6519.571 | 13003.737 | 20121.62 | 99.82367 | 98.7457 | 97.67359 | 96.49669 |
| 8371.6 | 8471.8 | 1056.38 | 4369.526 | 11264.4 | 18423.91 | 99.82533 | 99.10286 | 97.96283 | 96.77905 |
| 8471.8 | 8572 | 1098.38 | 811.182 | 854.277 | 29607.62 | 99.81839 | 99.68426 | 99.67714 | 94.92294 |

**Table 1: RA-2 L0, L1b and L2 FGD Data products availability summary for cycle 20**

## *5.3 Orbit quality*

The orbit was maintained within the +/- 1km ground track. A 1-burn SFCM was executed on 30-September-2003 for attitude control. The following table summarizes the SFCM observed performance:

| | **Burn Start Time** | **Nominal Delta-V** | **Calibrated Delta-V** | **Mode** |
|---|---|---|---|---|
| **First burn** | 2003/09/30-01:40:00 | 0.0163 m/sec | 0.0163 m/sec | SFCM |

## *5.4 Ground Segment Processing Chain Status*

### 5.4.1 IPF PROCESSING CHAIN

IPF S/W version: The current IPF processing chain is version 4.54.

### 5.4.2 F-PAC PROCESSING CHAIN

F-PAC SW version: The current F-PAC processing chain is version 6.1 since August 1st, 2003.

F-PAC anomalies: anomalies are detailed in the F-PAC Monthly Report [R - 1].

### 5.4.3 AUXILIARY DATA FILE

Hereafter all the Auxiliary files used actually used by the IPF ground processing are listed
RA2_CHD_AXVIEC20030402_094243_20030407_000000_20200101_000000
RA2_CON_AXVIEC20020606_164228_20020101_000000_20200101_000000
RA2_CST_AXVIEC20020621_135858_20020101_000000_20200101_000000
RA2_DIP_AXVIEC20020122_134206_20020101_000000_20200101_000000
RA2_GEO_AXVIEC20020314_093428_20020101_000000_20200101_000000
RA2_ICT_AXVIEC20020709_131546_20020101_000000_20200101_000000
RA2_IFA_AXVIEC20020313_174755_20020101_000000_20200101_000000
RA2_IFB_AXVIEC20020313_174959_20020101_000000_20200101_000000
RA2_IFF_AXVIEC20021023_085202_20020101_000000_20100101_000000
RA2_IOC_AXVIEC20020122_141121_20020101_000000_20200101_000000
RA2_MET_AXVIEC20020204_073357_20020101_000000_20200101_000000
RA2_MSS_AXVIEC20021023_141823_20020101_000000_20200101_000000
RA2_OT1_AXVIEC20020313_173134_20020101_000000_20200101_000000
RA2_OT2_AXVIEC20020313_173944_20020101_000000_20200101_000000
RA2_SET_AXVIEC20020122_150917_20020101_000000_20200101_000000
RA2_SL1_AXVIEC20030131_100228_20020101_000000_20200101_000000
RA2_SL2_AXVIEC20030131_101757_20020101_000000_20200101_000000
RA2_SOI_AXVIEC20021023_140434_20020621_000000_20200101_000000
RA2_SSB_AXVIEC20020122_160151_20020101_000000_20200101_000000
RA2_TLD_AXVIEC20020313_175443_20020101_000000_20200101_000000
RA2_USO_AXVIEC20020122_162920_20020101_000000_20200101_000000

No change has been performed during cycle 20, the most recent change has been performed to the RA-2 Characterization file during cycle 15 and uploaded in the processing chain on April the 7$^{th}$ together with IPF version 4.54. This introduces a bias of 3.5 dBs on the Ku Backscattering coefficient in order to be compatible with the “Witter and Chelton” wind model.

The RA2_POL_AX, the RA2_SOL_AX and the RA2_PLA_AX have been regularly updated every week without problems.

### 5.4.4 PLANNED UPGRADES

An upgrade of the IPF Level 1B and Level 2 (V4.56) processing chains is currently planned.
This will contain the following:

1. Change in the AGC evaluation for S-band in the L1b processor.
2. Neural Network algorithm for evaluation of Wet Tropospheric Correction, Water Vapor and Liquid Water Content in the L2 processing.
3. Refinement in L2 Ice2 Retracker Algorithm.
4. ADF updates:
    a. Level 1 ADF: New IF mask ADF

b. Level 2 ADF: Rain Flag, SSB, CLS01 MSS, Tides GOT002 and FES02, as recommended by the RA-2 and MWR CCVT.

The changes related to the L2 processor have already been implemented in the F-PAC chain (V6.1) as reported in [R – 1].

# 6 ENVISAT PAYLOAD STATUS

## *6.1 Altimeter Events*

The Radar Altimeter 2, during cycle 20, was unavailable four times, in the following time periods:
Start: 21 Sep 2003 15:36:40 Orbit = 08153 RA-2 to Stand-by/Refuse due to
Stop: 21 Sep 2003 17:33:30 Orbit = 08154 Individual Echoes MCMD Time out

Start: 27 Sep 2003 00:28:08 Orbit = 08229 RA-2 to Suspend mode (Reset/Wait/Init)
Stop: 27 Sep 2003 12:52:00 Orbit = 08237 due to a known SEU-problem

After the recovery of the anomaly on September the 27th, no CTI Tables were up-loaded in the on-board memory; this problem has been cured starting from 30 September 2003 at 12.45.00.

### 6.1.1 RA-2 INSTRUMENT PLANNING

The RA-2 instrument planning was performed as follows:

- IF Calibration Mode according the nominal operational acquisition scheme: 100 seconds of data per day over Himalayan region.
- Preset Loop Output mode for Austrian Range transponders.
- Preset Loop output acquisition over the transponder in support to CRYOSAT project, only descending pass.
- Preset Loop Output acquisition over ESA transponders, which should be located near Rome; both ascending and descending passes.
- Individual Echoes background planning: buffering of 20 Data block of individual Echoes and transmission of the in the following 160 Data Blocks. This repeated continuously.
- Individual Echoes planning in correspondence with IF Calibration Mode: buffering of one Data Block of Individual Echoes and transmission of it during the following 8 Data blocks. This has been repeated for 12 times. Starting from October the 2nd, the MCMD corresponding to this planning has been removed from the schedule due to the fact that it had caused several time-out anomalies.

## *6.2 MWR Events*

The MWR, during cycle 20 was never unavailable.

## 6.3 DORIS Events

The DORIS during cycle 20 was never unavailable.

# 7 INSTRUMENT PERFORMANCES

## 7.1 RA-2 Calibration performances

### 7.1.1 IF FILTER SHAPE

In Figure 1 all valid IF masks retrieved by averaging the 100 seconds of data acquired daily during cycle 20 are plotted in the left panel. The on-ground measured IF mask (ref [R – 4]) is also plotted in that panel with a red solid line. In the right panel the difference of each of the calculated IF masks with respect to the on-ground measured one is reported. During cycle 20 the number of valid IF masks has been of 11 representing the 31% of the total. Only valid IF masks are used to generate the final IF mask used in the Level 1B ground processing; the method used for editing the data is based on the comparison between each of the single IF masks and the reference one (on-ground).

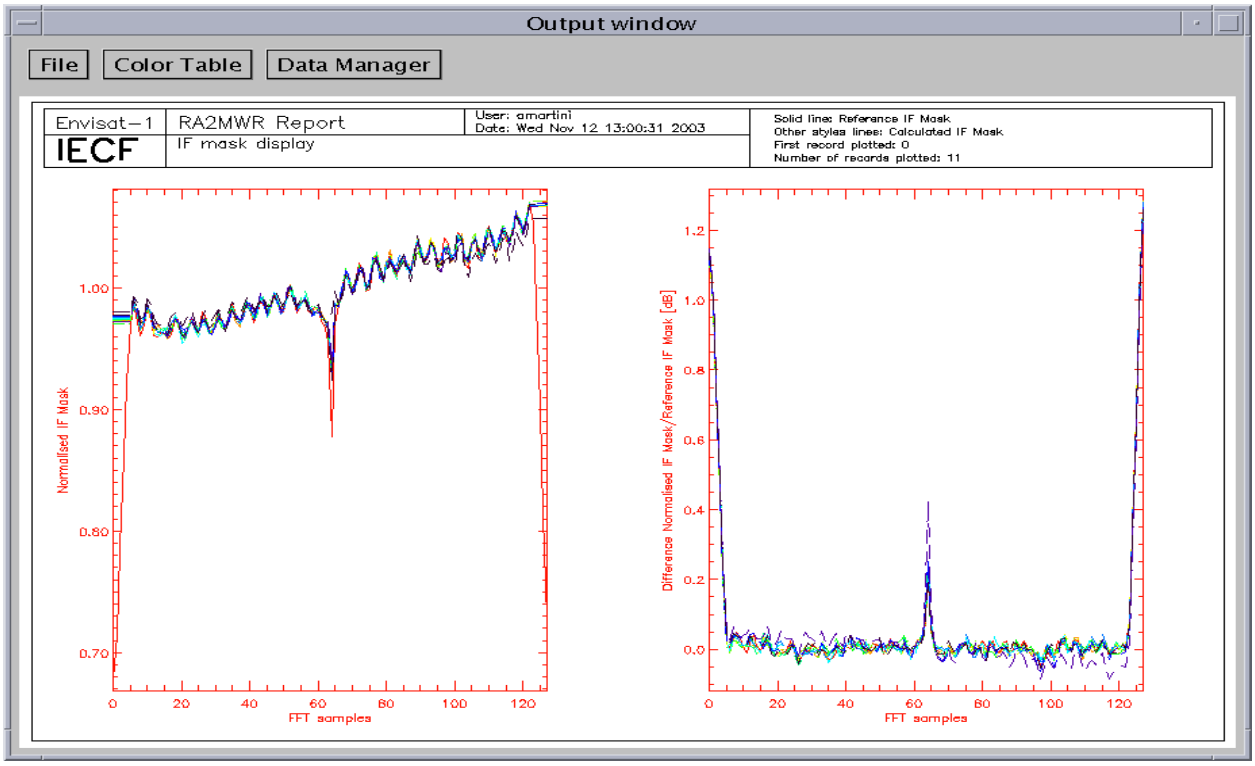


**Figure 1: Valid IF masks retrieved daily during cycle 20 plotted together with the on-ground reference.**

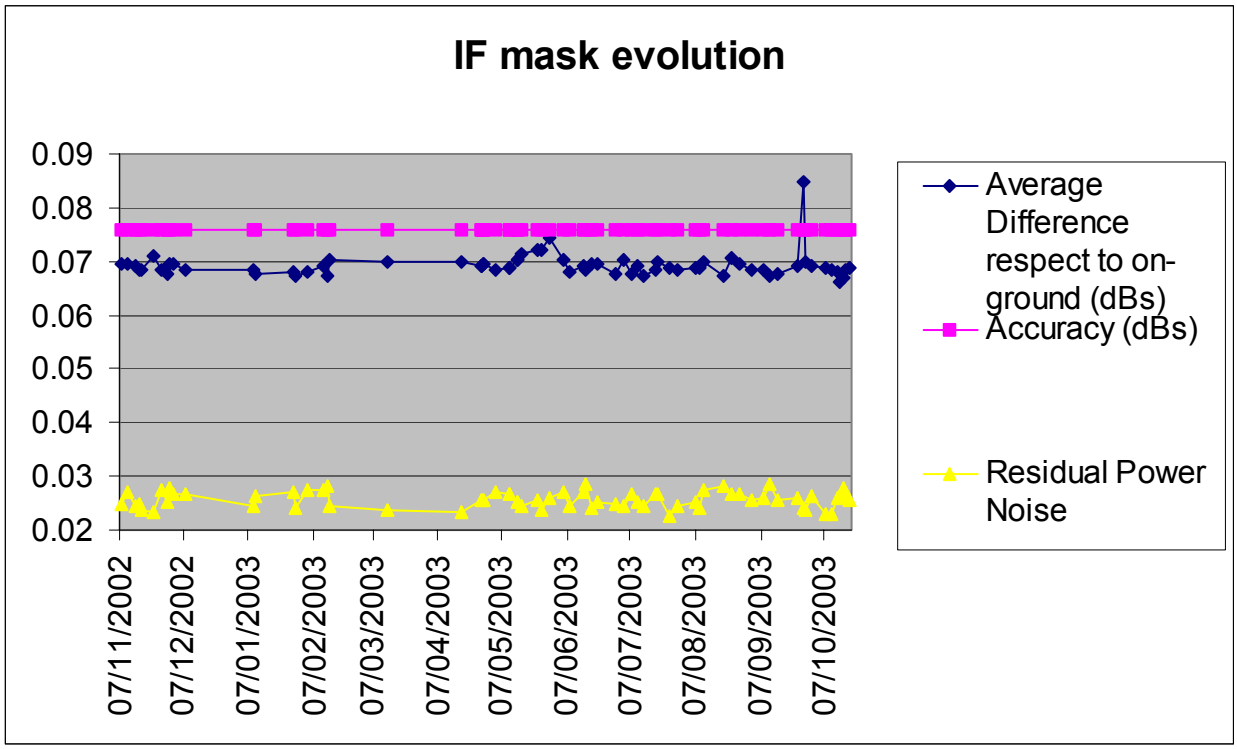


**Figure 2: Evolution of the IF mask related parameters for valid IF masks retrieved until cycle 20.**

In Figure 2 the evolution of the IF mask quality parameters evaluated as in [R – 4] is reported only for valid data. It can be observed that the difference with respect to the on-ground reference stays quite constant around 0.07 dBs. Only one high peak is visible on the plot that correspond to the data acquired on September the 27$^{th}$ at 15:48. The reason of this could be found in the instrument warming up considering that the IFCal acquisition has been made only a couple of hours after an anomaly recovery.
The residual noise and the accuracy show a very constant behavior over the whole period.

During cycle 20 the IF Calibration Mode still shows the weird behavior described in [R – 3]. This problem, present since the beginning of the mission, is still under investigation. The anomaly directly affects the number of valid RA-2 IF masks obtained per cycle, but does not refrain from the generation of the IF mask correction file, used in input to the Level 1 B ground processing.

### 7.1.2 USO

In Figure 3 the USO clock period trend retrieved until end of cycle 20 is reported. In order to make the variability visible, the difference of the actual USO clock period with respect to the nominal one has been plotted, in the upper panel. In the lower panel the Range error due to the USO clock variability has been reported taking a satellite altitude of 800 Km as a nominal value.

Currently the nominal USO clock period (12500 ps) is used within the processing, this means that the data are not corrected for the bias and the drift correlated to the actual USO clock period. Those values, translated into altimetric range figures, are respectively of 32 mm and –1.33 mm/year as

calculated with data covering the period 4 September 2002 to 21 October 2003. The given bias and drift have to subtracted from the original altimetric range.

A particular investigation has been performed regarding the USO clock trend and the associated auxiliary file; this is described in [R – 11]. The conclusion can be summarized as follows: the precision of 1ps available in the current USO auxiliary file is not enough to appreciate its trend and it is too rough for any altimetric application. A suitable resolution is considered to be of $10^{-6}$ ps.

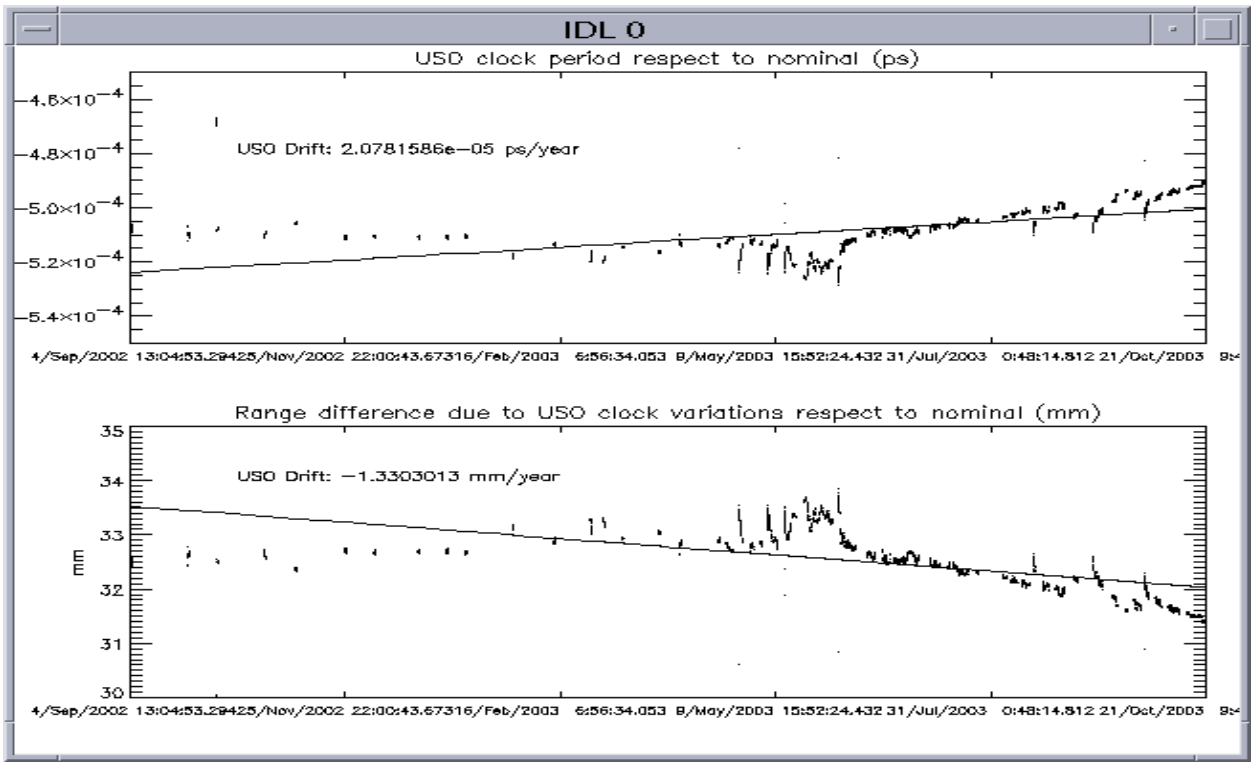


**Figure 3: USO clock period trend until end of cycle 20**

### 7.1.3 TRACKING CAPABILITY

In Figure 4 and Figure 5, the Chirp ID is plotted respectively for ascending and descending passes of cycle 20. The MDSRs acquired with 320MHz bandwidth are plotted in light gray (Chirp ID equal to 0), the ones acquired with 80MHz bandwidth are plotted in violet (Chirp ID equal to 1) and the ones acquired with the 20MH bandwidth are plotted in dark green (Chirp ID equal to 2).

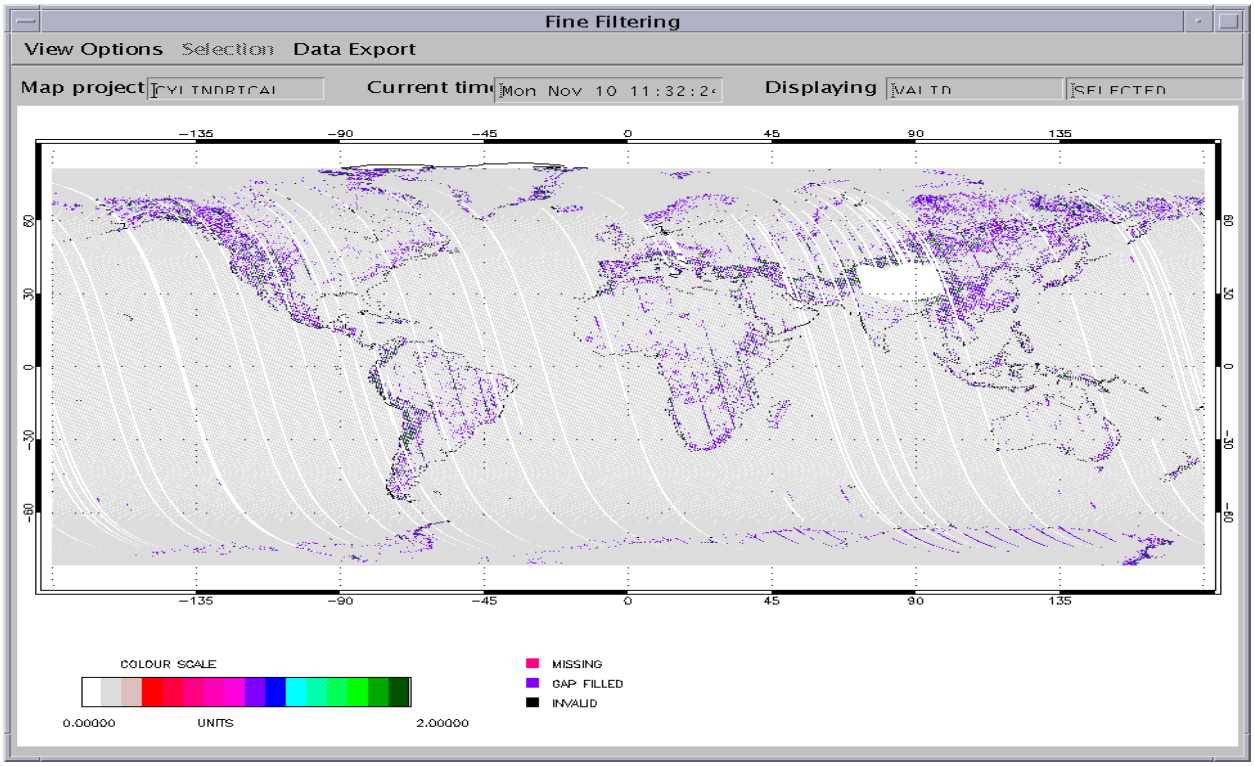


**Figure 4: RA-2 Chirp ID for ascending passes during cycle 20**

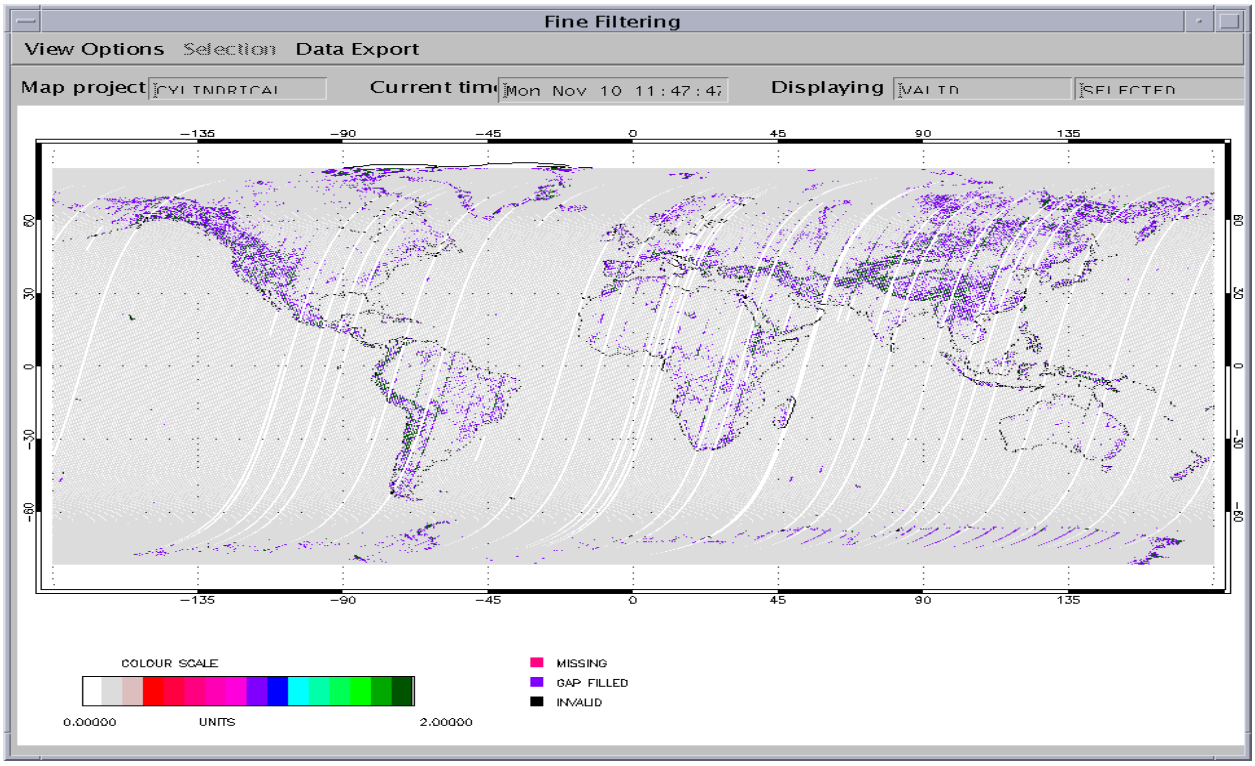


**Figure 5: RA-2 Chirp ID for descending passes during cycle 20**

The corresponding percentages of acquisition in the different resolutions subdivided by surface type are given in Table 2:

| Surface type | 320 MHz | 80 MHz | 20MHz |
|---|---|---|---|
| Open Ocean | 99.95% | 0.045% | 0.001% |
| Costal Water (ocean depth < 200 m) | 94.57% | 4.13% | 1.3% |
| Sea Ice | 99.0% | 0.9% | 0.1% |
| Ice Sheet | 93.72% | 5.45% | 0.83% |
| Land | 79.92% | 14.86% | 5.22% |
| All world | 93.43% | 5.08% | 1.49% |

**Table 2: RA-2 Tracking capability: Chirp ID percentages discriminated by surface type**

The figures given for the RA-2 tracking performances during this cycle are very much in line with the ones recorded at the end of the Commissioning Phase and presented in [R – 8]. The slight differences are in part due to the different algorithms used to discriminate the surface types.

On the other hand, in comparison to the previous cycles, the figures just presented are slightly worse; this is due to the three days period during which no CTI were up-loaded on board.

Those figures, however, still satisfy completely the objectives of the Commissioning Phase RSL and Tracking optimization hereafter reported:
320MHz over Ocean > 99%
320 MHz within 15km of Land/Ocean boundary (Costal Water)
320 MHz over Sea Ice > 95%
320/80 MHz Fixed resolution at Ice Sheet Crossovers > 95%
320MHz over Ice Shelves > 95%

### 7.1.4 SIGMA0 TRANSPONDER

No data relative to the Sigma_0 Transponder calibration is available for cycle 20. Some work has been performed to identify the temporary sites and to plan the acquisitions for future cycles.

### 7.1.5 DATATION

No value is available for the datation bias relative to cycle 20 since the GDR data needed for this aim are not yet available.

### 7.1.6 MISPOINTING

In Figure 6 the trend and the histogram of the mispointing squared (smoothed over 120 s) is reported in deg^2*10e-4
The average value is of about 0.03 deg^2 which is not in agreement with the figures reported at platform level [R – 13].

However this is known to be due to a not perfect tuning of the algorithm used to retrieve the mispointing value from the RA-2 waveform data. A new algorithm to determine this parameter has been identified and it will be implemented in the next version of L2 processor to come in mid-2004.

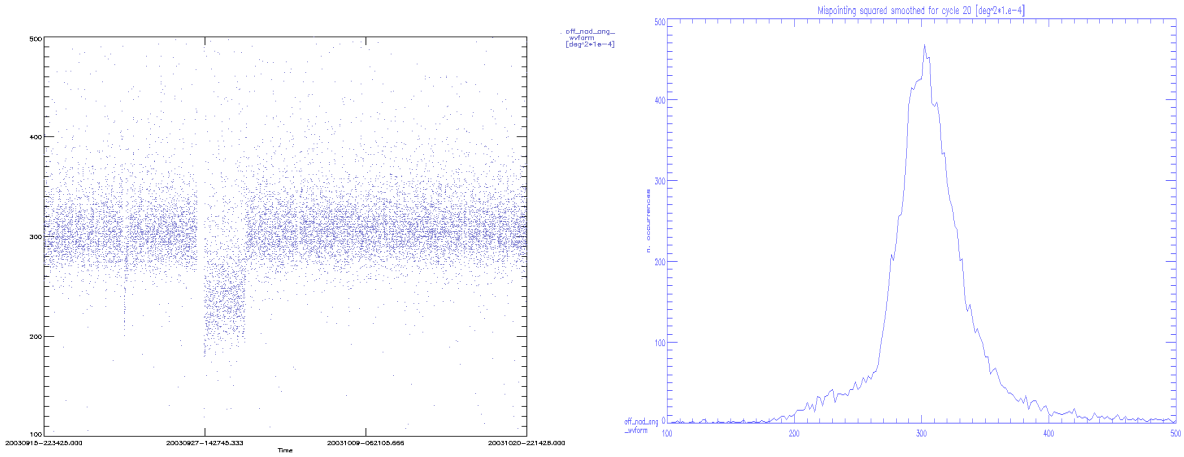


**Figure 6: Smoothed mispointing squared trend and histogram for cycle 20 (deg^2*10^4)**

Worthwhile to be noticed that the mispointing squared assumes lower values just after an instrument anomaly; afterwards an increasing trend of the parameter is visible until the it reaches stability at the usual value. Work is ongoing in order to understand the reason of this particular instrumental behavior.

Over the period from September the 27th until September the 30th very low values of the mispointing squared parameter can be identified in the plot. This behavior is correlated to the use of default values for the on-board SPSA SW (no CTI up-loaded).

### 7.1.7 S-BAND ANOMALY

The so-called "S-Band anomaly" still affects the performances of RA-2. Hereafter a list is reported of the products files that have been affected by this problem during cycle 20, which corresponds to a percentage of about 5%.
Being the method used a statistical one working on ocean data; files containing less than 1000 seconds of data over ocean have not been considered. This choice is supported by the fact that the "S-Band anomaly" is associated to a particular instrumental behavior that cannot appear and disappear within a short time frame.

| File name | Start date | Start time | Stop date | Stop time |
|---|---|---|---|---|
| RA2_FGD_2PNPDE20030922_215744_000063022020_00101_08171_0500.N1 | 22-Sep-03 | 21:57:44.159434 | 22-Sep-03 | 23:42:46.001490 |
| RA2_FGD_2PNPDE20030922_234116_000061862020_00102_08172_0501.N1 | 22-Sep-03 | 23:41:16.937190 | 23-Sep-03 | 01:24:22.923249 |
| RA2_FGD_2PNPDE20030923_012326_000063212020_00103_08173_0502.N1 | 23-Sep-03 | 01:23:26.164951 | 23-Sep-03 | 03:08:46.944999 |
| RA2_FGD_2PNPDE20030923_030809_000061192020_00104_08174_0503.N1 | 23-Sep-03 | 03:08:09.124702 | 23-Sep-03 | 04:50:08.270756 |
| RA2_FGD_2PNPDK20030923_063026_000062082020_00106_08176_0415.N1 | 23-Sep-03 | 06:30:26.154218 | 23-Sep-03 | 08:13:54.420268 |
| RA2_FGD_2PNPDK20030923_081322_000060282020_00107_08177_0416.N1 | 23-Sep-03 | 08:13:22.169969 | 23-Sep-03 | 09:53:49.968030 |
| RA2_FGD_2PNPDK20030923_095306_000059982020_00108_08178_0417.N1 | 23-Sep-03 | 09:53:06.577734 | 23-Sep-03 | 11:33:04.297795 |
| RA2_FGD_2PNPDK20030923_113232_000059622020_00109_08179_0418.N1 | 23-Sep-03 | 11:32:32.047498 | 23-Sep-03 | 13:11:54.119563 |

| | | | | |
|---|---|---|---|---|
| RA2_FGD_2PNPDK20030923_131105_000059672020_00110_08180_0419.N1 | 23-Sep-03 | 13:11:05.159266 | 23-Sep-03 | 14:50:31.687329 |
| RA2_FGD_2PNPDK20030923_144930_000050602020_00111_08181_0420.N1 | 23-Sep-03 | 14:49:30.473031 | 23-Sep-03 | 16:13:50.205100 |
| RA2_FGD_2PNPDK20031006_080408_000060662020_00293_08363_0586.N1 | 06-Oct-03 | 08:04:08.847307 | 06-Oct-03 | 09:45:14.521363 |
| RA2_FGD_2PNPDK20031006_094442_000059482020_00294_08364_0587.N1 | 06-Oct-03 | 09:44:42.271068 | 06-Oct-03 | 11:23:49.861134 |
| RA2_FGD_2PNPDK20031006_112251_000059902020_00295_08365_0588.N1 | 06-Oct-03 | 11:22:51.988837 | 06-Oct-03 | 13:02:41.910901 |
| RA2_FGD_2PNPDK20031006_130145_000060592020_00296_08366_0589.N1 | 06-Oct-03 | 13:01:45.152603 | 06-Oct-03 | 14:42:44.142663 |
| RA2_FGD_2PNPDK20031006_144134_000050172020_00297_08367_0590.N1 | 06-Oct-03 | 14:41:34.016366 | 06-Oct-03 | 16:05:11.416436 |
| RA2_FGD_2PNPDK20031019_210854_000062102020_00487_08557_0333.N1 | 19-Oct-03 | 21:08:54.781287 | 19-Oct-03 | 22:52:25.275328 |
| RA2_FGD_2PNPDE20031019_225129_000063012020_00488_08558_0627.N1 | 19-Oct-03 | 22:51:29.631028 | 20-Oct-03 | 00:36:30.359106 |
| RA2_FGD_2PNPDE20031020_003533_000061002020_00489_08559_0628.N1 | 20-Oct-03 | 00:35:33.600807 | 20-Oct-03 | 02:17:13.808868 |
| RA2_FGD_2PNPDE20031020_021617_000062642020_00490_08560_0629.N1 | 20-Oct-03 | 02:16:17.050572 | 20-Oct-03 | 04:00:41.016625 |
| RA2_FGD_2PNPDE20031020_035939_000061252020_00491_08561_0630.N1 | 20-Oct-03 | 03:59:39.802326 | 20-Oct-03 | 05:41:44.518383 |
| RA2_FGD_2PNPDK20031020_054028_000063392020_00492_08562_0334.N1 | 20-Oct-03 | 05:40:28.822089 | 20-Oct-03 | 07:26:07.426131 |
| RA2_FGD_2PNPDK20031020_072534_000059572020_00493_08563_0335.N1 | 20-Oct-03 | 07:25:34.061833 | 20-Oct-03 | 09:04:50.563902 |
| RA2_FGD_2PNPDK20031020_090356_000059542020_00494_08564_0336.N1 | 20-Oct-03 | 09:03:56.033604 | 20-Oct-03 | 10:43:10.307673 |
| RA2_FGD_2PNPDK20031020_104210_000059782020_00495_08565_0337.N1 | 20-Oct-03 | 10:42:10.207375 | 20-Oct-03 | 12:21:47.875440 |
| RA2_FGD_2PNPDK20031020_122051_000060672020_00496_08566_0338.N1 | 20-Oct-03 | 12:20:51.117142 | 20-Oct-03 | 14:01:57.905204 |
| RA2_FGD_2PNPDK20031020_140058_000050562020_00497_08567_0339.N1 | 20-Oct-03 | 14:00:58.918907 | 20-Oct-03 | 15:25:15.308974 |

**Table 3: List of L2 FGD Files affected by S-Band anomaly during cycle 20**

An algorithm useful to detect DSRs affected by the S-Band anomaly within the L2 products can be found in [R- 12]; this is valid only for data acquired over open ocean.

## *7.2 RA-2 Altimeter Parameters*

### 7.2.1 ALTIMETER RANGE

No current results for the time being. Monitoring of the RA-2 FD altimetric range is planned to be done along with the upgrade of the DORIS navigator data processing for the NRT orbit computation.

### 7.2.2 SIGNIFICANT WAVE HEIGHT

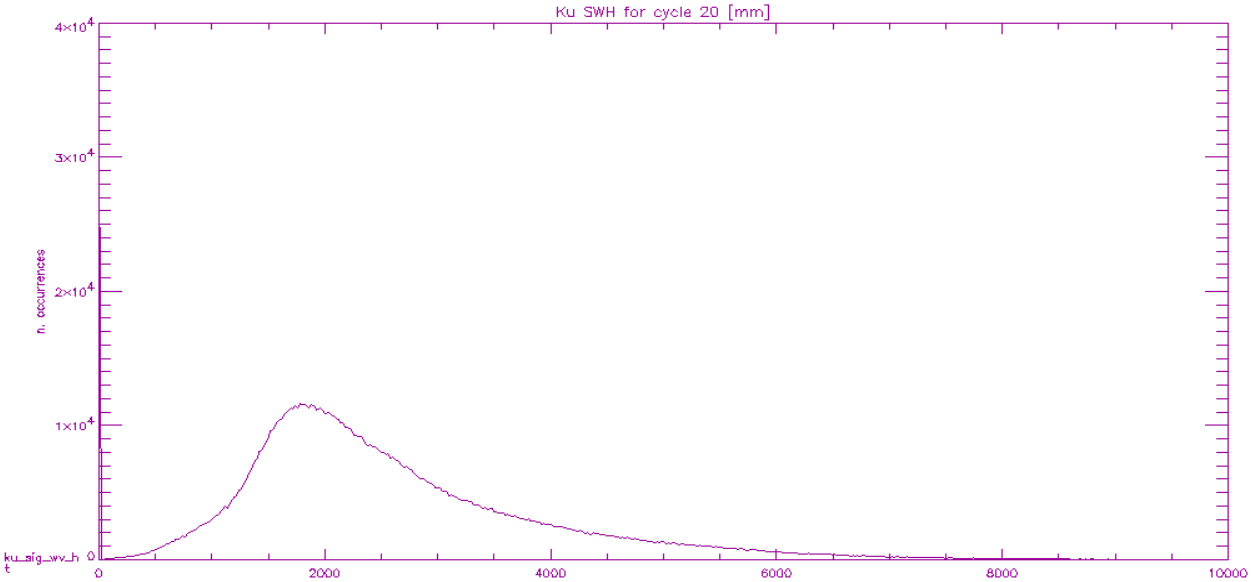


**Figure 7: Histogram of Ku SWH for cycle 20 (mm)**

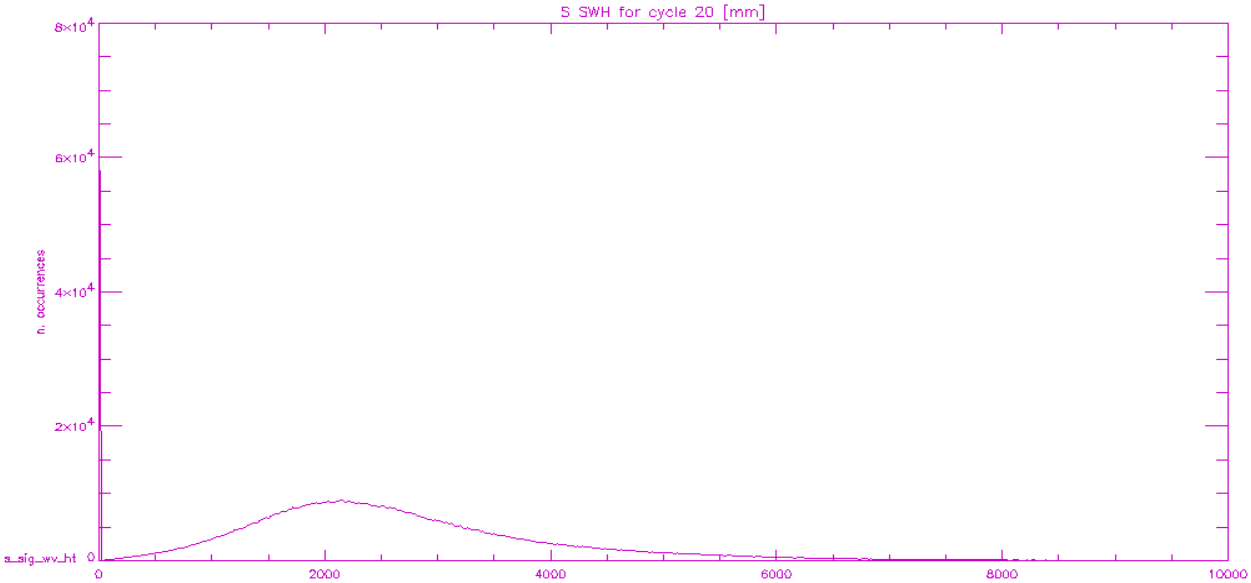


**Figure 8: Histogram of S SWH for cycle 20 (mm)**

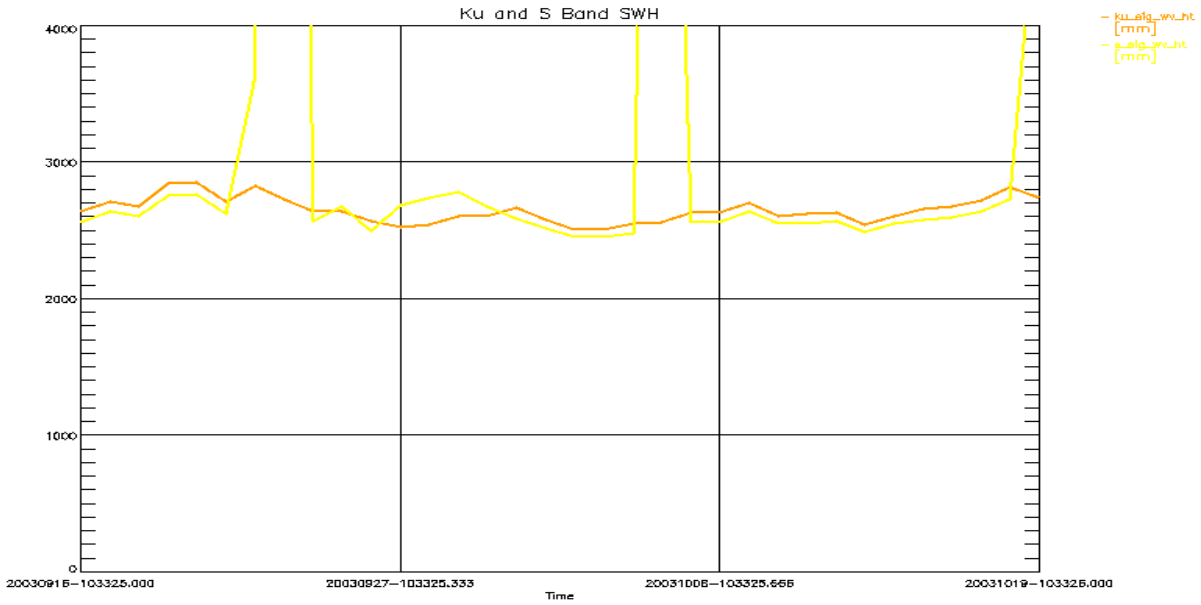


**Figure 9: Ku and S SWH daily average for cycle 20 (mm)**

## 7.2.3 BACKSCATTER COEFFICIENT – WIND SPEED

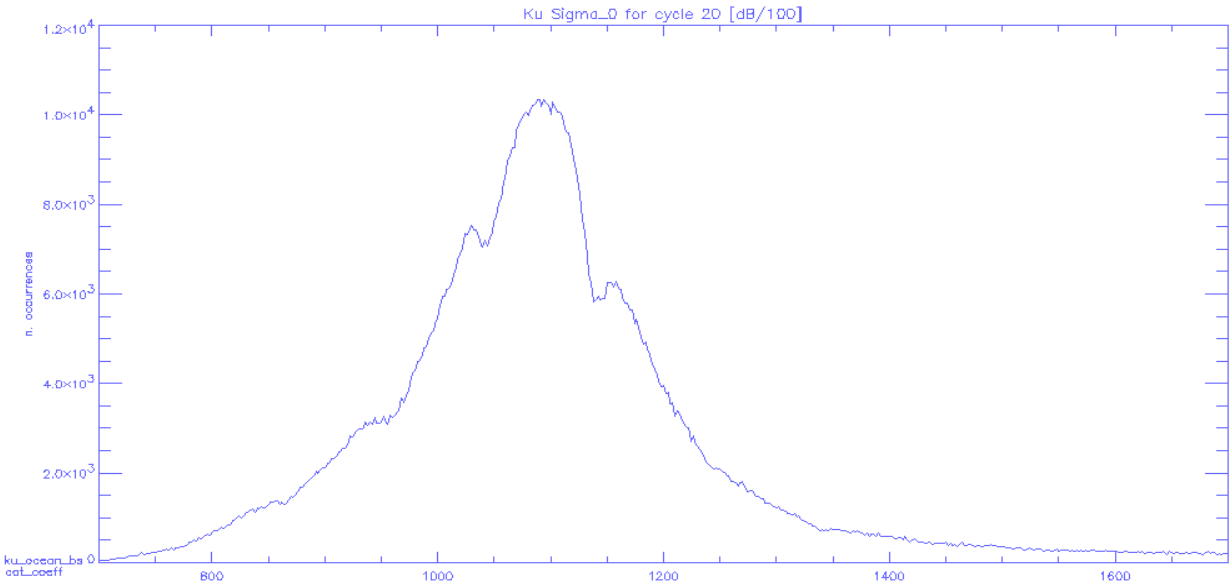


**Figure 10: Histogram of Ku Backscattering Coefficient for cycle 20 (dB/100)**

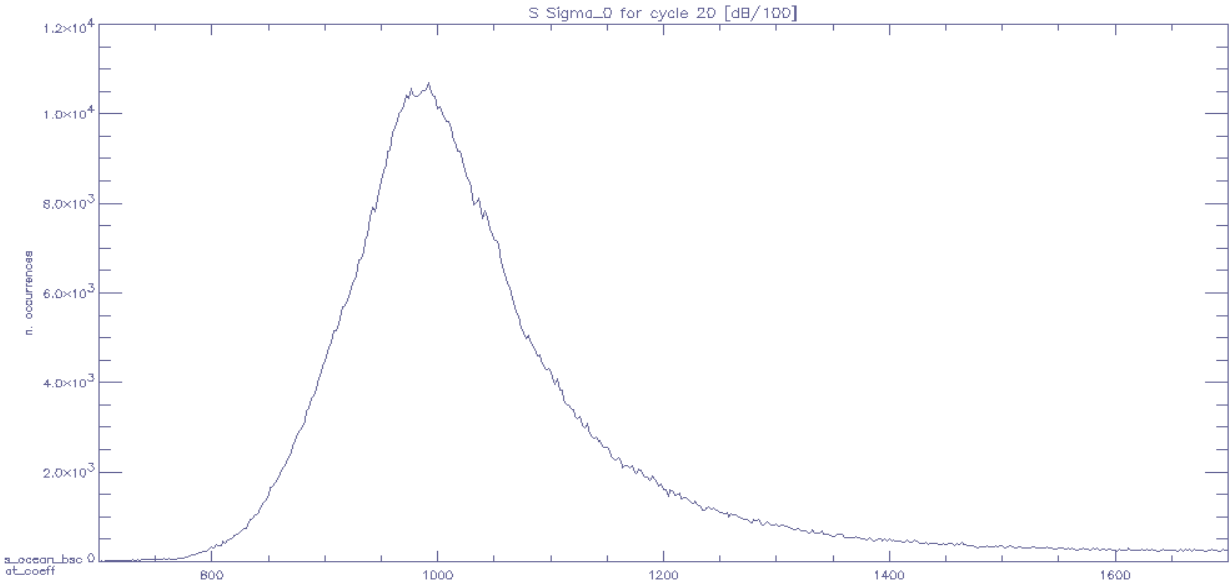


**Figure 11: Histogram of S Backscattering Coefficient for cycle 20 (dB/100)**

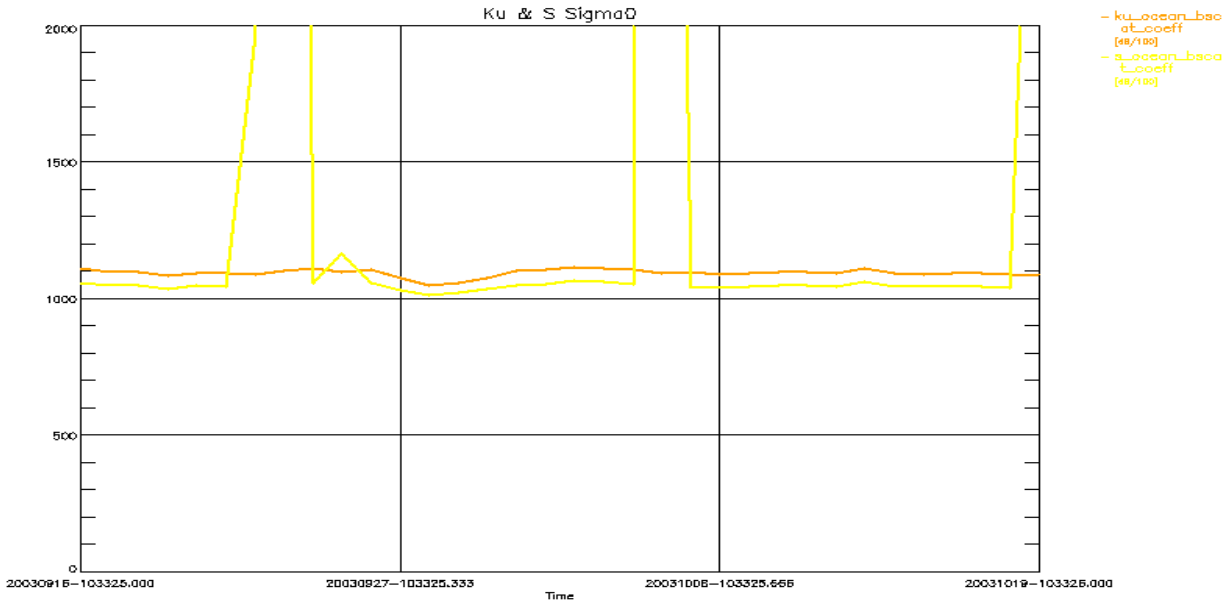


**Figure 12: Ku and S Sigma_0 daily average for cycle 20 (dB/100)**

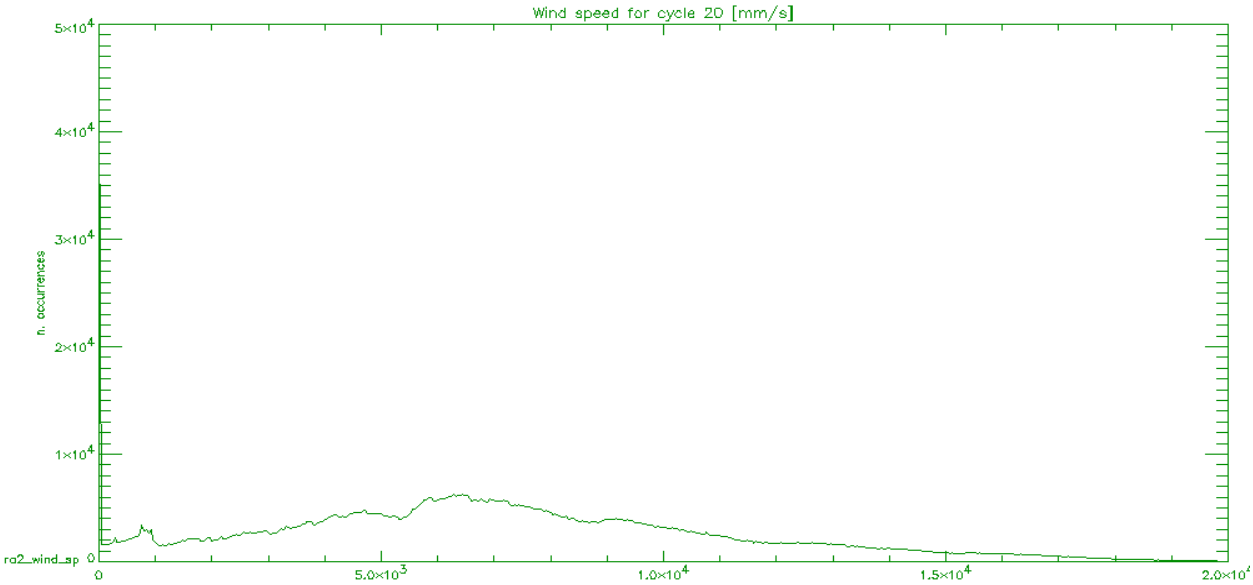


**Figure 13: Histogram of Ku Wind Speed for cycle 20 (mm/s)**

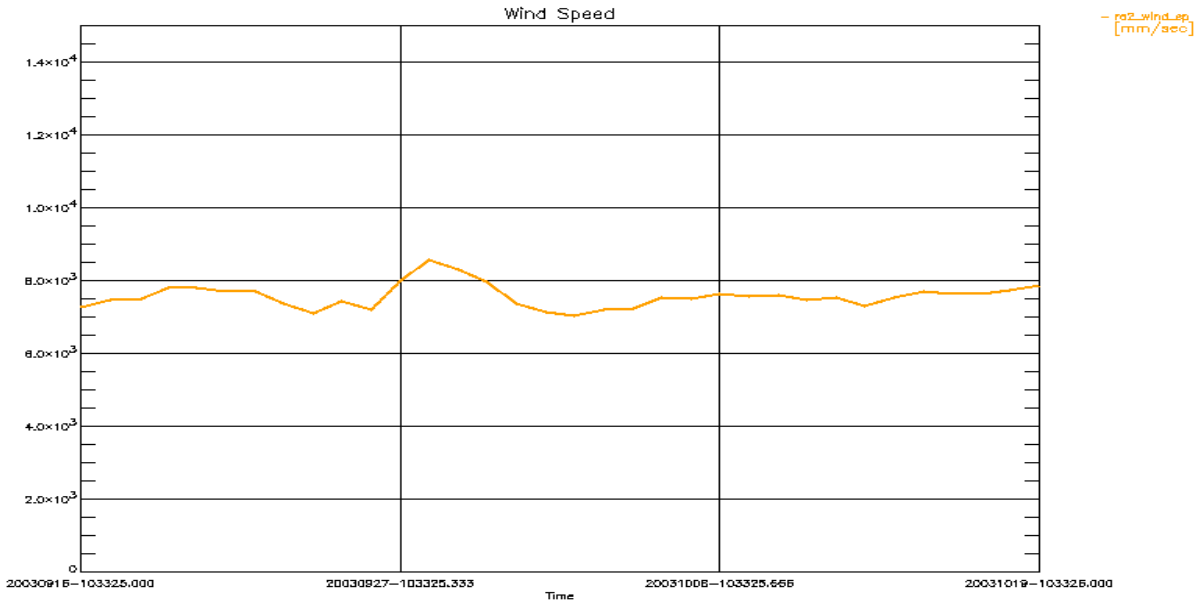


**Figure 14: Wind Speed daily average for cycle 20 (mm/s)**

## *7.3 MWR Performances*

For MWR performances please refer to the applicable CLS Cyclic Report of the type of [R – 2].

## *7.4 DORIS Performances*

For DORIS performances refer to the applicable F-PAC Monthly Report of the type of [R - 1].

# 8 PRODUCT PERFORMANCES

## *8.1 Availability of data*

In Figure 15, Figure 16 and Table 4 the summary of unavailable RA-2 L0 products is given. During this cycle only one cause of unavailability was present: PDS failure (plotted in red). It is easy to notice that close to the Himalayan region a small gap is present daily, this is due to the daily instrument switch-off (Heater 2 mode) performed to prevent the S-Band anomaly to last more than one day.



**Figure 15: RA-2 L0 unavailable products for first part of cycle 20 (16 Sept. - 1 Oct. 2003)**

**Figure 16: RA-2 L0 unavailable products for cycle second part of cycle 20 (1 – 20 Oct. 2003)**

| Start date | Start time | Stop date | Stop time | Duration (s) | Start orbit | Stop orbit | Reason |
|---|---|---|---|---|---|---|---|
| 16-Sep-03 | 16:36:47 | 16-Sep-03 | 16:38:04 | 77 | 8082 | 8082 | PDS_UNKNOWN_FAILURE |
| 16-Sep-03 | 17:15:00 | 16-Sep-03 | 18:23:32 | 4112 | 8082 | 8083 | PDS_UNKNOWN_FAILURE |
| 17-Sep-03 | 16:04:44 | 17-Sep-03 | 16:06:01 | 77 | 8096 | 8096 | PDS_UNKNOWN_FAILURE |
| 18-Sep-03 | 15:33:58 | 18-Sep-03 | 15:35:16 | 78 | 8110 | 8110 | PDS_UNKNOWN_FAILURE |
| 19-Sep-03 | 16:42:10 | 19-Sep-03 | 16:43:28 | 78 | 8125 | 8125 | PDS_UNKNOWN_FAILURE |
| 20-Sep-03 | 16:10:25 | 20-Sep-03 | 16:11:43 | 78 | 8139 | 8139 | PDS_UNKNOWN_FAILURE |
| 21-Sep-03 | 17:33:30 | 21-Sep-03 | 17:34:36 | 66 | 8154 | 8154 | PDS_UNKNOWN_FAILURE |
| 22-Sep-03 | 15:07:24 | 22-Sep-03 | 15:08:42 | 78 | 8167 | 8167 | PDS_UNKNOWN_FAILURE |
| 23-Sep-03 | 16:16:19 | 23-Sep-03 | 16:17:37 | 78 | 8182 | 8182 | PDS_UNKNOWN_FAILURE |
| 24-Sep-03 | 15:42:10 | 24-Sep-03 | 15:42:13 | 3 | 8196 | 8196 | PDS_UNKNOWN_FAILURE |
| 24-Sep-03 | 15:45:08 | 24-Sep-03 | 15:46:26 | 78 | 8196 | 8196 | PDS_UNKNOWN_FAILURE |
| 25-Sep-03 | 15:13:18 | 25-Sep-03 | 15:14:36 | 78 | 8210 | 8210 | PDS_UNKNOWN_FAILURE |
| 26-Sep-03 | 16:22:13 | 26-Sep-03 | 16:23:31 | 78 | 8225 | 8225 | PDS_UNKNOWN_FAILURE |
| 27-Sep-03 | 00:28:05 | 27-Sep-03 | 00:28:08 | 3 | 8229 | 8229 | PDS_UNKNOWN_FAILURE |
| 27-Sep-03 | 12:52:00 | 27-Sep-03 | 12:53:06 | 66 | 8237 | 8237 | PDS_UNKNOWN_FAILURE |
| 27-Sep-03 | 15:47:54 | 27-Sep-03 | 15:47:57 | 3 | 8239 | 8239 | PDS_UNKNOWN_FAILURE |
| 27-Sep-03 | 15:50:42 | 27-Sep-03 | 15:52:00 | 78 | 8239 | 8239 | PDS_UNKNOWN_FAILURE |
| 28-Sep-03 | 15:16:45 | 28-Sep-03 | 15:16:48 | 3 | 8253 | 8253 | PDS_UNKNOWN_FAILURE |
| 28-Sep-03 | 15:19:12 | 28-Sep-03 | 15:20:30 | 78 | 8253 | 8253 | PDS_UNKNOWN_FAILURE |
| 29-Sep-03 | 16:28:07 | 29-Sep-03 | 16:29:25 | 78 | 8268 | 8268 | PDS_UNKNOWN_FAILURE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30-Sep-03 | 15:56:17 | 30-Sep-03 | 15:57:35 | 78 | 8282 | 8282 | PDS_UNKNOWN_FAILURE |
| 01-Oct-03 | 09:01:40 | 01-Oct-03 | 10:41:15 | 5975 | 8292 | 8293 | PDS_UNKNOWN_FAILURE |
| 01-Oct-03 | 15:25:06 | 01-Oct-03 | 15:26:24 | 78 | 8296 | 8296 | PDS_UNKNOWN_FAILURE |
| 02-Oct-03 | 16:34:01 | 02-Oct-03 | 16:35:19 | 78 | 8311 | 8311 | PDS_UNKNOWN_FAILURE |
| 03-Oct-03 | 16:01:53 | 03-Oct-03 | 16:03:11 | 78 | 8325 | 8325 | PDS_UNKNOWN_FAILURE |
| 04-Oct-03 | 15:31:01 | 04-Oct-03 | 15:32:19 | 78 | 8339 | 8339 | PDS_UNKNOWN_FAILURE |
| 05-Oct-03 | 16:39:26 | 05-Oct-03 | 16:40:44 | 78 | 8354 | 8354 | PDS_UNKNOWN_FAILURE |
| 06-Oct-03 | 16:07:29 | 06-Oct-03 | 16:08:46 | 77 | 8368 | 8368 | PDS_UNKNOWN_FAILURE |
| 07-Oct-03 | 15:36:43 | 07-Oct-03 | 15:38:01 | 78 | 8382 | 8382 | PDS_UNKNOWN_FAILURE |
| 08-Oct-03 | 10:21:32 | 08-Oct-03 | 11:24:47 | 3795 | 8393 | 8393 | PDS_UNKNOWN_FAILURE |
| 08-Oct-03 | 16:44:50 | 08-Oct-03 | 16:46:08 | 78 | 8397 | 8397 | PDS_UNKNOWN_FAILURE |
| 09-Oct-03 | 16:13:21 | 09-Oct-03 | 16:14:38 | 77 | 8411 | 8411 | PDS_UNKNOWN_FAILURE |
| 10-Oct-03 | 15:39:20 | 10-Oct-03 | 15:39:22 | 2 | 8425 | 8425 | PDS_UNKNOWN_FAILURE |
| 10-Oct-03 | 15:42:19 | 10-Oct-03 | 15:43:37 | 78 | 8425 | 8425 | PDS_UNKNOWN_FAILURE |
| 11-Oct-03 | 15:10:20 | 11-Oct-03 | 15:11:38 | 78 | 8439 | 8439 | PDS_UNKNOWN_FAILURE |
| 12-Oct-03 | 10:00:52 | 12-Oct-03 | 10:01:17 | 25 | 8450 | 8450 | PDS_UNKNOWN_FAILURE |
| 12-Oct-03 | 16:19:15 | 12-Oct-03 | 16:20:33 | 78 | 8454 | 8454 | PDS_UNKNOWN_FAILURE |
| 13-Oct-03 | 15:45:01 | 13-Oct-03 | 15:45:04 | 3 | 8468 | 8468 | PDS_UNKNOWN_FAILURE |
| 13-Oct-03 | 15:47:54 | 13-Oct-03 | 15:49:12 | 78 | 8468 | 8468 | PDS_UNKNOWN_FAILURE |
| 14-Oct-03 | 15:13:55 | 14-Oct-03 | 15:13:58 | 3 | 8482 | 8482 | PDS_UNKNOWN_FAILURE |
| 14-Oct-03 | 15:16:14 | 14-Oct-03 | 15:17:32 | 78 | 8482 | 8482 | PDS_UNKNOWN_FAILURE |
| 14-Oct-03 | 18:41:47 | 14-Oct-03 | 18:44:47 | 180 | 8484 | 8484 | PDS_UNKNOWN_FAILURE |
| 15-Oct-03 | 16:25:09 | 15-Oct-03 | 16:26:27 | 78 | 8497 | 8497 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:37:36 | 16-Oct-03 | 09:37:57 | 21 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:38:01 | 16-Oct-03 | 09:38:58 | 57 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 15:50:46 | 16-Oct-03 | 15:50:48 | 2 | 8511 | 8511 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 15:53:29 | 16-Oct-03 | 15:54:47 | 78 | 8511 | 8511 | PDS_UNKNOWN_FAILURE |
| 17-Oct-03 | 15:19:33 | 17-Oct-03 | 15:19:36 | 3 | 8525 | 8525 | PDS_UNKNOWN_FAILURE |
| 17-Oct-03 | 15:22:09 | 17-Oct-03 | 15:23:26 | 77 | 8525 | 8525 | PDS_UNKNOWN_FAILURE |
| 18-Oct-03 | 16:31:04 | 18-Oct-03 | 16:32:21 | 77 | 8540 | 8540 | PDS_UNKNOWN_FAILURE |
| 19-Oct-03 | 15:56:30 | 19-Oct-03 | 15:56:32 | 2 | 8554 | 8554 | PDS_UNKNOWN_FAILURE |
| 19-Oct-03 | 15:59:04 | 19-Oct-03 | 16:00:22 | 78 | 8554 | 8554 | PDS_UNKNOWN_FAILURE |
| 20-Oct-03 | 15:28:03 | 20-Oct-03 | 15:29:20 | 77 | 8568 | 8568 | PDS_UNKNOWN_FAILURE |

**Table 4: List of gaps for RA-2 L0 products during cycle 20**

In Figure 17, Figure 18and Table 5 the summary of unavailable MWR L0 products is given. Only gaps due to PDS failure since no unplanned MWR switch-off have happened during this cycle.

**Figure 17: MWR L0 unavailable products for first part of cycle 20 (16 Sept. - 1 Oct. 2003)**

**Figure 18: MWR L0 unavailable products for second part of cycle 20 (1 – 20 Oct. 2003)**

| Start date | Start time | Stop date | Stop time | Duration (s) | Start orbit | Stop orbit | Reason |
|---|---|---|---|---|---|---|---|
| 16-Sep-03 | 17:14:17 | 16-Sep-03 | 18:23:29 | 4152 | 8082 | 8083 | PDS_UNKNOWN_FAILURE |
| 01-Oct-03 | 09:00:47 | 01-Oct-03 | 10:41:11 | 6024 | 8292 | 8293 | PDS_UNKNOWN_FAILURE |
| 08-Oct-03 | 10:20:38 | 08-Oct-03 | 11:24:38 | 3840 | 8393 | 8393 | PDS_UNKNOWN_FAILURE |

**Table 5: List of gaps for MWR L0 products during cycle 20**

In Figure 19, Figure 20and Table 6 the summary of unavailable RA-2 L1b products is given. In this case no distinction is made among the different types of gaps.



**Figure 19: RA-2 L1b unavailable products for first part of cycle 20 (16 Sept. - 1 Oct. 2003)**

**Figure 20: RA-2 L1b unavailable products for second part of cycle 20 (1 – 20 Oct. 2003)**

| Start date | Start time | Stop date | Stop time | Duration (s) | Start orbit | Stop orbit | Reason |
|---|---|---|---|---|---|---|---|
| 16-Sep-03 | 03:28:15 | 16-Sep-03 | 05:09:14 | 6059 | 8074 | 8075 | PDS_UNKNOWN_FAILURE |
| 16-Sep-03 | 16:36:47 | 16-Sep-03 | 16:38:04 | 77 | 8082 | 8082 | PDS_UNKNOWN_FAILURE |
| 16-Sep-03 | 17:15:35 | 16-Sep-03 | 18:23:32 | 4077 | 8082 | 8083 | PDS_UNKNOWN_FAILURE |
| 17-Sep-03 | 16:04:44 | 17-Sep-03 | 16:06:01 | 77 | 8096 | 8096 | PDS_UNKNOWN_FAILURE |
| 18-Sep-03 | 02:24:42 | 18-Sep-03 | 04:05:23 | 6041 | 8102 | 8103 | PDS_UNKNOWN_FAILURE |
| 18-Sep-03 | 15:33:58 | 18-Sep-03 | 15:35:16 | 78 | 8110 | 8110 | PDS_UNKNOWN_FAILURE |
| 18-Sep-03 | 20:36:35 | 18-Sep-03 | 20:36:50 | 15 | 8113 | 8113 | PDS_UNKNOWN_FAILURE |
| 19-Sep-03 | 13:35:00 | 19-Sep-03 | 15:11:01 | 5761 | 8123 | 8124 | PDS_UNKNOWN_FAILURE |
| 19-Sep-03 | 16:42:10 | 19-Sep-03 | 16:43:28 | 78 | 8125 | 8125 | PDS_UNKNOWN_FAILURE |
| 20-Sep-03 | 16:10:25 | 20-Sep-03 | 16:11:43 | 78 | 8139 | 8139 | PDS_UNKNOWN_FAILURE |
| 21-Sep-03 | 17:33:30 | 21-Sep-03 | 17:34:36 | 66 | 8154 | 8154 | PDS_UNKNOWN_FAILURE |
| 22-Sep-03 | 01:57:00 | 22-Sep-03 | 03:39:07 | 6127 | 8159 | 8160 | PDS_UNKNOWN_FAILURE |
| 22-Sep-03 | 15:07:24 | 22-Sep-03 | 15:08:42 | 78 | 8167 | 8167 | PDS_UNKNOWN_FAILURE |
| 23-Sep-03 | 04:50:08 | 23-Sep-03 | 06:30:26 | 6018 | 8175 | 8176 | PDS_UNKNOWN_FAILURE |
| 23-Sep-03 | 16:16:19 | 23-Sep-03 | 16:17:37 | 78 | 8182 | 8182 | PDS_UNKNOWN_FAILURE |
| 24-Sep-03 | 15:45:08 | 24-Sep-03 | 15:46:26 | 78 | 8196 | 8196 | PDS_UNKNOWN_FAILURE |
| 25-Sep-03 | 15:13:18 | 25-Sep-03 | 15:14:36 | 78 | 8210 | 8210 | PDS_UNKNOWN_FAILURE |
| 25-Sep-03 | 20:17:52 | 25-Sep-03 | 20:18:16 | 24 | 8213 | 8213 | PDS_UNKNOWN_FAILURE |
| 26-Sep-03 | 16:22:13 | 26-Sep-03 | 16:23:31 | 78 | 8225 | 8225 | PDS_UNKNOWN_FAILURE |
| 27-Sep-03 | 12:52:00 | 27-Sep-03 | 12:53:06 | 66 | 8237 | 8237 | PDS_UNKNOWN_FAILURE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27-Sep-03 | 15:50:42 | 27-Sep-03 | 15:52:00 | 78 | 8239 | 8239 | PDS_UNKNOWN_FAILURE |
| 28-Sep-03 | 07:17:14 | 28-Sep-03 | 08:54:58 | 5864 | 8248 | 8249 | PDS_UNKNOWN_FAILURE |
| 28-Sep-03 | 15:19:12 | 28-Sep-03 | 15:20:30 | 78 | 8253 | 8253 | PDS_UNKNOWN_FAILURE |
| 28-Sep-03 | 20:23:35 | 28-Sep-03 | 20:23:59 | 24 | 8256 | 8256 | PDS_UNKNOWN_FAILURE |
| 28-Sep-03 | 20:24:04 | 28-Sep-03 | 20:27:41 | 217 | 8256 | 8256 | PDS_UNKNOWN_FAILURE |
| 29-Sep-03 | 16:28:07 | 29-Sep-03 | 16:29:25 | 78 | 8268 | 8268 | PDS_UNKNOWN_FAILURE |
| 30-Sep-03 | 09:33:28 | 30-Sep-03 | 09:41:53 | 505 | 8278 | 8278 | PDS_UNKNOWN_FAILURE |
| 30-Sep-03 | 09:41:53 | 30-Sep-03 | 09:42:13 | 20 | 8278 | 8278 | PDS_UNKNOWN_FAILURE |
| 30-Sep-03 | 15:56:17 | 30-Sep-03 | 15:57:35 | 78 | 8282 | 8282 | PDS_UNKNOWN_FAILURE |
| 01-Oct-03 | 09:01:41 | 01-Oct-03 | 10:41:15 | 5974 | 8292 | 8293 | PDS_UNKNOWN_FAILURE |
| 01-Oct-03 | 10:41:15 | 01-Oct-03 | 10:41:16 | 1 | 8293 | 8293 | PDS_UNKNOWN_FAILURE |
| 01-Oct-03 | 15:25:06 | 01-Oct-03 | 15:26:24 | 78 | 8296 | 8296 | PDS_UNKNOWN_FAILURE |
| 02-Oct-03 | 16:34:01 | 02-Oct-03 | 16:35:19 | 78 | 8311 | 8311 | PDS_UNKNOWN_FAILURE |
| 03-Oct-03 | 16:01:53 | 03-Oct-03 | 16:03:11 | 78 | 8325 | 8325 | PDS_UNKNOWN_FAILURE |
| 04-Oct-03 | 07:28:10 | 04-Oct-03 | 09:07:29 | 5959 | 8334 | 8335 | PDS_UNKNOWN_FAILURE |
| 04-Oct-03 | 15:31:01 | 04-Oct-03 | 15:32:19 | 78 | 8339 | 8339 | PDS_UNKNOWN_FAILURE |
| 05-Oct-03 | 16:39:26 | 05-Oct-03 | 16:40:44 | 78 | 8354 | 8354 | PDS_UNKNOWN_FAILURE |
| 06-Oct-03 | 16:07:29 | 06-Oct-03 | 16:08:46 | 77 | 8368 | 8368 | PDS_UNKNOWN_FAILURE |
| 07-Oct-03 | 09:13:06 | 07-Oct-03 | 10:52:22 | 5956 | 8378 | 8379 | PDS_UNKNOWN_FAILURE |
| 07-Oct-03 | 15:36:43 | 07-Oct-03 | 15:38:01 | 78 | 8382 | 8382 | PDS_UNKNOWN_FAILURE |
| 07-Oct-03 | 20:39:24 | 07-Oct-03 | 20:39:38 | 14 | 8385 | 8385 | PDS_UNKNOWN_FAILURE |
| 07-Oct-03 | 20:39:42 | 07-Oct-03 | 20:44:51 | 309 | 8385 | 8385 | PDS_UNKNOWN_FAILURE |
| 08-Oct-03 | 10:21:33 | 08-Oct-03 | 11:24:47 | 3794 | 8393 | 8393 | PDS_UNKNOWN_FAILURE |
| 08-Oct-03 | 16:44:50 | 08-Oct-03 | 16:46:08 | 78 | 8397 | 8397 | PDS_UNKNOWN_FAILURE |
| 09-Oct-03 | 16:13:21 | 09-Oct-03 | 16:14:38 | 77 | 8411 | 8411 | PDS_UNKNOWN_FAILURE |
| 10-Oct-03 | 15:42:19 | 10-Oct-03 | 15:43:37 | 78 | 8425 | 8425 | PDS_UNKNOWN_FAILURE |
| 10-Oct-03 | 15:43:37 | 10-Oct-03 | 15:54:00 | 623 | 8425 | 8425 | PDS_UNKNOWN_FAILURE |
| 11-Oct-03 | 15:10:20 | 11-Oct-03 | 15:11:38 | 78 | 8439 | 8439 | PDS_UNKNOWN_FAILURE |
| 12-Oct-03 | 10:00:53 | 12-Oct-03 | 10:01:17 | 24 | 8450 | 8450 | PDS_UNKNOWN_FAILURE |
| 12-Oct-03 | 16:19:15 | 12-Oct-03 | 16:20:33 | 78 | 8454 | 8454 | PDS_UNKNOWN_FAILURE |
| 13-Oct-03 | 15:47:54 | 13-Oct-03 | 15:49:12 | 78 | 8468 | 8468 | PDS_UNKNOWN_FAILURE |
| 14-Oct-03 | 15:16:14 | 14-Oct-03 | 15:17:32 | 78 | 8482 | 8482 | PDS_UNKNOWN_FAILURE |
| 14-Oct-03 | 18:41:48 | 14-Oct-03 | 18:44:47 | 179 | 8484 | 8484 | PDS_UNKNOWN_FAILURE |
| 14-Oct-03 | 20:20:43 | 14-Oct-03 | 20:21:07 | 24 | 8485 | 8485 | PDS_UNKNOWN_FAILURE |
| 15-Oct-03 | 16:25:09 | 15-Oct-03 | 16:26:27 | 78 | 8497 | 8497 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:37:32 | 16-Oct-03 | 09:37:36 | 4 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:37:36 | 16-Oct-03 | 09:37:57 | 21 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:38:01 | 16-Oct-03 | 09:38:58 | 57 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:38:58 | 16-Oct-03 | 09:39:03 | 5 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 09:39:03 | 16-Oct-03 | 09:39:23 | 20 | 8507 | 8507 | PDS_UNKNOWN_FAILURE |
| 16-Oct-03 | 15:53:29 | 16-Oct-03 | 15:54:47 | 78 | 8511 | 8511 | PDS_UNKNOWN_FAILURE |
| 17-Oct-03 | 15:19:34 | 17-Oct-03 | 15:19:36 | 2 | 8525 | 8525 | PDS_UNKNOWN_FAILURE |
| 17-Oct-03 | 15:22:09 | 17-Oct-03 | 15:23:26 | 77 | 8525 | 8525 | PDS_UNKNOWN_FAILURE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 18-Oct-03 | 16:31:04 | 18-Oct-03 | 16:32:21 | 77 | 8540 | 8540 | PDS_UNKNOWN_FAILURE |
| 19-Oct-03 | 15:59:04 | 19-Oct-03 | 16:00:22 | 78 | 8554 | 8554 | PDS_UNKNOWN_FAILURE |
| 20-Oct-03 | 15:28:03 | 20-Oct-03 | 15:29:20 | 77 | 8568 | 8568 | PDS_UNKNOWN_FAILURE |

**Table 6: List of gaps for RA-2 L1b products during cycle 20**

## *8.2 Edited measurements*

In order to produce the statistics reported in 7.2 the following editing criteria have been used:

| Parameter | Surface type | Zone | Range |
|---|---|---|---|
| Ku SWH | Open Ocean | All world | [0, 10] (m) |
| Ku Backscattering Coeff. | Open ocean | All world | [7, 17] (dBs) |
| Ku Wind Speed | Open ocean | All world | [0, 20] (m/s) |

**Table 7: Editing criteria for RA-2 parameters statistics**

## *8.3 Product Disclaimer*

For the product disclaimers please refer to the following web link:
http://envisat.esa.int/dataproducts/availability/

## *8.4 Geophysical quality assessment*

Refer to the ECMWF report given in [R – 9].

# 9 INSTRUMENT LONG TERM MONITORING

For the time being, considering the available amount of data analyzed, no long-term monitoring is possible

# 10 PARTICULAR INVESTIGATIONS

An investigation has been performed regarding the accuracy of the USO clock period as given in the current auxiliary file (RA2_USO_AX), see [R – 11].