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ENVISAT CYCLIC ALTIMETRIC REPORT

CYCLE 31 from 05-10-2004 to 08-11-2004

Quality Assessment Report

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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 31.

This report covers the period from the 5th of October 2004 and the 8th of November 2004.

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
EPC	Electronic Power Converter
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
OBT	On-Board Time
OCM	Orbit Control Mode/Manoeuvres
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
PLSOL	Payload Switch-Off Line

PMC	Payload Main Computer
PTR	Point Target Response
RA-2	EnviSat Radar Altimeter bi-frequency
RSL	Resolution Selection Logic
SAD	Static Auxiliary Files
SBT	Satellite Binary Time
SEU	Single Event
SFCM	Stellar Fine Control Mode
SPH	Specific Product header
SPSA	Signal Processing Sub-Assembly
SYSM	Stellar Yaw Steering Mode
S/W	Software
TM	Telemetry
TRP	Transponder
TWT	Traveling Wave Tube
UTC	Coordinated Universal Time
YSM	Yaw Stellar Mode

4 REFERENCE DOCUMENTS

[R – 1] F-PAC MONTHLY REPORT, SALP-RP-M-OP-15351-CN, October 2004
[R – 2] ENVISAT Microwave Radiometer Assessment Report Cycle 031, CLS.DOS/04.238, http://earth.esa.int/pcs/envisat/mwr/reports/
[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, http://earth.esa.int/pcs/envisat/ra2/articles/
[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 October 2004, Report on ENVISAT Radar Altimeter - 2 (RA- 2), Wind/ Wave Product with Height Information (RA2_ WWV_ 2P), http://earth.esa.int/pcs/envisat/ra2/reports/ecmwf/
[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 # 122-126, ENVI-ESOC-OPS-RP-1011-TOS-OF
[R – 14] Envisat validation and cross calibration activities during the verification phase. Synthesis Report ESTEC contract No. 16243/02/NL/FF WP6, http://earth.esa.int/pcs/envisat/ra2/articles/

[R – 15] ENVISAT-1 Products Specifications - Vol. 14: RA-2 Products Specifications, PO-RS-MDA-GS-2009, Iss 3, Rev. K, 24/05/2004
[R – 16] Algorithm for Flag identification and waveforms reconstruction of RA-2 data affected by "S-Band anomaly", ENVI-GSEG-TN-04-0004, Issue 1.4

5 GENERAL QUALITY ASSESSMENT

5.1 Instruments status

The RA-2 instrument, during this cycle underwent no instrument anomaly as given in par. 6.1.

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.
13582	13682.2	1974.429	2336.452	2219.565	2236.242	99.67354	99.28722	99.30655	99.30379
13682.2	13782.4	2121.04	5237.311	11157.95	5252.178	99.6493	98.78334	97.8044	98.78089
13782.4	13882.6	2115.157	1093.662	1089.332	1107.225	99.65027	99.46944	99.47016	99.4672
13882.6	13982.8	2067.749	1113.757	6831.41	6851.658	99.65811	99.47396	98.52858	98.52523
13982.8	14083	2152.515	4583.682	4563.687	4596.741	99.64409	98.88621	98.88951	98.88405

Table 1: RA-2 L0, L1b and L2 FGD Data products availability summary for cycle 31

The summary of the MWR L0 data products availability for this cycle is given in Table 2.

Start orbit	Stop orbit	Time instrum. unavailability	Time L0 gaps	% instrum. avail.	% L0 avail.
13582	13682.2	0	1175.999	100	99.80556
13682.2	13782.4	0.001	4199.999	100	99.30556
13782.4	13882.6	0	0	100	100
13882.6	13982.8	0.001	95.999	100	99.98413
13982.8	14083	0	4079.999	100	99.3254

Table 2: MWR L0 Data products availability summary for cycle 31

The summary of the DORIS L0 data products availability for this cycle is given in Table 3.

Start orbit	Stop orbit	Time instrum. unavailability	Time L0 gaps	% instrum. avail.	% L0 avail.
13582	13682.2	0	8033.999	100	99.33582
13682.2	13782.4	393840	22318	67.44053	65.59546
13782.4	13882.6	0	1275	100	99.89459
13882.6	13982.8	0	1532.999	100	99.87326
13982.8	14083	0	11731	100	99.03017

Table 3: DORIS L0 Data products availability summary for cycle 31

5.3 Orbit quality

During cycle 31 the orbit was maintained within the +/- 1km to the reference ground track.

On the 22-October-2004, a 2-burn SFCM collision avoidance manoeuvre was executed as planned. The following table summarises the SFCM observed performance:

	Burn Start Time	Nominal Delta-V	Calibrated Delta-V	Mode
First burn	2004/10/22-04:20:00	-0.0400 m/sec	-0.0395 m/sec	SFCM
	Burn Start Time	**Nominal Delta-V**	**Calibrated Delta-V**	**Mode**
Second burn	2004/10/22-06:00:00	0.0390 m/sec	0.0386 m/sec	SFCM

5.4 Ground Segment Processing Chain Status

5.4.1 IPF PROCESSING CHAIN

Current version of the IPF processing chain is V4.58, installed in both PDHS-E and PDHS-K on July the 16th. This is equivalent to the previous version for what regards all the algorithms and auxiliary files, only a new parameter has been added in the SPH that is the pass number which, for NRT data is nominally set to 0. This was done in order to be compliant with the off-line products version that indeed includes the pass number.

Previous IPF version V4.57 was operational at the Envisat PDHS-K and PDHS-E since April 29th and 28th 2004 respectively.

5.4.2 F-PAC PROCESSING CHAIN

Current version of CMA is V6.3 operational since Apr. 29, 2004.

F-PAC CMA 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_AXVIEC20031208_143628_20020101_000000_20200101_000000
RA2_IFA_AXVIEC20020313_174755_20020101_000000_20200101_000000
RA2_IFB_AXVIEC20020313_174959_20020101_000000_20200101_000000
RA2_IFF_AXVIEC20031208_151817_20030602_215929_20100101_000000
RA2_IOC_AXVIEC20020122_141121_20020101_000000_20200101_000000
RA2_MET_AXVIEC20020204_073357_20020101_000000_20200101_000000
RA2_MSS_AXVIEC20031208_145545_20020101_000000_20200101_000000
RA2_OT1_AXVIEC20040120_082051_20020101_000000_20200101_000000
RA2_OT2_AXVIEC20031208_150159_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_AXVIEC20031208_150608_20020101_000000_20200101_000000
RA2_SSB_AXVIEC20031208_150749_20020101_000000_20200101_000000
RA2_TLD_AXVIEC20031208_151137_20020101_000000_20200101_000000
RA2_USO_AXVIEC20020122_162920_20020101_000000_20200101_000000
```

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

The RA-2 Auxiliary Data Files (ADF) are accessible from the Envisat Web pages under http://envisat.esa.int/services/tools_table.html.

5.4.4 PLANNED UPGRADES

Evolution of the IPF Level 1B and Level 2 processing chain is currently planned. The next IPF version release shall nominally contain the following:

1. USO instrumental correction within the RA-2 L1b processor.
2. New MWR Side Lobes correction algorithm within MWR L1b processor
3. Correction of the mispointing evaluation algorithm within the RA-2 L2 processor
4. Inclusion of the loading tide for the GOT2000.2 model.
5. Addition of the peakiness fields in Ku and S band to the RA-2 and MWR FD/I/MAR meteorological products
6. Inclusion of the square of the significant wave height in Ku and S band
7. Inclusion of an S-band anomaly flag, see [R – 16]
8. Upgrade of the Level 1B and Level 2 processing for DORIS NRT orbital information computation.

Evolutions 3, 5 and 6 shall be reflected too in the F-PAC CMA processing chain.

6 ENVISAT PAYLOAD STATUS

6.1 Altimeter Events

The Radar Altimeter 2, during cycle 31, was never unavailable.

The HSU1 fuse problem (Ref anomaly occurrence during cycle 22) is still present. This problem does not affect nominal operations since the RA-2 instrument is heated by the nearby hardware.

The cause of the problem is still unknown. The heater fuses as well as the hardware used to report on the status of the fuses are presently under examination.

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 twice per day over Himalayan region (ascending and descending passes).
- Preset Loop Output mode for GAVDOS Range transponders, located in Creta.
- Preset Loop Output acquisition over ESA transponders, located near Rome; for 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.

Hereafter the map is reported showing the acquisition sites for both the Range and Sigma_0 transponders.

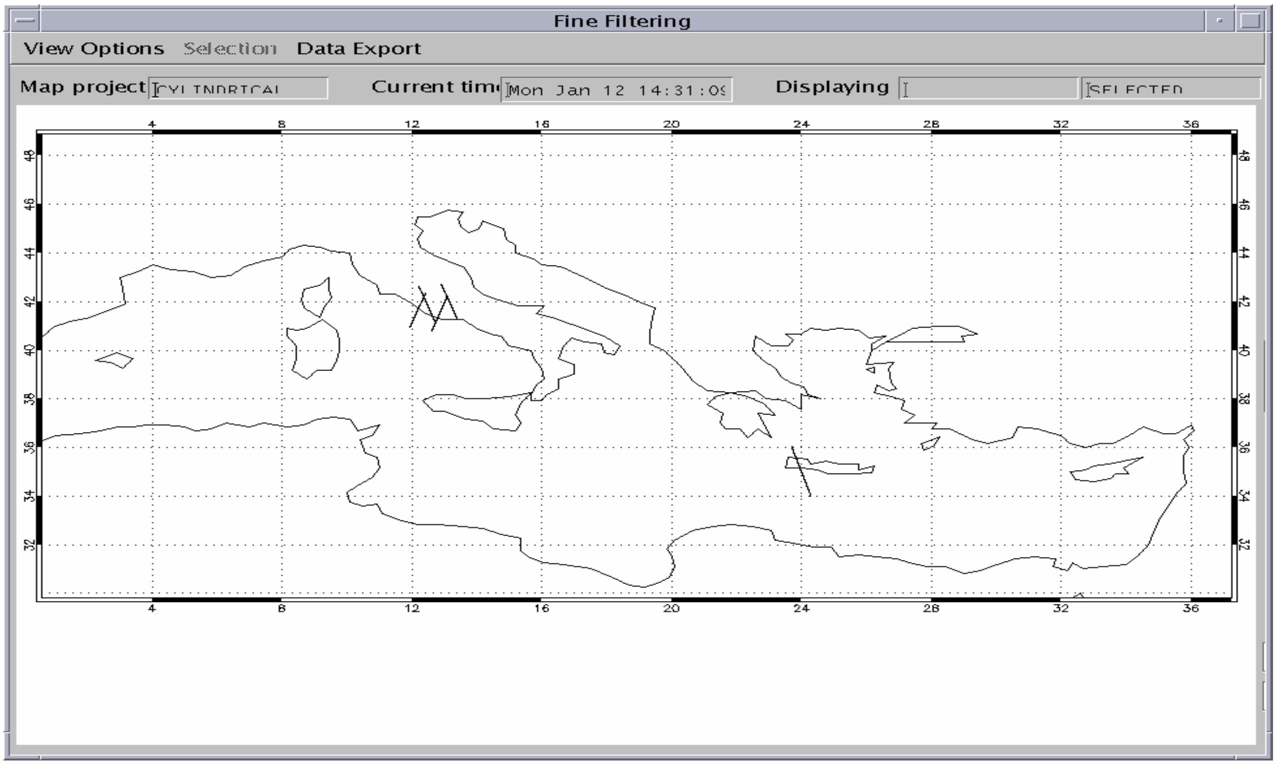

Figure 1: Transponder Acquisition sites for cycle 31

6.2 MWR Events

The MWR, during cycle 31 was never unavailable.

6.3 DORIS Events

The DORIS during cycle 31 was never unavailable.

Starting from June the 14th 2004 the DORIS USO was switched to the redundancy component and it is now working correctly.

7 INSTRUMENT PERFORMANCES

7.1 RA-2 Performances

7.1.1 IF FILTER MASK

In Figure 2 all valid IF masks retrieved by averaging the 100 seconds of data acquired daily during cycle 31 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 31 the number of valid IF masks has been of 16, representing about the 23% of the total available IF masks. 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).

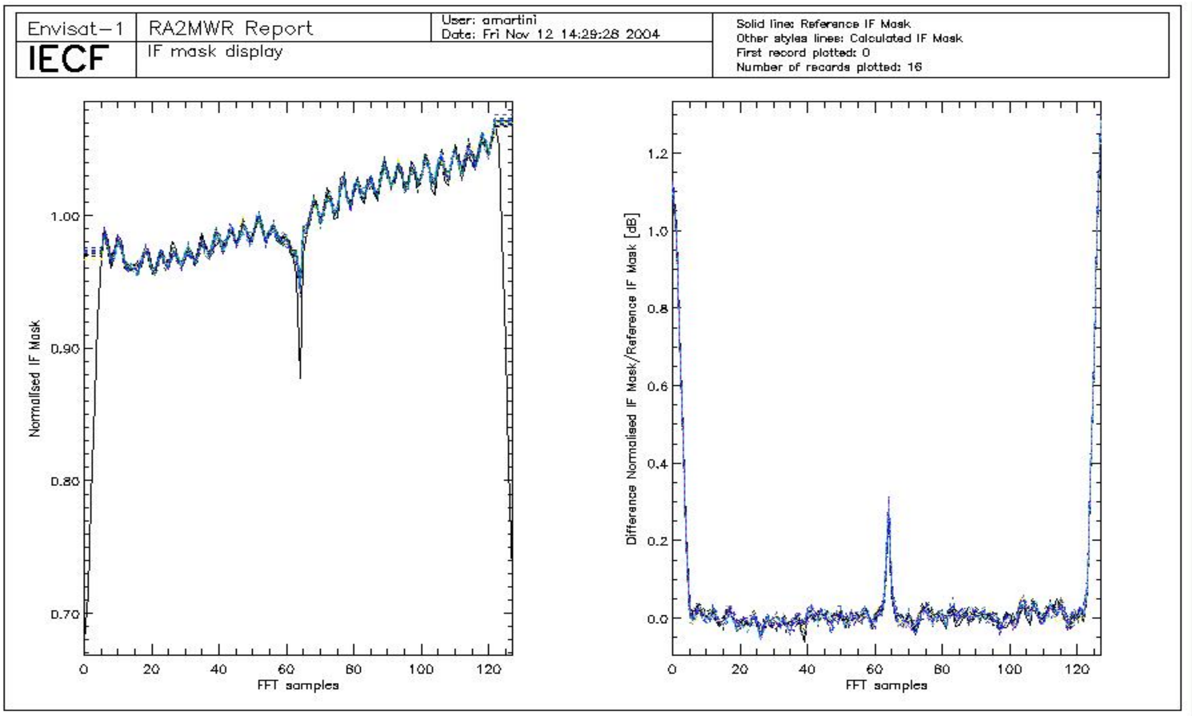

Figure 2: Valid IF masks retrieved daily during cycle 31 plotted together with the on-ground reference.

7.1.2 USO

In Figure 3 the USO clock period trend retrieved for cycle 31 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.

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. This problem will be corrected with the following upgrade of the IPF as described in par. 5.4.4.

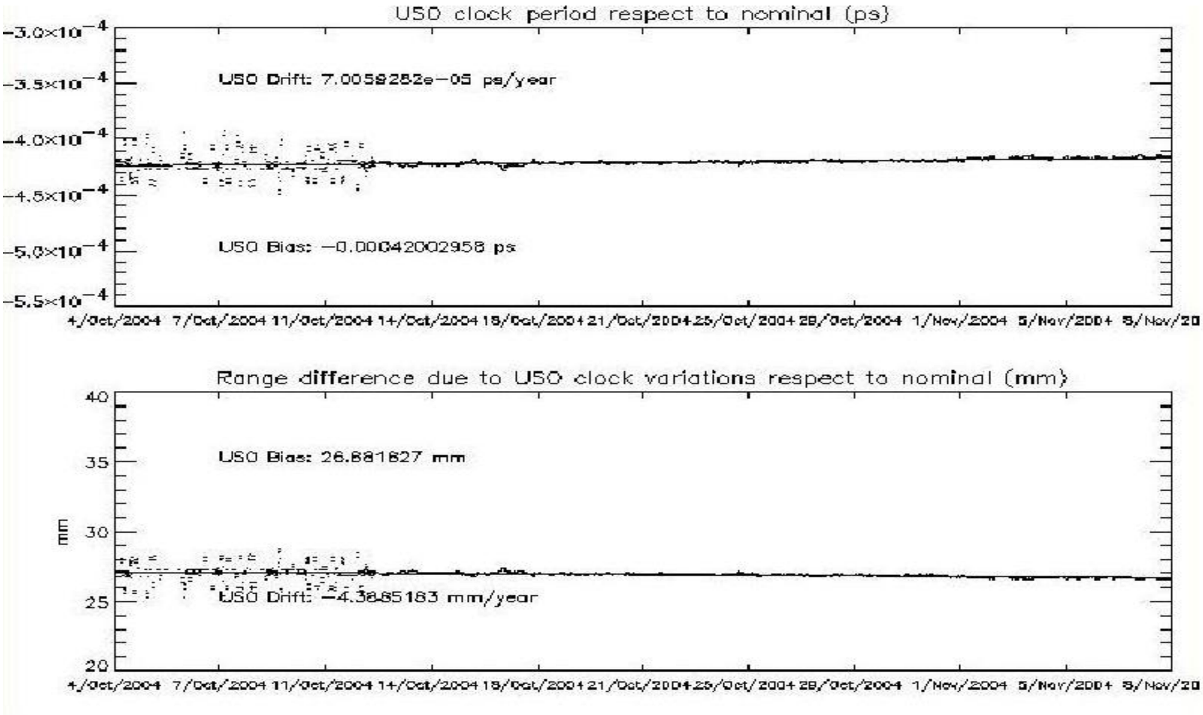

Figure 3: USO clock period for cycle 31

7.1.3 TRACKING CAPABILITY

In Figure 4 and Figure 5, the Chirp ID is plotted respectively for ascending and descending passes of cycle 31. 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).

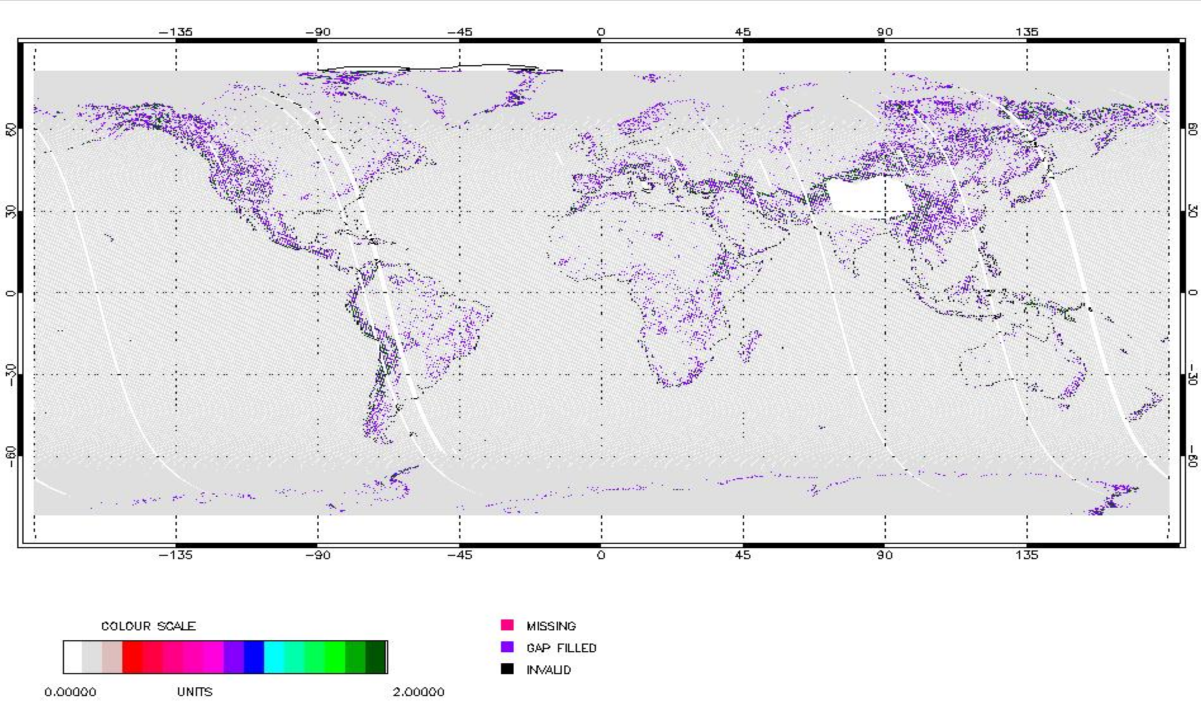

Figure 4: RA-2 Chirp ID for ascending passes during cycle 31

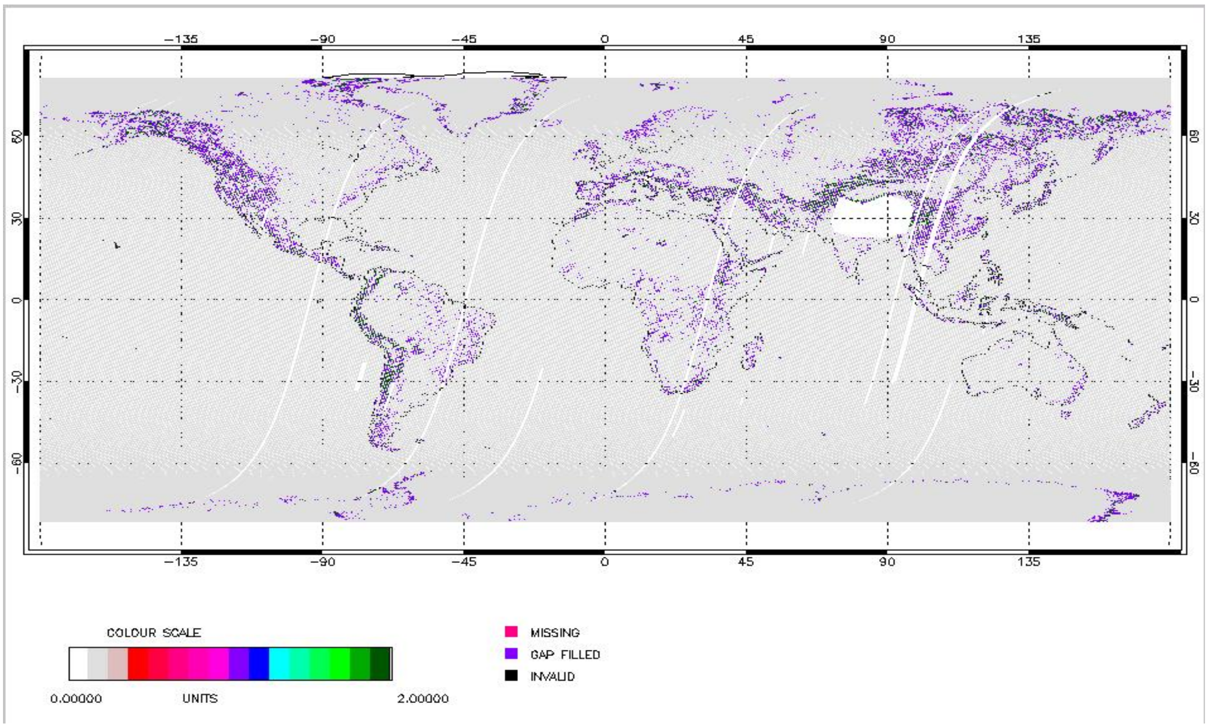

Figure 5: RA-2 Chirp ID for descending passes during cycle 31

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

Surface type	320 MHz	80 MHz	20MHz
Open Ocean	99.990%	0.009%	0.001%
Costal Water (ocean depth < 200 m)	98.20%	1.60%	0.20%
Sea Ice	99.22%	0.69%	0.09%
Ice Sheet	96.53%	2.85%	0.62%
Land	82.22%	13.34%	4.44%
All world	95.23%	3.70%	1.07%

Table 4: 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.
The objectives of the Commissioning Phase "RSL and Tracking optimization" are 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

During cycle 31 none of the Sigma_0 Transponder planned acquisition were not performed due to a Transponder failure. The problem has already been identified and it will be solved as soon as possible.
On the other hand, all the measurements acquired until now have been processed giving the following results:

Orbit	Date	Location/Rel. Track	Coordinates	Resolution	Not Corrected Backscattering Bias [dB]	Wet Tropospheric Correction (one way) [dB]
10389	24-feb-04	Rome/315	41.8472, 12.4819	Low	1,552	0,0606
10511	04-mar-04	Valmontone/437	41.7673, 12.9247	Low	1,542	0,0519
10618	11-mar-04	Fiuggi/43	41.7875, 13.2212	Low	1,447	0,0578
10783	23-mar-04	Maccarese/208	41.8605, 12.2385	Low	1,54	0,0636
10890	30-mar-04	Rome/315	41.8472, 12.4819	Low	1,442	0,0789
11513	13-mag-04	Valmontone/437	41.7673, 12.9247	Low	1,353	0,0672
11620	20-mag-04	Fiuggi/43	41.7875, 13.2212	Low	1,417	0,0719
11892	08-giu-04	Rome/315	41.8472,	Low	1,504	0,0772

			12.4819			
12014	17-giu-04	Valmontone/437	41.7673, 12.9247	Low	1,448	0,2538
12121	24-giu-04	Fiuggi/43	41.7875, 13.2212	Low	1,576	0,0767
11119	15-apr-04	Fiuggi/43	41.7875, 13.2212	High	0,963	0,0588

Table 5: Absolute backscattering calibration results obtained with Transponder measurements

As it is possible to notice from Table 5 the values obtained at Low resolution are about 0.5 dB higher than the one obtained at High resolution, which is in agreement with the Commissioning Phase Transponder results.

7.1.5 DATATION

A significant part of an eventual error in the RA-2 products datation could be given by the not perfect synchronism between the Satellite Binary Time and the UTC Time due to a drift of the ICU clock period. A correlation between those two times is performed at every Kiruna orbit dump and then extrapolated for the four non-Kiruna orbits. In Figure 6 (upper panel) the differences between the extrapolated UTC values and the corresponding real UTC values measured at the next Kiruna dump, are reported. For the whole cycle they are well under the 20 microseconds warning threshold. In the lower panel the ICU clock step for the same period is shown.

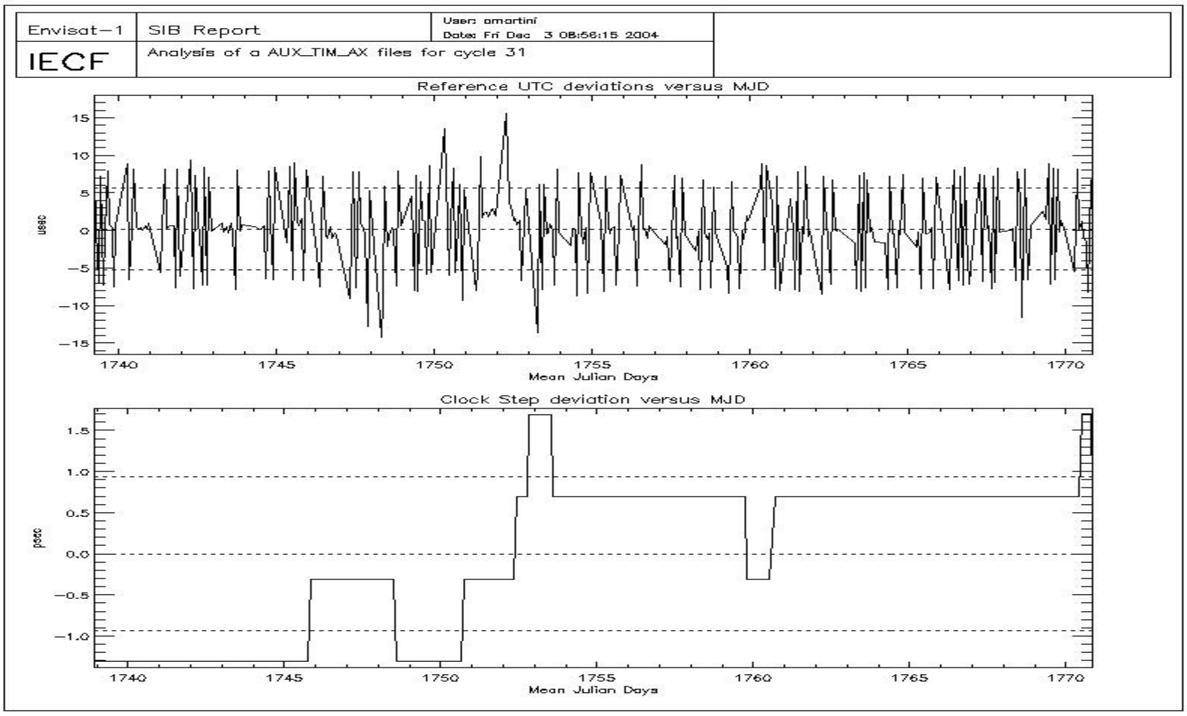

Figure 6: UTC deviations and ICU clock period for cycle 31

7.1.6 MISPOINTING

In Figure7 the trend of the mispointing squared (averaged every orbit) is reported in deg^2*10e-4
The average mispointing value, as extracted from the RA2_FGD_2P data products, is around 0.028 deg^2, is known to be higher than the one reported at platform level [R – 13]. This is due to a not perfect tuning of the algorithm currently used to retrieve the mispointing value from the RA-2 waveform data. An optimization of this algorithm shall be part of the next Level 2 processors upgrade, planned for end-2004 (ref. 5.4.4).
In particular for this cycle no event of low mispointing values is visible in the plot since no instrument anomaly occurred as reported in par. 6.1. However, in general the mispointing values appear to be lower during a period of several orbits after instrument anomalies. The explanation of the anomalous mispointing behavior in correspondence to instrument switch-offs is given in par 7.1.6. Furthermore high mispointing values can be noticed in correlation with the Out-of-Plane manoeuvre performed in the 21st of September (ref. par. 5.3).

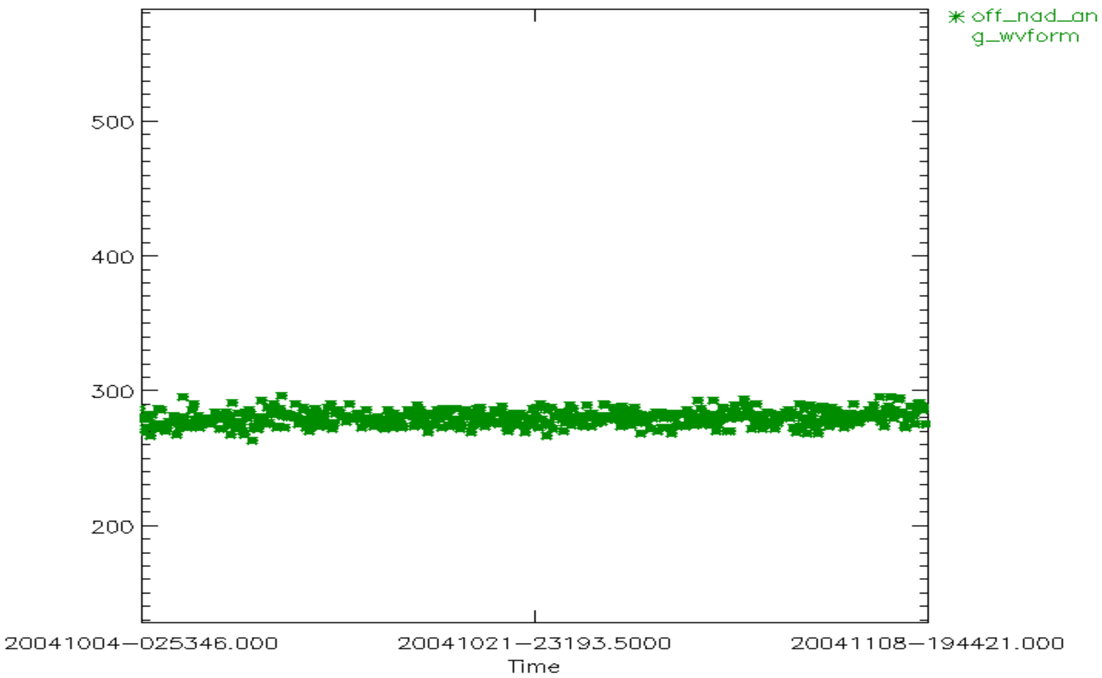

Figure 7: Smoothed mispointing squared trend for cycle 31 (deg^2*10^4)

7.1.7 S-BAND ANOMALY

The so-called “S-Band anomaly” affects the RA-2 data products quality. Hereafter, the table lists the products files affected by the S-band anomaly problem during cycle 31. This corresponds to a total percentage of about 3.4% of the acquired data.

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. (ref. [R – 7])

File name	Start date	Start time	Stop date	Stop time
RA2_FGD_2PNPDK20041013_123923_000059352031_00124_13705_1508.N1	13-OCT-2004	12:39:23.152479	13-OCT-2004	14:18:18.488579
RA2_FGD_2PNPDK20041013_141643_000051302031_00125_13706_1509.N1	13-OCT-2004	14:16:43.854274	13-OCT-2004	15:42:13.768364
RA2_FGD_2PNPDK20041023_104505_000059792031_00266_13847_1628.N1	23-OCT-2004	10:45:05.076184	23-OCT-2004	12:24:43.858284
RA2_FGD_2PNPDK20041023_122343_000060142031_00267_13848_1629.N1	23-OCT-2004	12:23:43.757978	23-OCT-2004	14:03:58.188076
RA2_FGD_2PNPDK20041023_140255_000051112031_00268_13849_1630.N1	23-OCT-2004	14:02:55.859778	23-OCT-2004	15:28:06.835873
RA2_FGD_2PNPDK20041025_094358_000060032031_00294_13875_1652.N1	25-OCT-2004	09:43:58.188442	25-OCT-2004	11:24:01.478540
RA2_FGD_2PNPDK20041025_112256_000059812031_00295_13876_1653.N1	25-OCT-2004	11:22:56.922249	25-OCT-2004	13:02:37.932351
RA2_FGD_2PNPDK20041025_130131_000060012031_00296_13877_1654.N1	25-OCT-2004	13:01:31.148053	25-OCT-2004	14:41:32.210152
RA2_FGD_2PNPDK20041029_091728_000060172031_00351_13932_1704.N1	29-OCT-2004	09:17:28.078165	29-OCT-2004	10:57:44.736264
RA2_FGD_2PNPDK20041029_105640_000059922031_00352_13933_1705.N1	29-OCT-2004	10:56:40.179959	29-OCT-2004	12:36:32.330058
RA2_FGD_2PNPDK20041029_123525_000060012031_00353_13934_1706.N1	29-OCT-2004	12:35:25.545769	29-OCT-2004	14:15:26.607867
RA2_FGD_2PNPDK20041029_141415_000051082031_00354_13935_1707.N1	29-OCT-2004	14:14:15.367561	29-OCT-2004	15:39:23.001699
RA2_FGD_2PNPDK20041030_070248_000062212031_00364_13945_1716.N1	30-OCT-2004	07:02:48.834218	30-OCT-2004	08:46:29.354307
RA2_FGD_2PNPDK20041030_084523_000059722031_00365_13946_1717.N1	30-OCT-2004	08:45:23.684009	30-OCT-2004	10:24:55.782109
RA2_FGD_2PNPDK20041030_102348_000061482031_00366_13947_1718.N1	30-OCT-2004	10:23:48.997805	30-OCT-2004	12:06:17.107897
RA2_FGD_2PNPDK20041030_120454_000059822031_00367_13948_1719.N1	30-OCT-2004	12:04:54.727609	30-OCT-2004	13:44:36.851709
RA2_FGD_2PNPDK20041030_134330_000050922031_00368_13949_1720.N1	30-OCT-2004	13:43:30.067410	30-OCT-2004	15:08:22.105475

Table 6: List of L2 FGD Files affected by S-Band anomaly during cycle 31

A valuable algorithm to detect the RA-2 DSRs affected by the S-Band anomaly within the L2 products can be found in [R- 12]. Note that the algorithm is only valid for data acquired over open-ocean.

7.1.8 IN-FLIGHT INTERNAL CALIBRATION

The RA-2 Range and Sigma0 measurements are corrected to take into account the internal path delay and attenuation respectively. This is done by measuring those two variables in relation to the internal Point Target Response. The two correction factors are calculated during the L1b processing and directly applied. They are also continuously monitored and the results for cycle 31 (averaged per day) are reported in Figure 8 and Figure 9. It can be noticed that the time delay calibration factor shows a very stable behaviour while the Sigma0 one reports a small decreasing trend of few thousands of a dB over the cycle.

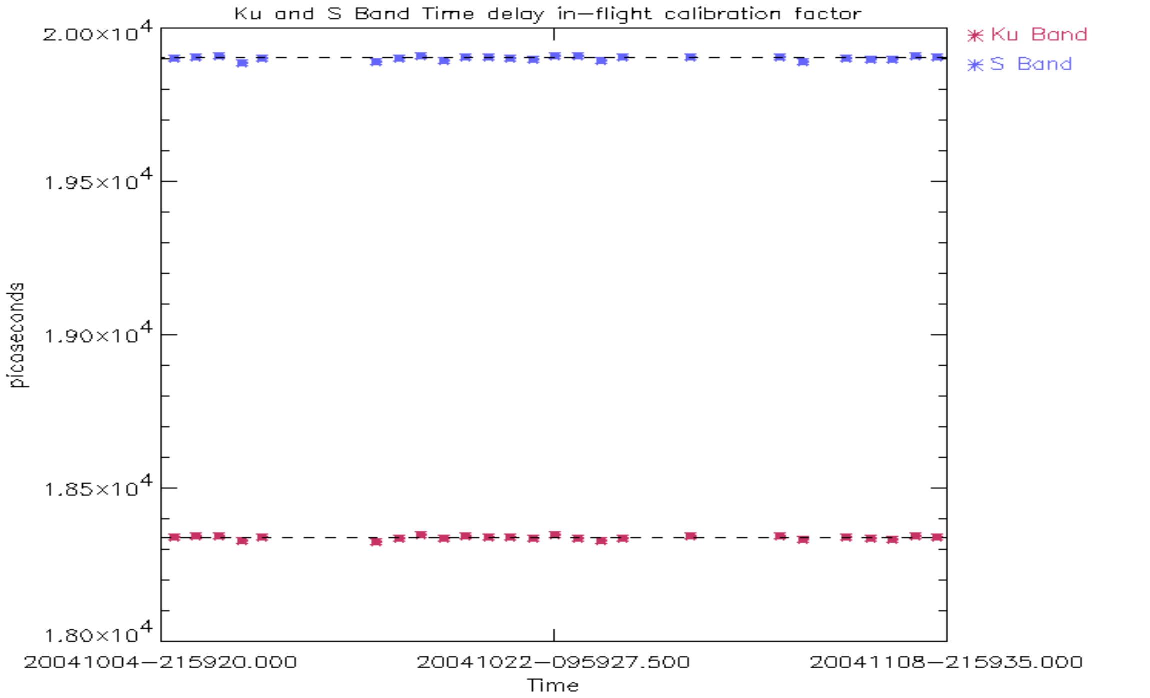

Figure 8: Ku and S Band in-flight time delay calibration factor for cycle 31

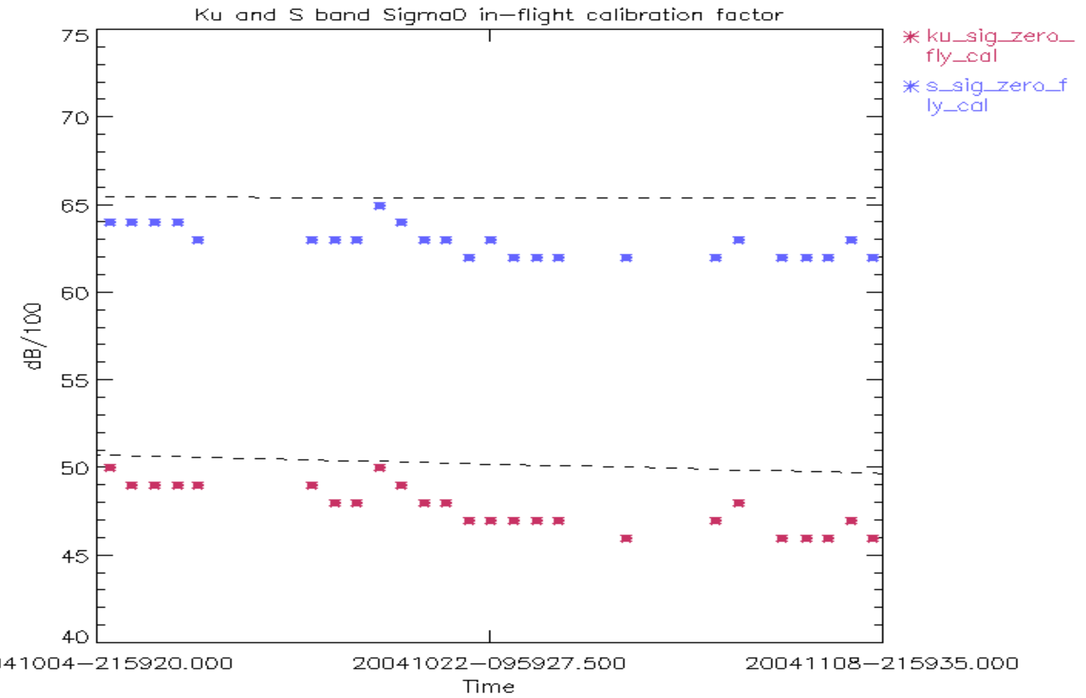

Figure 9: Ku and S Band in-flight Sigma0 calibration factor for cycle 31

7.2 MWR Performances

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

7.3 DORIS Performances

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

8 PRODUCT PERFORMANCES

8.1 Availability of data

In Figure 10 and **Error! Reference source not found.** the summary of unavailable RA-2 L0 products is given.
It is easy to notice that close to the Himalayan region two small gaps in the data are present. This is due to the daily instrument switch-offs (Heater 2 mode) performed to prevent the S-Band anomaly to last more than half a day when it occurs

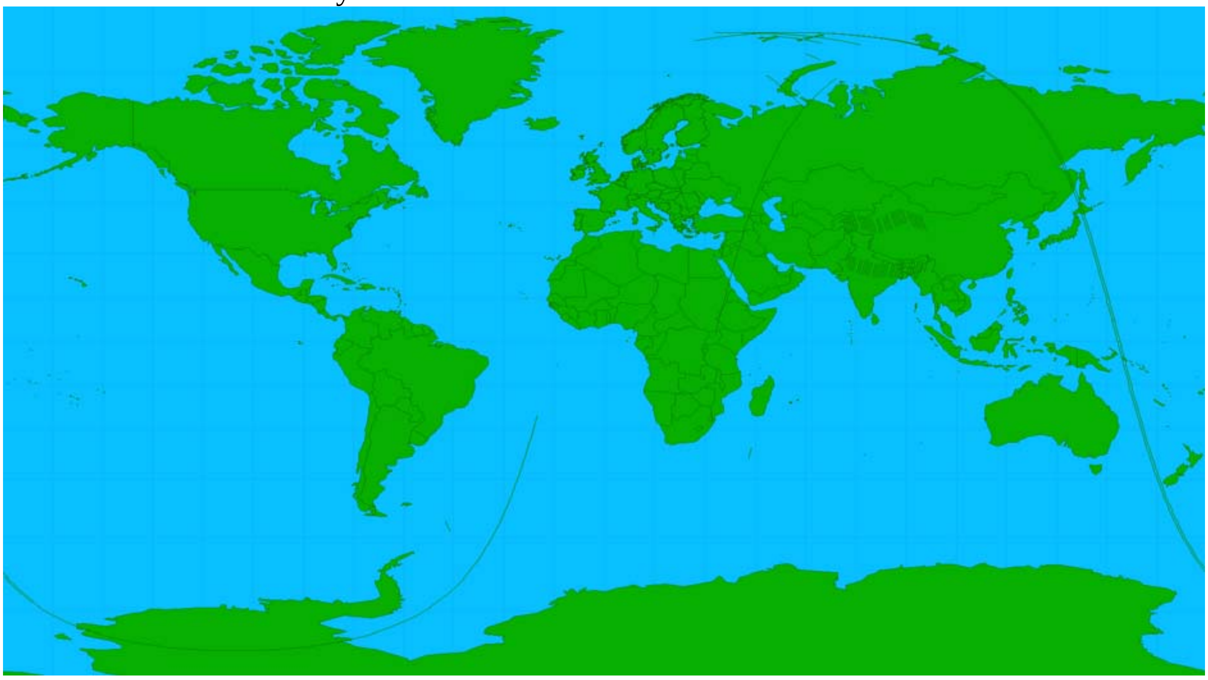

Figure 10: RA-2 L0 unavailable products for first part of cycle 31

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
05-Oct-04	05:23:57	05-Oct-04	05:25:14	77	13586	13586	PDS_UNKNOWN_FAILURE
05-Oct-04	16:36:44	05-Oct-04	16:38:02	78	13593	13593	PDS_UNKNOWN_FAILURE
06-Oct-04	04:53:02	06-Oct-04	04:54:20	78	13600	13600	PDS_UNKNOWN_FAILURE
06-Oct-04	16:04:41	06-Oct-04	16:05:59	78	13607	13607	PDS_UNKNOWN_FAILURE
07-Oct-04	04:21:25	07-Oct-04	04:22:43	78	13614	13614	PDS_UNKNOWN_FAILURE

07-Oct-04	07:28:50	07-Oct-04	07:49:33	1243	13616	13616	PDS_UNKNOWN_FAILURE
07-Oct-04	15:33:56	07-Oct-04	15:35:14	78	13621	13621	PDS_UNKNOWN_FAILURE
08-Oct-04	05:28:56	08-Oct-04	05:30:14	78	13629	13629	PDS_UNKNOWN_FAILURE
08-Oct-04	16:42:09	08-Oct-04	16:43:26	77	13636	13636	PDS_UNKNOWN_FAILURE
09-Oct-04	04:58:41	09-Oct-04	04:59:59	78	13643	13643	PDS_UNKNOWN_FAILURE
09-Oct-04	16:10:24	09-Oct-04	16:11:42	78	13650	13650	PDS_UNKNOWN_FAILURE
10-Oct-04	04:23:57	10-Oct-04	04:24:00	3	13657	13657	PDS_UNKNOWN_FAILURE
10-Oct-04	04:27:11	10-Oct-04	04:28:28	77	13657	13657	PDS_UNKNOWN_FAILURE
10-Oct-04	15:36:32	10-Oct-04	15:36:34	2	13664	13664	PDS_UNKNOWN_FAILURE
10-Oct-04	15:39:32	10-Oct-04	15:40:50	78	13664	13664	PDS_UNKNOWN_FAILURE
12-Oct-04	05:04:19	12-Oct-04	05:05:36	77	13686	13686	PDS_UNKNOWN_FAILURE
12-Oct-04	16:16:19	12-Oct-04	16:17:37	78	13693	13693	PDS_UNKNOWN_FAILURE
13-Oct-04	04:29:43	13-Oct-04	04:29:45	2	13700	13700	PDS_UNKNOWN_FAILURE
13-Oct-04	04:32:56	13-Oct-04	04:34:14	78	13700	13700	PDS_UNKNOWN_FAILURE
13-Oct-04	15:45:08	13-Oct-04	15:46:26	78	13707	13707	PDS_UNKNOWN_FAILURE
14-Oct-04	04:00:58	14-Oct-04	04:02:16	78	13714	13714	PDS_UNKNOWN_FAILURE
14-Oct-04	15:13:19	14-Oct-04	15:14:37	78	13721	13721	PDS_UNKNOWN_FAILURE
15-Oct-04	05:07:43	15-Oct-04	05:07:46	3	13729	13729	PDS_UNKNOWN_FAILURE
15-Oct-04	05:09:56	15-Oct-04	05:11:14	78	13729	13729	PDS_UNKNOWN_FAILURE
15-Oct-04	16:22:15	15-Oct-04	16:23:32	77	13736	13736	PDS_UNKNOWN_FAILURE
16-Oct-04	04:38:41	16-Oct-04	04:39:59	78	13743	13743	PDS_UNKNOWN_FAILURE
16-Oct-04	15:50:44	16-Oct-04	15:52:02	78	13750	13750	PDS_UNKNOWN_FAILURE
17-Oct-04	04:06:50	17-Oct-04	04:08:08	78	13757	13757	PDS_UNKNOWN_FAILURE
17-Oct-04	11:04:06	17-Oct-04	12:13:09	4143	13761	13762	PDS_UNKNOWN_FAILURE
17-Oct-04	15:19:14	17-Oct-04	15:20:32	78	13764	13764	PDS_UNKNOWN_FAILURE
19-Oct-04	04:44:27	19-Oct-04	04:45:44	77	13786	13786	PDS_UNKNOWN_FAILURE
19-Oct-04	15:56:20	19-Oct-04	15:57:38	78	13793	13793	PDS_UNKNOWN_FAILURE
20-Oct-04	04:12:43	20-Oct-04	04:14:01	78	13800	13800	PDS_UNKNOWN_FAILURE
20-Oct-04	15:22:26	20-Oct-04	15:22:29	3	13807	13807	PDS_UNKNOWN_FAILURE
20-Oct-04	15:25:09	20-Oct-04	15:26:27	78	13807	13807	PDS_UNKNOWN_FAILURE
21-Oct-04	05:21:11	21-Oct-04	05:22:28	77	13815	13815	PDS_UNKNOWN_FAILURE
21-Oct-04	16:34:04	21-Oct-04	16:35:22	78	13822	13822	PDS_UNKNOWN_FAILURE
22-Oct-04	04:50:12	22-Oct-04	04:51:30	78	13829	13829	PDS_UNKNOWN_FAILURE
22-Oct-04	16:01:56	22-Oct-04	16:03:13	77	13836	13836	PDS_UNKNOWN_FAILURE
23-Oct-04	04:18:35	23-Oct-04	04:19:52	77	13843	13843	PDS_UNKNOWN_FAILURE
23-Oct-04	15:28:05	23-Oct-04	15:28:07	2	13850	13850	PDS_UNKNOWN_FAILURE
23-Oct-04	15:31:04	23-Oct-04	15:32:22	78	13850	13850	PDS_UNKNOWN_FAILURE
24-Oct-04	05:26:29	24-Oct-04	05:27:47	78	13858	13858	PDS_UNKNOWN_FAILURE
24-Oct-04	16:39:28	24-Oct-04	16:40:46	78	13865	13865	PDS_UNKNOWN_FAILURE
26-Oct-04	04:24:20	26-Oct-04	04:25:37	77	13886	13886	PDS_UNKNOWN_FAILURE
26-Oct-04	15:36:46	26-Oct-04	15:38:04	78	13893	13893	PDS_UNKNOWN_FAILURE
27-Oct-04	03:52:10	27-Oct-04	03:53:28	78	13900	13900	PDS_UNKNOWN_FAILURE
27-Oct-04	16:44:52	27-Oct-04	16:46:10	78	13908	13908	PDS_UNKNOWN_FAILURE
28-Oct-04	05:01:31	28-Oct-04	05:02:49	78	13915	13915	PDS_UNKNOWN_FAILURE

28-Oct-04	16:13:23	28-Oct-04	16:14:41	78	13922	13922	PDS_UNKNOWN_FAILURE
28-Oct-04	16:23:30	28-Oct-04	16:23:48	18	13922	13922	PDS_UNKNOWN_FAILURE
29-Oct-04	04:30:04	29-Oct-04	04:31:22	78	13929	13929	PDS_UNKNOWN_FAILURE
29-Oct-04	15:39:21	29-Oct-04	15:39:24	3	13936	13936	PDS_UNKNOWN_FAILURE
29-Oct-04	15:42:21	29-Oct-04	15:43:39	78	13936	13936	PDS_UNKNOWN_FAILURE
30-Oct-04	03:55:59	30-Oct-04	03:56:02	3	13943	13943	PDS_UNKNOWN_FAILURE
30-Oct-04	03:58:02	30-Oct-04	03:59:20	78	13943	13943	PDS_UNKNOWN_FAILURE
30-Oct-04	15:10:22	30-Oct-04	15:11:40	78	13950	13950	PDS_UNKNOWN_FAILURE
31-Oct-04	05:07:08	31-Oct-04	05:08:25	77	13958	13958	PDS_UNKNOWN_FAILURE
31-Oct-04	16:19:17	31-Oct-04	16:20:35	78	13965	13965	PDS_UNKNOWN_FAILURE
02-Nov-04	04:03:54	02-Nov-04	04:05:11	77	13986	13986	PDS_UNKNOWN_FAILURE
02-Nov-04	11:23:17	02-Nov-04	12:10:57	2860	13990	13991	PDS_UNKNOWN_FAILURE
02-Nov-04	15:16:16	02-Nov-04	15:17:34	78	13993	13993	PDS_UNKNOWN_FAILURE
03-Nov-04	05:10:31	03-Nov-04	05:10:34	3	14001	14001	PDS_UNKNOWN_FAILURE
03-Nov-04	05:12:44	03-Nov-04	05:14:02	78	14001	14001	PDS_UNKNOWN_FAILURE
03-Nov-04	13:16:51	03-Nov-04	13:18:51	120	14006	14006	PDS_UNKNOWN_FAILURE
03-Nov-04	14:56:28	03-Nov-04	14:56:50	22	14007	14007	PDS_UNKNOWN_FAILURE
03-Nov-04	16:25:11	03-Nov-04	16:26:29	78	14008	14008	PDS_UNKNOWN_FAILURE
03-Nov-04	16:34:03	03-Nov-04	16:36:07	124	14008	14008	PDS_UNKNOWN_FAILURE
03-Nov-04	19:47:40	03-Nov-04	19:51:11	211	14010	14010	PDS_UNKNOWN_FAILURE
04-Nov-04	02:01:31	04-Nov-04	02:02:12	41	14013	14013	PDS_UNKNOWN_FAILURE
04-Nov-04	03:17:59	04-Nov-04	03:18:09	10	14014	14014	PDS_UNKNOWN_FAILURE
04-Nov-04	04:41:33	04-Nov-04	04:42:51	78	14015	14015	PDS_UNKNOWN_FAILURE
04-Nov-04	06:39:48	04-Nov-04	06:40:40	52	14016	14016	PDS_UNKNOWN_FAILURE
04-Nov-04	15:50:47	04-Nov-04	15:50:50	3	14022	14022	PDS_UNKNOWN_FAILURE
04-Nov-04	15:53:31	04-Nov-04	15:54:49	78	14022	14022	PDS_UNKNOWN_FAILURE
05-Nov-04	04:09:45	05-Nov-04	04:11:03	78	14029	14029	PDS_UNKNOWN_FAILURE
05-Nov-04	13:54:20	05-Nov-04	13:55:06	46	14035	14035	PDS_UNKNOWN_FAILURE
05-Nov-04	15:22:10	05-Nov-04	15:23:28	78	14036	14036	PDS_UNKNOWN_FAILURE
06-Nov-04	05:16:08	06-Nov-04	05:16:10	2	14044	14044	PDS_UNKNOWN_FAILURE
06-Nov-04	05:18:20	06-Nov-04	05:19:38	78	14044	14044	PDS_UNKNOWN_FAILURE
06-Nov-04	16:31:05	06-Nov-04	16:32:23	78	14051	14051	PDS_UNKNOWN_FAILURE
07-Nov-04	04:47:17	07-Nov-04	04:48:35	78	14058	14058	PDS_UNKNOWN_FAILURE
07-Nov-04	15:56:32	07-Nov-04	15:56:34	2	14065	14065	PDS_UNKNOWN_FAILURE
07-Nov-04	15:59:06	07-Nov-04	16:00:23	77	14065	14065	PDS_UNKNOWN_FAILURE

Table 7: List of gaps for RA-2 L0 products during cycle 31

In Figure 11 and Table 8 the summary of unavailable MWR L0 products is given.

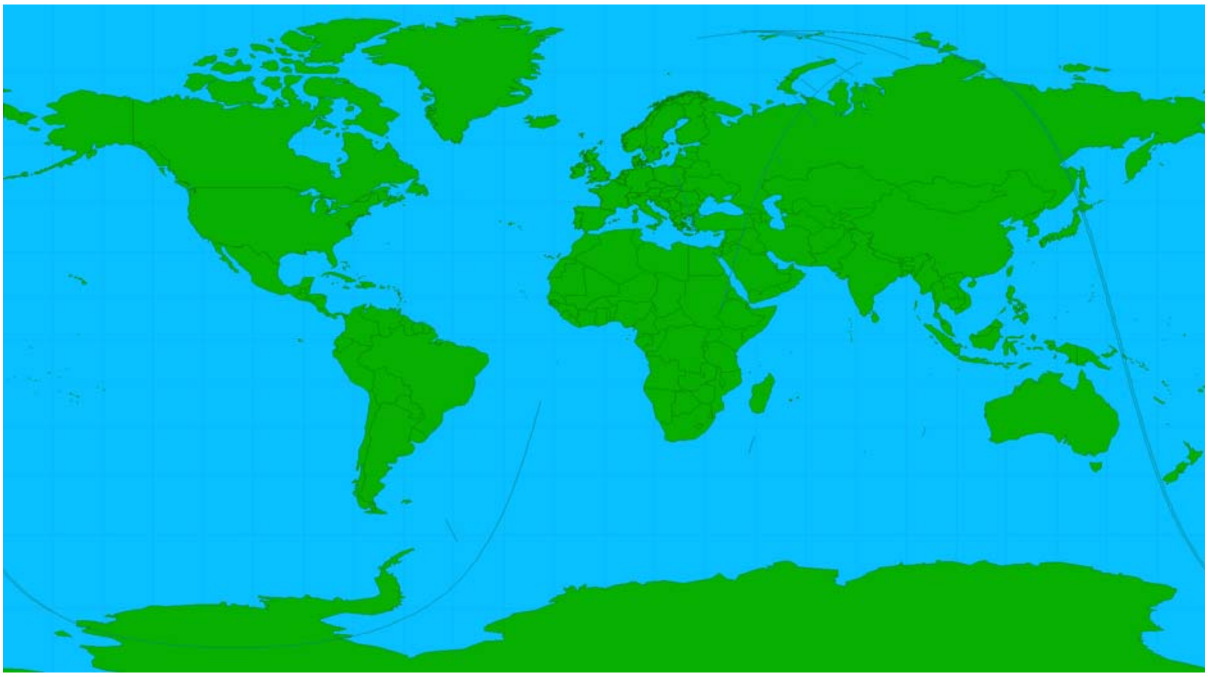

Figure 11: MWR L0 unavailable products for cycle 31

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
07-Oct-04	07:27:56	07-Oct-04	07:47:32	1176	13616	13616	PDS_UNKNOWN_FAILURE
17-Oct-04	11:03:07	17-Oct-04	12:13:07	4200	13761	13762	PDS_UNKNOWN_FAILURE
27-Oct-04	13:37:30	27-Oct-04	13:38:18	48	13906	13906	PDS_UNKNOWN_FAILURE
28-Oct-04	16:22:44	28-Oct-04	16:23:32	48	13922	13922	PDS_UNKNOWN_FAILURE
02-Nov-04	11:22:31	02-Nov-04	12:10:55	2904	13990	13991	PDS_UNKNOWN_FAILURE
03-Nov-04	13:15:45	03-Nov-04	13:18:33	168	14006	14006	PDS_UNKNOWN_FAILURE
03-Nov-04	14:55:22	03-Nov-04	14:56:34	72	14007	14007	PDS_UNKNOWN_FAILURE
03-Nov-04	16:32:58	03-Nov-04	16:35:46	168	14008	14008	PDS_UNKNOWN_FAILURE
03-Nov-04	19:46:34	03-Nov-04	19:50:58	264	14010	14010	PDS_UNKNOWN_FAILURE
04-Nov-04	02:00:35	04-Nov-04	02:02:11	96	14013	14013	PDS_UNKNOWN_FAILURE
04-Nov-04	03:16:59	04-Nov-04	03:17:47	48	14014	14014	PDS_UNKNOWN_FAILURE
04-Nov-04	06:38:59	04-Nov-04	06:40:35	96	14016	14016	PDS_UNKNOWN_FAILURE
04-Nov-04	16:03:24	04-Nov-04	16:04:12	48	14022	14022	PDS_UNKNOWN_FAILURE
04-Nov-04	17:39:00	04-Nov-04	17:39:48	48	14023	14023	PDS_UNKNOWN_FAILURE
05-Nov-04	13:53:26	05-Nov-04	13:55:02	96	14035	14035	PDS_UNKNOWN_FAILURE

Table 8: List of gaps for MWR L0 products during cycle 31

In Figure 12 and Table 9 the summary of unavailable RA-2 L1b products is given. Please note that in this case, only the gaps due to problems with the PDS are reported.

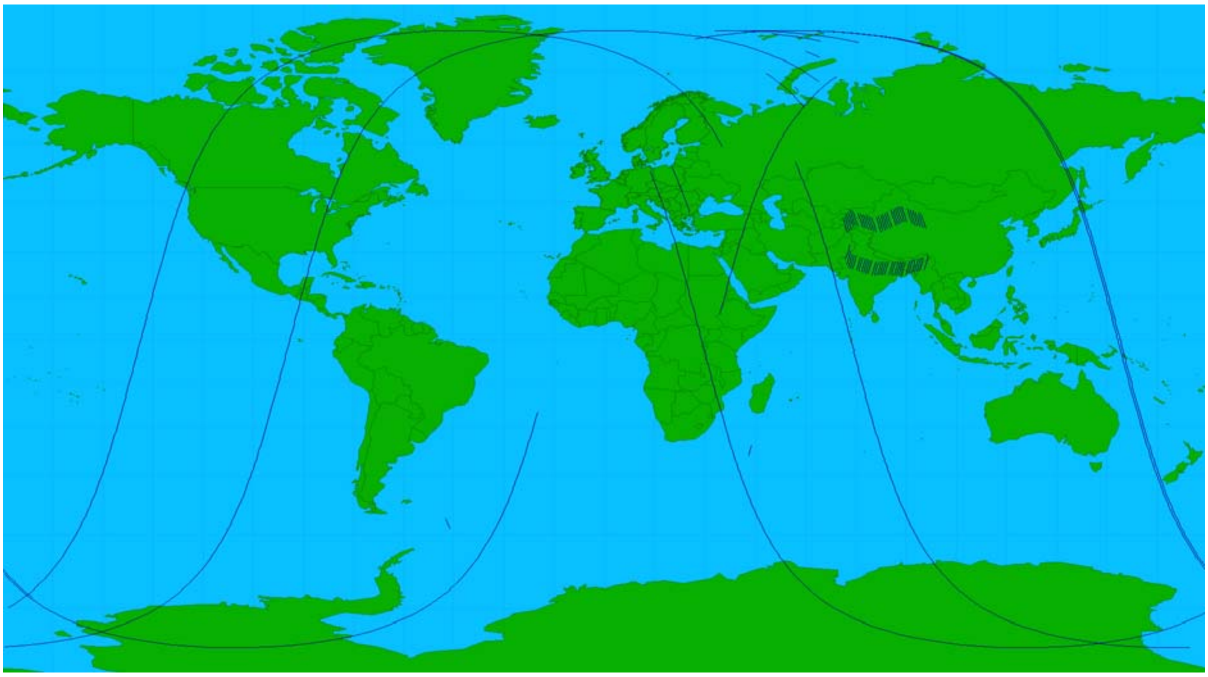

Figure 12: RA-2 L1b unavailable products for cycle 31

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
05-Oct-04	05:23:57	05-Oct-04	05:25:14	77	13586	13586	PDS_UNKNOWN_FAILURE
05-Oct-04	16:36:44	05-Oct-04	16:38:02	78	13593	13593	PDS_UNKNOWN_FAILURE
06-Oct-04	04:53:02	06-Oct-04	04:54:20	78	13600	13600	PDS_UNKNOWN_FAILURE
06-Oct-04	16:04:41	06-Oct-04	16:05:59	78	13607	13607	PDS_UNKNOWN_FAILURE
07-Oct-04	04:21:25	07-Oct-04	04:22:43	78	13614	13614	PDS_UNKNOWN_FAILURE
07-Oct-04	07:28:51	07-Oct-04	07:47:41	1130	13616	13616	PDS_UNKNOWN_FAILURE
07-Oct-04	15:33:56	07-Oct-04	15:35:14	78	13621	13621	PDS_UNKNOWN_FAILURE
08-Oct-04	05:28:56	08-Oct-04	05:30:14	78	13629	13629	PDS_UNKNOWN_FAILURE
08-Oct-04	16:42:09	08-Oct-04	16:43:26	77	13636	13636	PDS_UNKNOWN_FAILURE
08-Oct-04	16:43:26	08-Oct-04	16:43:27	1	13636	13636	PDS_UNKNOWN_FAILURE
09-Oct-04	04:58:41	09-Oct-04	04:59:59	78	13643	13643	PDS_UNKNOWN_FAILURE
09-Oct-04	16:10:24	09-Oct-04	16:11:42	78	13650	13650	PDS_UNKNOWN_FAILURE
10-Oct-04	04:27:11	10-Oct-04	04:28:28	77	13657	13657	PDS_UNKNOWN_FAILURE
10-Oct-04	15:39:32	10-Oct-04	15:40:50	78	13664	13664	PDS_UNKNOWN_FAILURE
12-Oct-04	05:04:19	12-Oct-04	05:05:36	77	13686	13686	PDS_UNKNOWN_FAILURE
12-Oct-04	16:16:19	12-Oct-04	16:17:37	78	13693	13693	PDS_UNKNOWN_FAILURE
13-Oct-04	04:32:56	13-Oct-04	04:34:14	78	13700	13700	PDS_UNKNOWN_FAILURE
13-Oct-04	15:45:08	13-Oct-04	15:46:26	78	13707	13707	PDS_UNKNOWN_FAILURE
14-Oct-04	04:00:58	14-Oct-04	04:02:16	78	13714	13714	PDS_UNKNOWN_FAILURE
14-Oct-04	15:13:19	14-Oct-04	15:14:37	78	13721	13721	PDS_UNKNOWN_FAILURE
14-Oct-04	18:40:49	14-Oct-04	20:19:38	5929	13723	13724	PDS_UNKNOWN_FAILURE
15-Oct-04	05:09:56	15-Oct-04	05:11:14	78	13729	13729	PDS_UNKNOWN_FAILURE
15-Oct-04	16:22:15	15-Oct-04	16:23:32	77	13736	13736	PDS_UNKNOWN_FAILURE

16-Oct-04	04:38:41	16-Oct-04	04:39:59	78	13743	13743	PDS_UNKNOWN_FAILURE
16-Oct-04	15:50:44	16-Oct-04	15:52:02	78	13750	13750	PDS_UNKNOWN_FAILURE
17-Oct-04	04:06:50	17-Oct-04	04:08:08	78	13757	13757	PDS_UNKNOWN_FAILURE
17-Oct-04	11:04:07	17-Oct-04	12:13:09	4142	13761	13762	PDS_UNKNOWN_FAILURE
17-Oct-04	15:19:14	17-Oct-04	15:20:32	78	13764	13764	PDS_UNKNOWN_FAILURE
19-Oct-04	04:44:27	19-Oct-04	04:45:44	77	13786	13786	PDS_UNKNOWN_FAILURE
19-Oct-04	15:56:20	19-Oct-04	15:57:38	78	13793	13793	PDS_UNKNOWN_FAILURE
20-Oct-04	04:12:43	20-Oct-04	04:14:01	78	13800	13800	PDS_UNKNOWN_FAILURE
20-Oct-04	15:25:09	20-Oct-04	15:26:27	78	13807	13807	PDS_UNKNOWN_FAILURE
21-Oct-04	05:21:11	21-Oct-04	05:22:28	77	13815	13815	PDS_UNKNOWN_FAILURE
21-Oct-04	16:34:04	21-Oct-04	16:35:22	78	13822	13822	PDS_UNKNOWN_FAILURE
22-Oct-04	04:50:12	22-Oct-04	04:51:30	78	13829	13829	PDS_UNKNOWN_FAILURE
22-Oct-04	16:01:56	22-Oct-04	16:03:13	77	13836	13836	PDS_UNKNOWN_FAILURE
22-Oct-04	16:03:13	22-Oct-04	16:03:14	1	13836	13836	PDS_UNKNOWN_FAILURE
23-Oct-04	04:18:35	23-Oct-04	04:19:52	77	13843	13843	PDS_UNKNOWN_FAILURE
23-Oct-04	15:31:04	23-Oct-04	15:32:22	78	13850	13850	PDS_UNKNOWN_FAILURE
24-Oct-04	05:26:29	24-Oct-04	05:27:47	78	13858	13858	PDS_UNKNOWN_FAILURE
24-Oct-04	16:39:28	24-Oct-04	16:40:46	78	13865	13865	PDS_UNKNOWN_FAILURE
26-Oct-04	04:24:20	26-Oct-04	04:25:37	77	13886	13886	PDS_UNKNOWN_FAILURE
26-Oct-04	15:36:46	26-Oct-04	15:38:04	78	13893	13893	PDS_UNKNOWN_FAILURE
26-Oct-04	15:46:45	26-Oct-04	17:22:08	5723	13893	13894	PDS_UNKNOWN_FAILURE
27-Oct-04	03:52:10	27-Oct-04	03:53:28	78	13900	13900	PDS_UNKNOWN_FAILURE
27-Oct-04	16:44:52	27-Oct-04	16:46:10	78	13908	13908	PDS_UNKNOWN_FAILURE
28-Oct-04	05:01:31	28-Oct-04	05:02:49	78	13915	13915	PDS_UNKNOWN_FAILURE
28-Oct-04	16:13:23	28-Oct-04	16:14:41	78	13922	13922	PDS_UNKNOWN_FAILURE
28-Oct-04	16:23:31	28-Oct-04	16:23:48	17	13922	13922	PDS_UNKNOWN_FAILURE
29-Oct-04	04:30:04	29-Oct-04	04:31:22	78	13929	13929	PDS_UNKNOWN_FAILURE
29-Oct-04	15:42:21	29-Oct-04	15:43:39	78	13936	13936	PDS_UNKNOWN_FAILURE
30-Oct-04	03:56:00	30-Oct-04	03:56:02	2	13943	13943	PDS_UNKNOWN_FAILURE
30-Oct-04	03:58:02	30-Oct-04	03:59:20	78	13943	13943	PDS_UNKNOWN_FAILURE
30-Oct-04	15:10:22	30-Oct-04	15:11:40	78	13950	13950	PDS_UNKNOWN_FAILURE
31-Oct-04	05:07:08	31-Oct-04	05:08:25	77	13958	13958	PDS_UNKNOWN_FAILURE
31-Oct-04	16:19:17	31-Oct-04	16:20:35	78	13965	13965	PDS_UNKNOWN_FAILURE
02-Nov-04	04:03:54	02-Nov-04	04:05:11	77	13986	13986	PDS_UNKNOWN_FAILURE
02-Nov-04	04:05:11	02-Nov-04	04:05:12	1	13986	13986	PDS_UNKNOWN_FAILURE
02-Nov-04	11:23:19	02-Nov-04	12:10:57	2858	13990	13991	PDS_UNKNOWN_FAILURE
02-Nov-04	15:16:16	02-Nov-04	15:17:34	78	13993	13993	PDS_UNKNOWN_FAILURE
03-Nov-04	05:12:44	03-Nov-04	05:14:02	78	14001	14001	PDS_UNKNOWN_FAILURE
03-Nov-04	13:16:52	03-Nov-04	13:18:51	119	14006	14006	PDS_UNKNOWN_FAILURE
03-Nov-04	14:56:29	03-Nov-04	14:56:50	21	14007	14007	PDS_UNKNOWN_FAILURE
03-Nov-04	16:25:11	03-Nov-04	16:26:29	78	14008	14008	PDS_UNKNOWN_FAILURE
03-Nov-04	16:34:05	03-Nov-04	16:36:07	122	14008	14008	PDS_UNKNOWN_FAILURE
03-Nov-04	19:47:41	03-Nov-04	19:51:11	210	14010	14010	PDS_UNKNOWN_FAILURE
04-Nov-04	02:01:32	04-Nov-04	02:02:12	40	14013	14013	PDS_UNKNOWN_FAILURE

04-Nov-04	03:18:00	04-Nov-04	03:18:09	9	14014	14014	PDS_UNKNOWN_FAILURE
04-Nov-04	04:41:33	04-Nov-04	04:42:51	78	14015	14015	PDS_UNKNOWN_FAILURE
04-Nov-04	06:39:49	04-Nov-04	06:40:40	51	14016	14016	PDS_UNKNOWN_FAILURE
04-Nov-04	15:53:31	04-Nov-04	15:54:49	78	14022	14022	PDS_UNKNOWN_FAILURE
05-Nov-04	04:09:45	05-Nov-04	04:11:03	78	14029	14029	PDS_UNKNOWN_FAILURE
05-Nov-04	13:54:22	05-Nov-04	13:55:06	44	14035	14035	PDS_UNKNOWN_FAILURE
05-Nov-04	15:22:10	05-Nov-04	15:23:28	78	14036	14036	PDS_UNKNOWN_FAILURE
06-Nov-04	05:18:20	06-Nov-04	05:19:38	78	14044	14044	PDS_UNKNOWN_FAILURE
06-Nov-04	16:31:05	06-Nov-04	16:32:23	78	14051	14051	PDS_UNKNOWN_FAILURE
07-Nov-04	04:47:17	07-Nov-04	04:48:35	78	14058	14058	PDS_UNKNOWN_FAILURE
07-Nov-04	15:59:06	07-Nov-04	16:00:23	77	14065	14065	PDS_UNKNOWN_FAILURE

Table 9: List of gaps for RA-2 L1b products during cycle 31

8.2 RA-2 Altimeter Parameters

Hereafter a summary of the main Altimetric parameters performances is reported; these results have been obtained with the editing criteria mentioned in par. 8.3.

8.2.1 ALTIMETER RANGE

No current results for the time being. The monitoring of the RA-2 FD altimetric range shall be done once the NRT products shall be upgraded with the DORIS navigator NRT orbital information.

8.2.2 SIGNIFICANT WAVE HEIGHT

The histogram of the SWH, reported hereafter, shows a nominal behavior for this cycle. The trend goes on in following the behavior as detected for the previous cycle. On July the 2nd the SWH value in the two bands dropped of about 10 cm in average. After a more detailed analysis that drop can be now interpreted more like a smoother decrease which can be correlated to a seasonal variability as it could be observed during year 2003.

The high daily means (sometimes plotted outside the figure range) reported for the S-Band values are due to the so-called S-Band anomaly (ref. par.7.1.7).

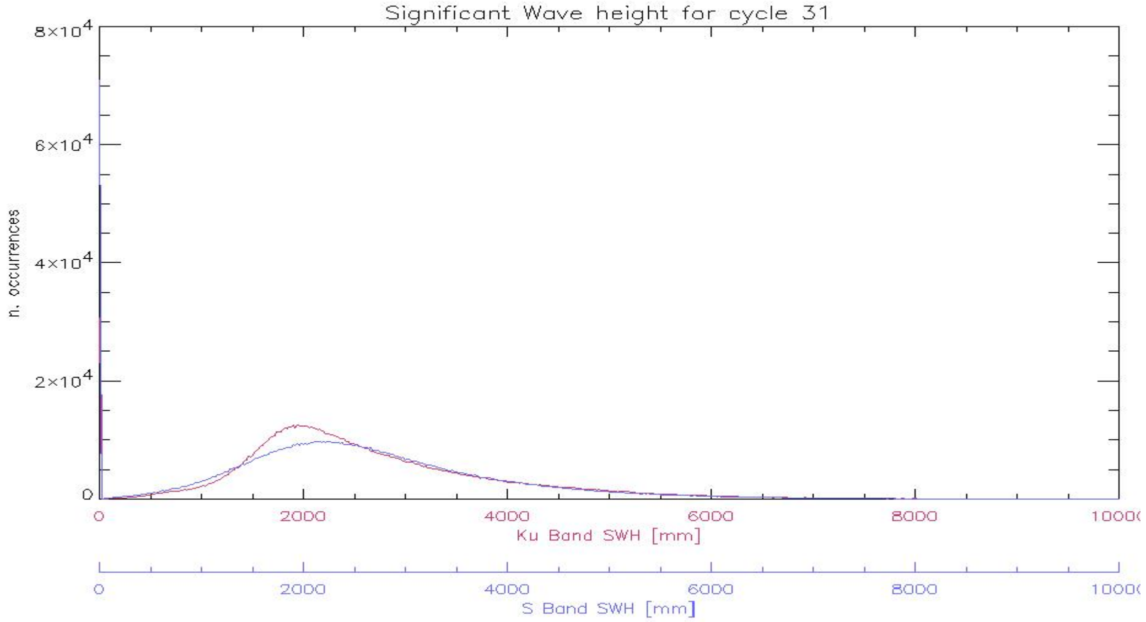

Figure 13: Histogram of Ku and S Band SWH for cycle 31 (mm)

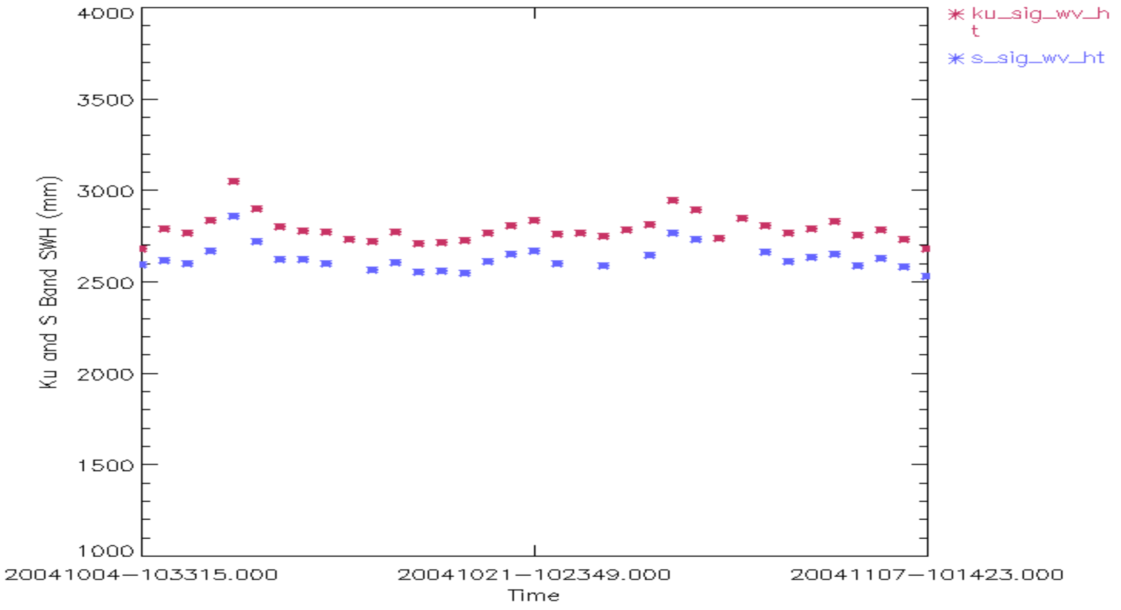

Figure 14: Ku and S SWH daily average for cycle 31 (mm)

8.2.3 BACKSCATTER COEFFICIENT – WIND SPEED

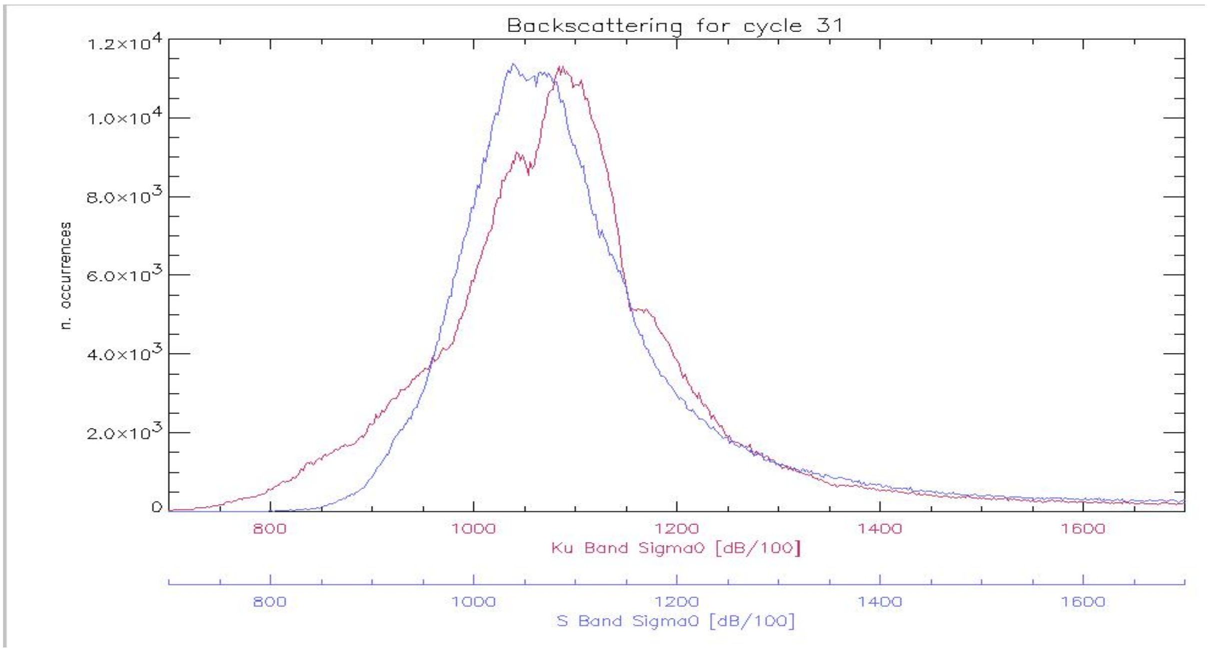

Figure 15: Histogram of Ku and S Band Backscattering Coefficient for cycle 31 (dB/100)

The Sigma_0 histogram both in Ku and S Band shows secondary peaks. A small investigation on this problem, performed on the data of cycle 28, demonstrated that the backscattering distribution assumes a different behavior for different sea conditions. Indeed, for both the bands, the majority of the data is concentrated on lower values for rough sea state (southern hemisphere, winter conditions) and on higher values for calm sea state (northern hemisphere, summer conditions). This demonstrates that the instrument has a non-linear behavior respect to the backscattered power; one of the most probable causes of this has been thought to be the non perfect characterization of the on-board step attenuator.

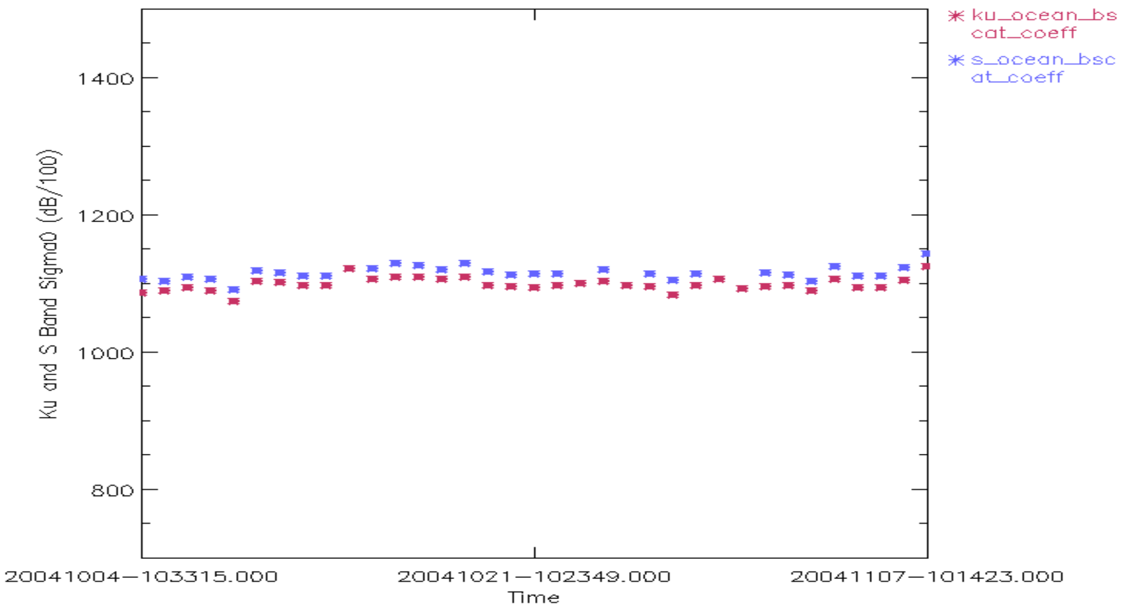

Figure 16: Ku and S Sigma_0 daily average for cycle 31 (dB/100)

The backscattering coefficient daily average trend shows, for both bands, a nominal behavior.
The high daily means (sometimes plotted outside the figure range) reported for the S-Band Sigma_0 trend are due to the so-called S-Band anomaly (ref. par. 7.1.7).

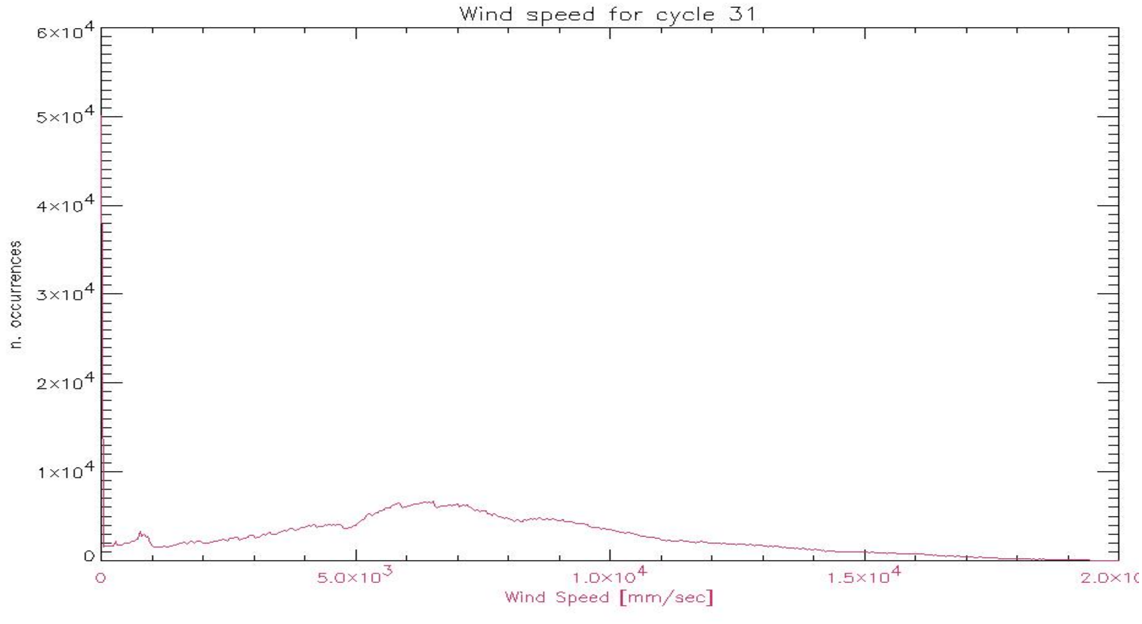

Figure 17: Histogram of Ku Wind Speed for cycle 31 (mm/s)

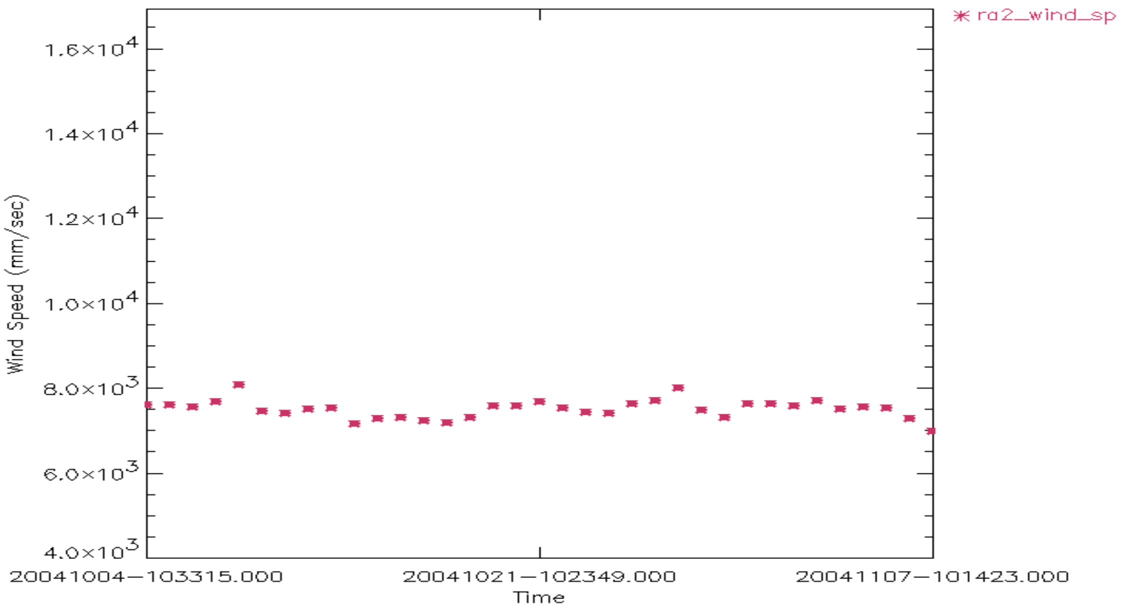

Figure 18: Wind Speed daily average for cycle 31 (mm/s)

8.3 Edited measurements

In order to produce the statistics reported in 8.2 the following editing criteria have been used before using RA2_FGD products:

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 10: Editing criteria for RA-2 parameters statistics

8.4 Product disclaimer

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

8.5 Data handling recommendations

8.5.1 SEA-ICE FLAG

The following algorithm is proposed for the determination of a sea-ice flag, presently missing in the Level 2 Ra-2 and MWR data products. (See [R – 14]):

|Latitude *(lat: field#4 of L2 data)*| >50 deg
AND
The number of 20Hz valid data *(num_18hz_ku_ocean: field#23 of L2 data)* < 17
OR
|MWR Wet Tropospheric Correction *(mwr_wet_tropo_corr: field#42 of L2 data)*–ECMWF Wet Tropospheric Correction *(mod_wet_tropo_corr: field#41 of L2 data)*| > 10 cm

OR

Peakiness *(Ku_peak: field#139 of L2 data)* >2

8.5.2 OCEAN S-BAND ANOMALIES DETECTION

A valuable algorithm to detect the Level 2 DSR affected by the RA-2 S-Band anomaly is proposed in [R- 12]. Note that its validity is limited to the data acquired over open-ocean.

8.5.3 WARNING ON IPF 4.56 VERSION IDENTIFICATION FIELD

All RA-2 and MWR level 1B and NRT Level 2 products generated after November 26, 2003 report a software version as being 4.54 (available in MPH field 8).

Nevertheless those products have been generated with the IPF V4.56 operational since November 26, 2003. The first nominal generated product, using the new SW version, will be the one relevant to the absolute orbit number 9094.

The software version ID is correct since December 4, 2003.

8.5.4 S-BAND BACKSCATTERING COEFFICIENT

For the data processed with IPF version 4.56 on, the S-Band Backscattering coefficient has been demonstrated to be in average about 0.65 dBs higher than for the previous versions of the processor. This is due to the algorithm used for the retrieval of the AGC in S-Band, corrected in IPF version 4.56 to be more coherent with the real functioning of the instrument.

An average value of 0.65 dBs is suggested to be added to the old software versions S-Band Sigma0 in order to be in line with the new IPF V4.56 version.

As a consequence of the IPF V4.56 s/w version installation, the rain flag validity is currently affected. This shall be corrected with the loading of a new ADF table.

8.5.5 USO RANGE CORRECTION

The actual data of cycle 31 have to be corrected to compensate for the Ultra Stable Oscillator drift shown in Figure 3. The measured Range shall be corrected considering a drift of –4.38 mm per year. Eventually it could also be corrected for the cyclic average given bias (26.88 mm) that has to be added to the measured value.

8.5.6 KU-BAND BACKSCATTERING COEFFICIENT CALIBRATION

The results of the Ku-Band Sigma0 absolute calibration performed with a transponder have been presented in par. 7.1.4. Those results are still not conclusive since some problems have still to be solved, in any case, in order to absolutely calibrate the backscattering coefficient given in the RA2 L2 products the following shall be used by the end user to get to the real Sigma0 measurement:

Sigma_0_true = Sigma_0_prod + **G_tx_rx_prod - G_tx_rx_real - Bias** [dB]

Where:
Bias: Bias retrieved from the Sigma0 Absolute Calibration
G_tx_rx_prod: Current effective Tx-Rx Gain value used in the operational ground processing chain (ADF file RA2_CHD_AX). The value nominally used since IPF V4.54 is (for configuration RFSS=A and HPA=A) is 170.70 dB
G_tx_rx_real: Pre-launch characterization value (configuration value RFSS=A and HPA=A is 167.46 dB)

8.5.7 ABNORMAL RA-2 RANGE BEHAVIOR AFTER ANOMALY RECOVERY

An un-expected behavior of the Envisat RA-2 sensor was observed in the period from 2004/09/27 at ~16:00 and ending on 2004/09/29 at ~12:00 AM. This directly happened after the recovery of a RA-2 on-board anomaly occurred on the 2004/09/26 at ~13:40. The altimetric range jumped by several meters w.r.t. the Mean Sea Surface; on the other hand everything came back to normal as from the 29th of September around noon. RA-2 data from the above period have to be considered with caution.

8.6 Wind & Wave quality assessment

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

9 LONG TERM MONITORING

9.1 *RA-2 Instrument monitoring*

9.1.1 IF FILTER MASK

In Figure 19 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. Three peaks are visible on the plot that correspond to the data acquired on September the 27th 2003 at 15:48, on October the 29th 2003 at 15:42 and on May the 10th 2004 at 15:45. The reason of this could be found in the instrument warming up considering that the IF Cal acquisition has been made, in all the cases, only a couple of hours after an anomaly recovery. The residual noise and the accuracy show a very constant behavior over the whole period. Despite the quite constant IF mask trend, a weird behavior had been observed during the validation of several newly created IF mask correction auxiliary files. After an investigation, it has been recently found out that the phenomenon was due to an error done by the operator while manually creating the auxiliary files.

During cycle 31 the IF Calibration Mode still shows the weird behavior described in [R – 3]. This problem, present since the beginning of the mission, is 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.

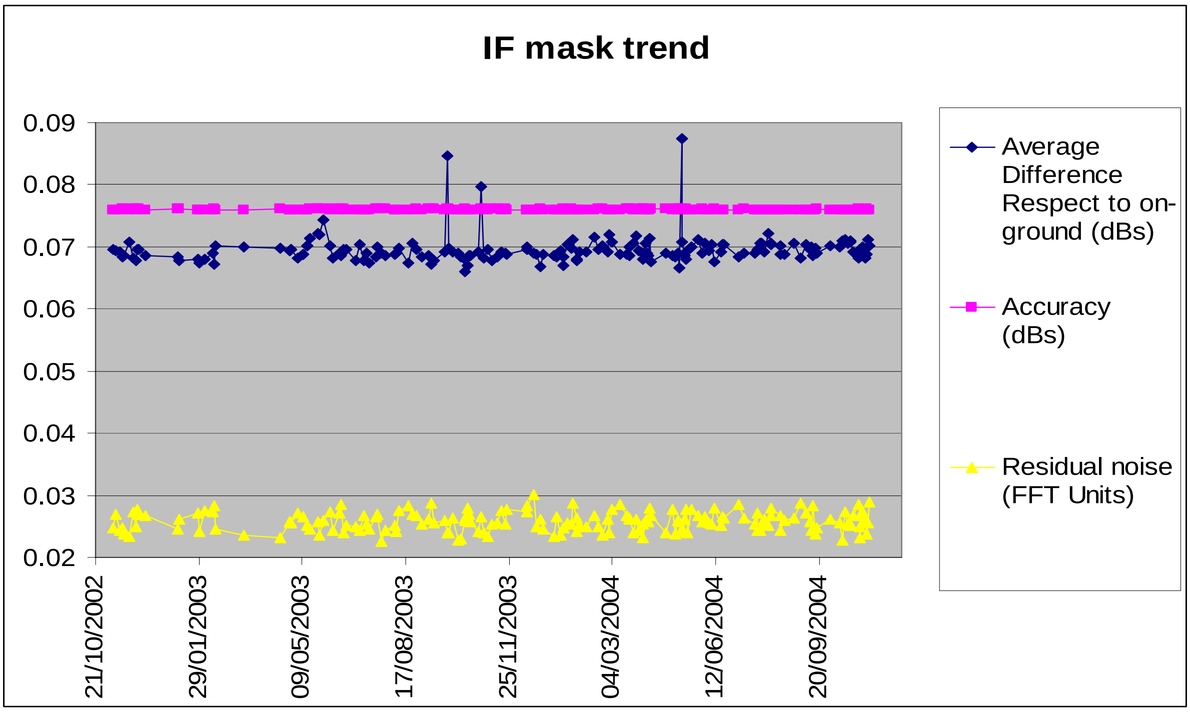

Figure 19: Evolution of the IF mask related parameters for valid IF masks retrieved up to cycle 31

9.1.2 USO

In Figure 20 the USO clock period trend retrieved until the end of cycle 31 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 31.88 mm and –4.62 mm/year as calculated with data covering the period 13 June 2003 to 8 November 2004 (the data covering the anomalous period between 2004/09/27 at ~16:00 and 2004/09/29 at ~12:00 AM have not been used to evaluate these figures). The given bias and drift have to be added to the original altimetric range.

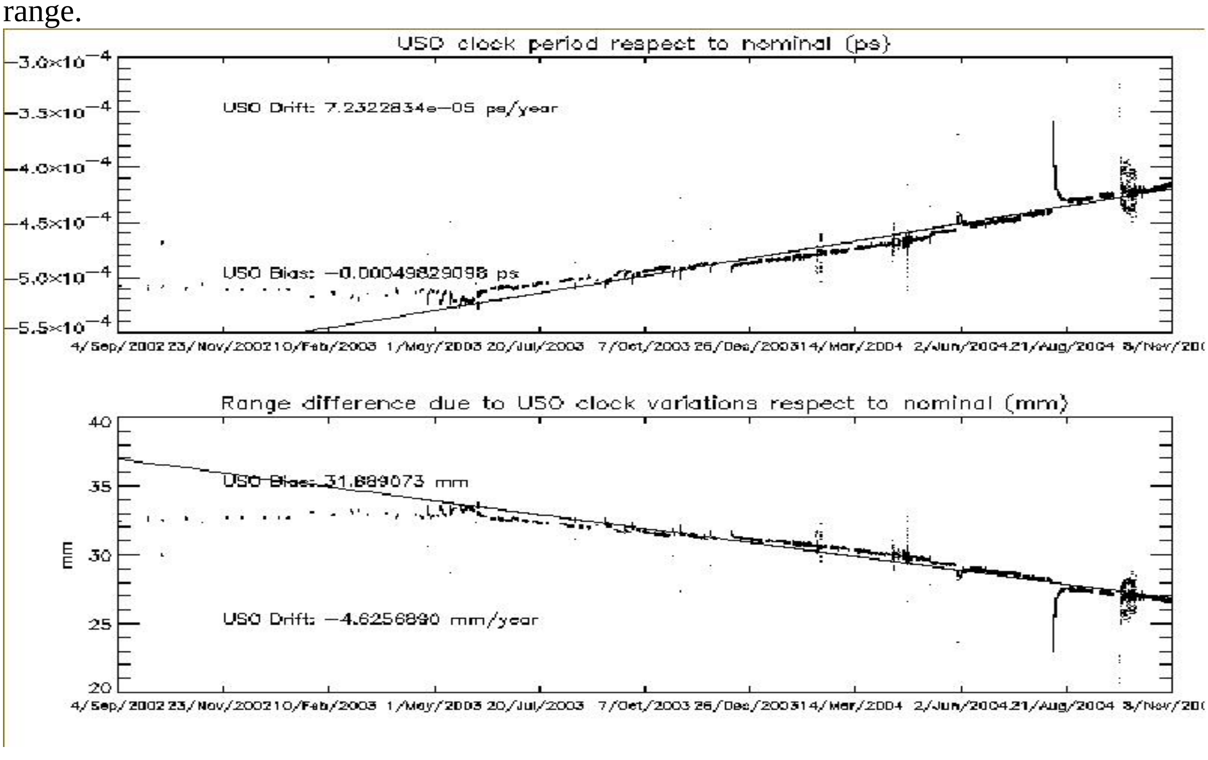

Figure 20: USO clock period until end of cycle 31

9.1.3 TRACKING CAPABILITY

In Figure 21, Figure 22 and Figure 23 the cyclic tracking percentages for the three RA-2 bandwidths are reported.
The worsening in performances noticeable for cycle 20 was due to the up-load of wrong on-board software parameters for the lasted for about three days.

In general, even if a tiny evolution can be observed, the tracking performances are well in line with the output figures and objectives of the Commissioning Phase as given in par. 7.1.3.

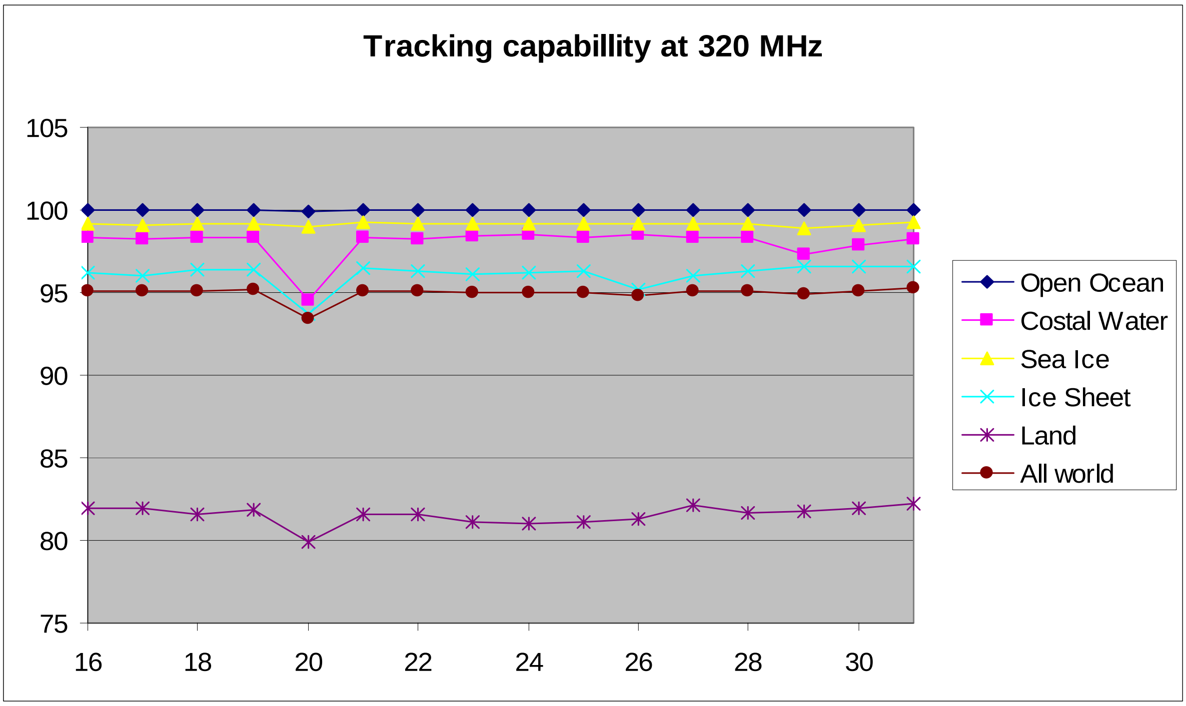

Figure 21: RA-2 Tracking percentage at 320MHz for different surfaces

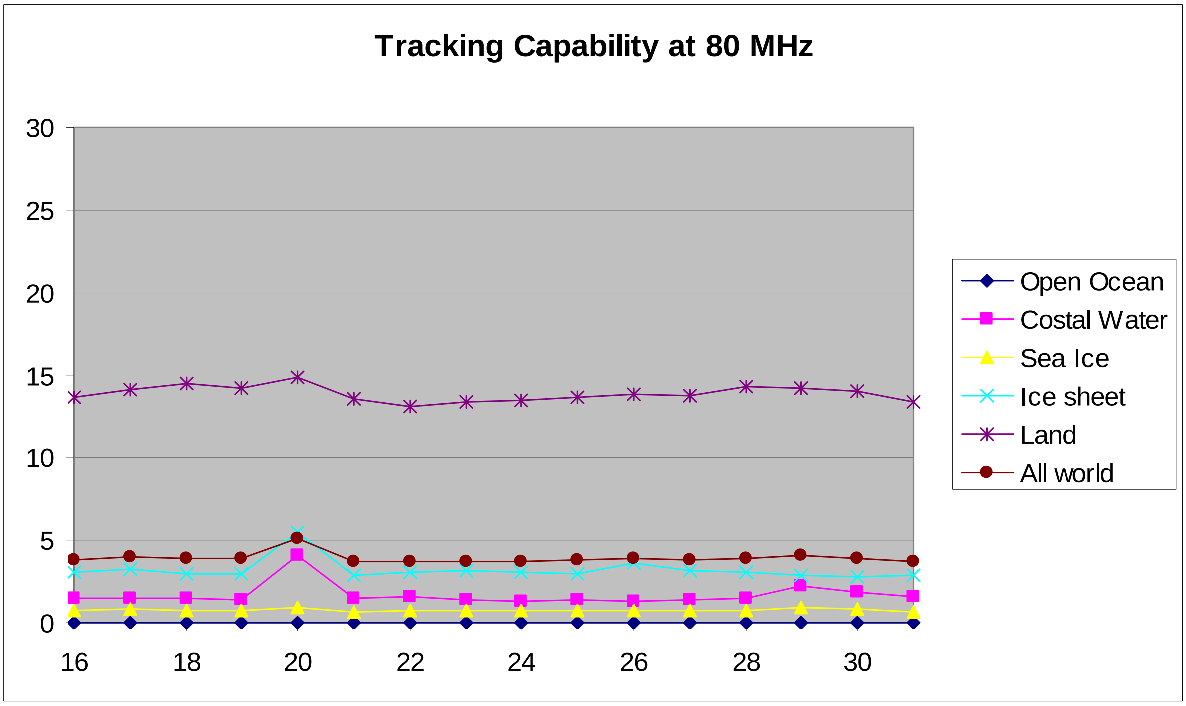

Figure 22: RA-2 Tracking percentage at 80MHz for different surfaces

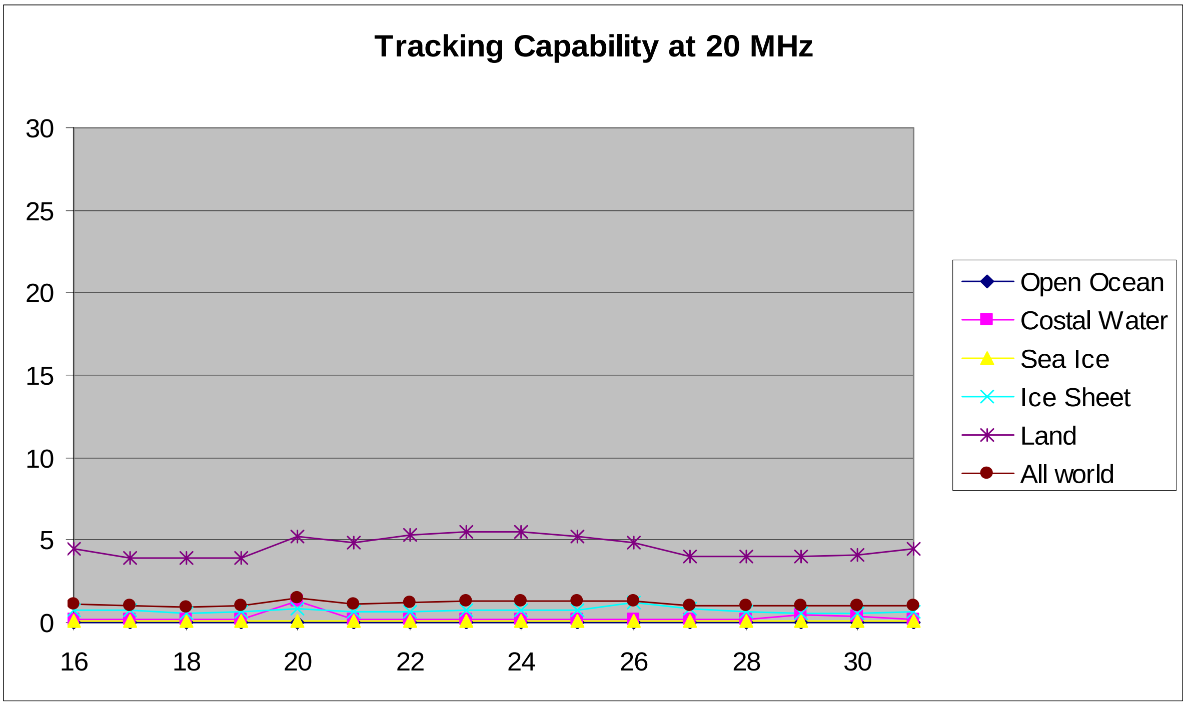

Figure 23: RA-2 Tracking percentage at 20MHz for different surfaces

9.1.4 DATATION

In Figure 24 (upper panel) the differences between the extrapolated UTC values and the corresponding real UTC values measured at the next Kiruna dump, are reported. Only few anomalous events can be observed at the beginning of the period (cycles 16/17) for which the difference rises above the 20 microseconds warning threshold. However, starting from cycles 22/23, the number of small differences (10 microseconds plus or minus) has increased a lot; this problem is currently under investigation.

In the lower panel the ICU clock step for the same period is shown where big variations are reported. This is however not a problem because the ICU clock period variations are included in the algorithm for the SBT/UTC correlation evaluation.

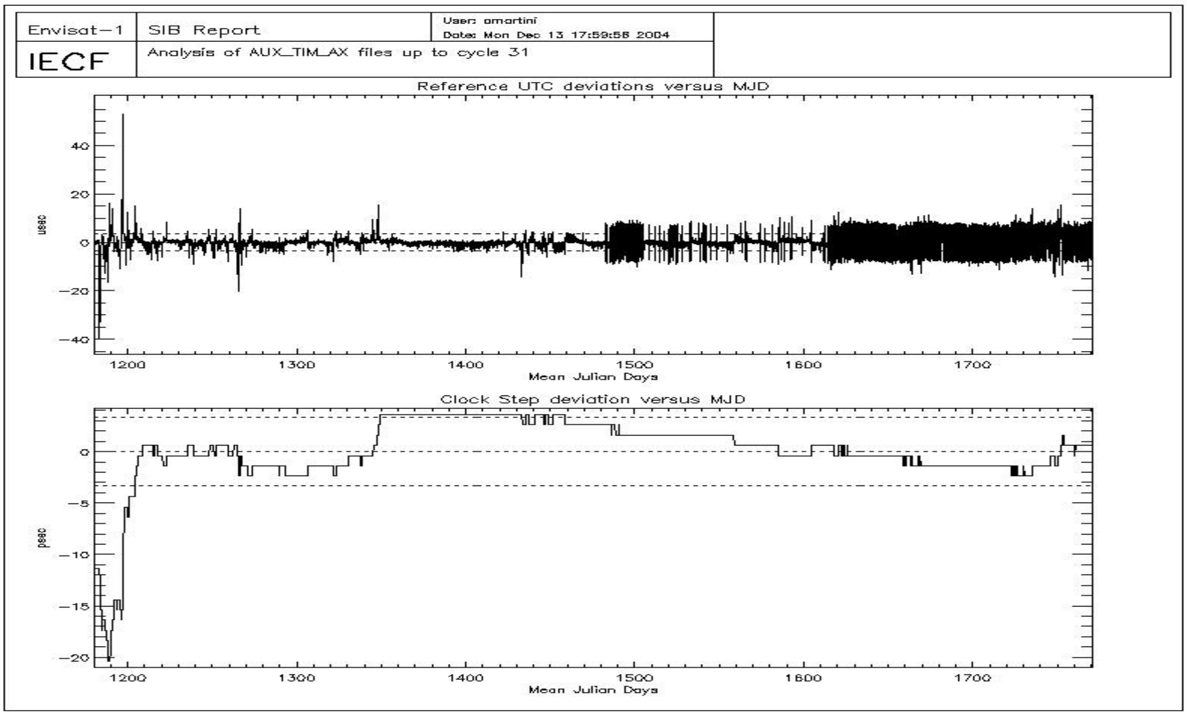

Figure 24: UTC deviations and ICU clock period up to cycle 31

9.1.5 MISPOINTING

In Figure 25 the overall mispointing squared trend (averaged over each orbit) is plotted for cycles 16 to 31. The jump occurred on November the 26th 2003 is correlated to the upload of IPF version 4.56; the abrupt decreasing of the mispointing squared value is due to the usage of a new RA2_IFF_AX IF mask auxiliary file.

On the other hand, it can be noticed that the mispointing squared assumes lower values just after an instrument anomaly; showing an increasing trend until it reaches back a standard mispointing value. This particular behavior can be explained by the different shape that the over-ocean average waveform has before and after an anomalous event as visible in Figure 26. Observe, in particular, the disappearance of the small dip in the waveforms acquired after the anomaly. This problem will be solved with the introduction of an updated mispointing retrieval algorithm with the next version of the processing software as described in par. 5.4.4.

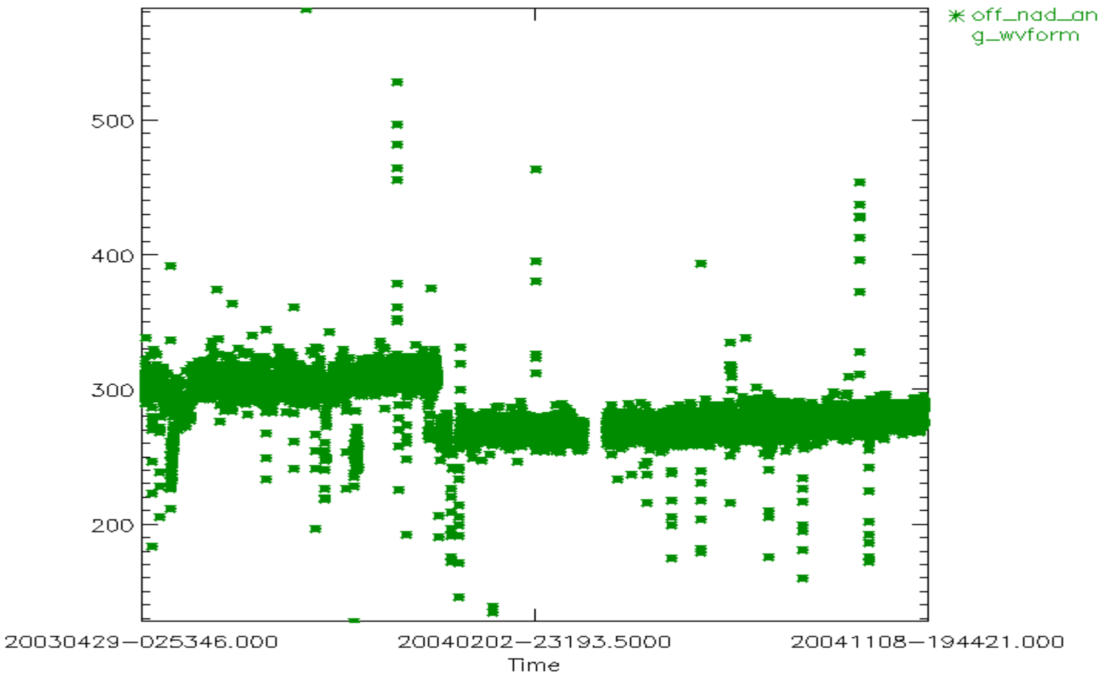

Figure 25: Smoothed mispointing squared trend until end of cycle 31 (deg^2*10e-4)

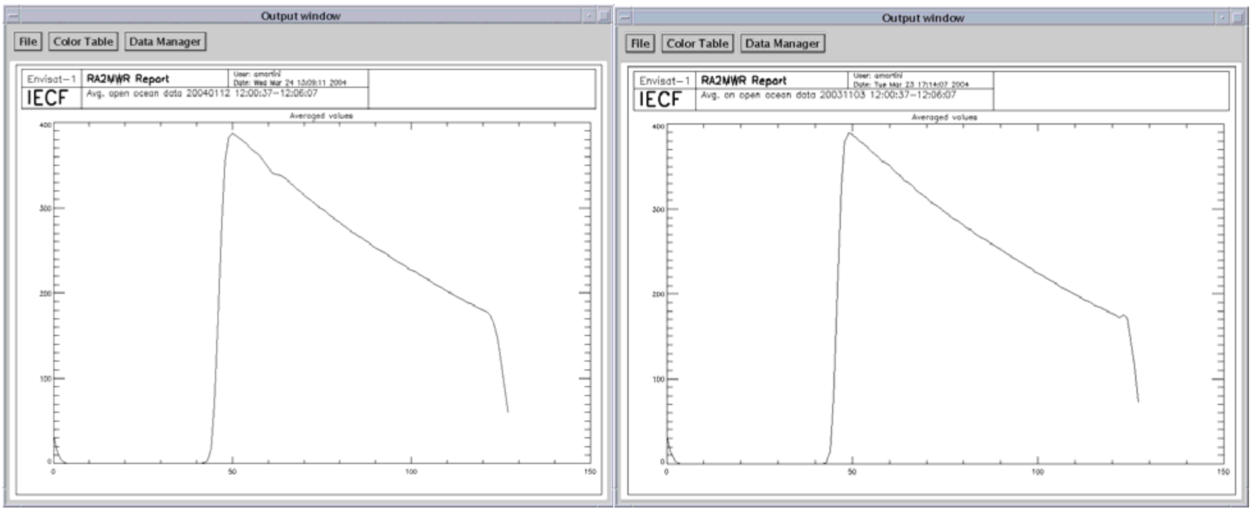

Figure 26: Open Ocean average waveforms before (left) and after an anomaly (right)

9.1.6 S-BAND ANOMALY

In the percentage of data per cycle that are affected by the so-called “S-Band” anomaly is reported. The figures are quite stable between 0% and 8.1%.
The relatively high value recorded for cycle 27 is due to the fact that on the day 1st of June, the S-band anomaly started at around 14:30 while the instrument didn’t switch to mode Heater 2 when

foreseen (at about 15:50). For this reason the S-Band anomaly continued for the next 24 hours until the next Heater 2 mode on June the 2nd.

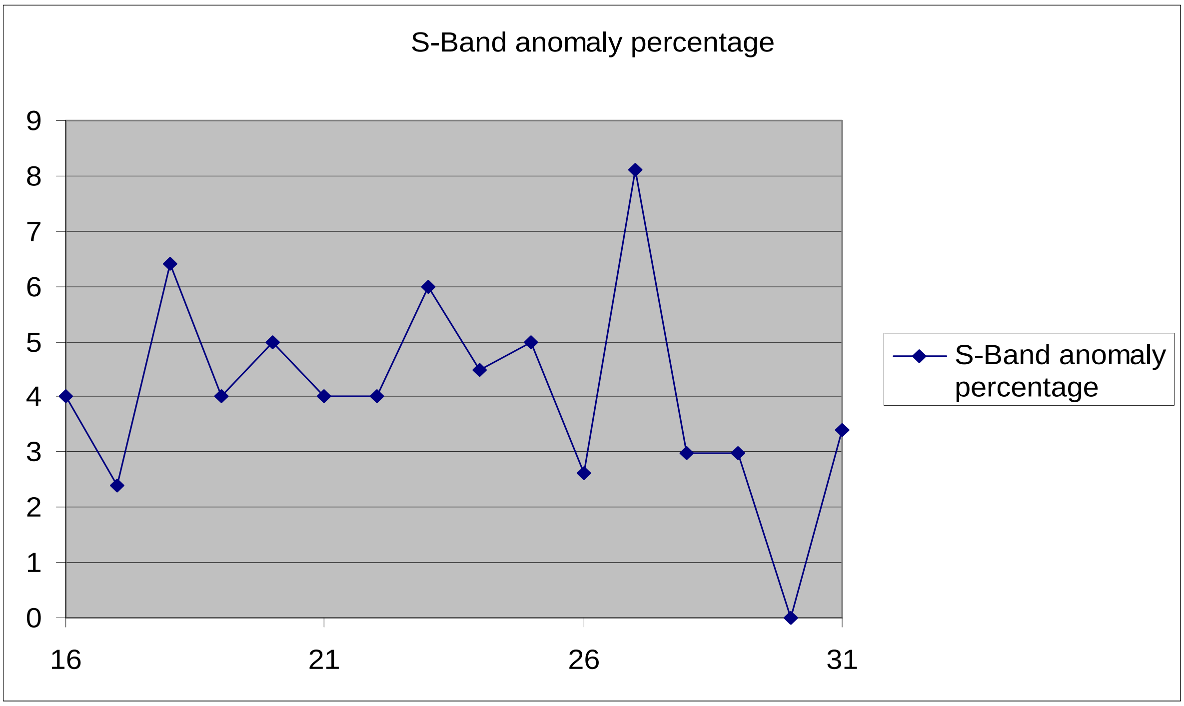

Figure 27: Percentage of data affected by the "S-Band Anomaly" for cycles 16-31

9.1.7 IN-FLIGHT INTERNAL CALIBRATION

Figure 28 and Figure 29 report Ku and S Band in-flight calibration factors for Time Delay and Sigma0 respectively, daily averaged. The Time Delay factor shows to be very stable for both the working frequencies, but the Ku band Sigma0 factor reveals a decrease of about 0.2 dBs over a period of one year and a half. This means that the overall internal gain has been continuously decreasing. Being the decreasing factor quite small this is not being considered a problem, for the moment, since the calibration factor is indeed introduced especially to correct for eventual instrumental changes. However a special eye is kept on the monitoring of this parameter.

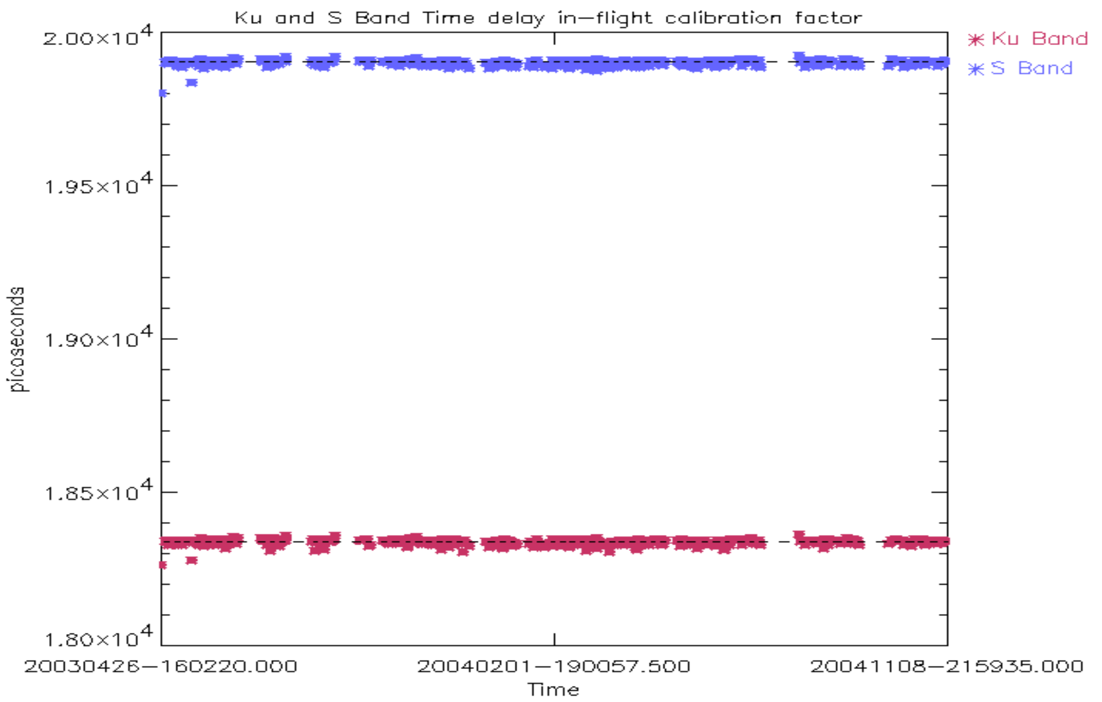

Figure 28: Ku and S Band in-flight time delay calibration factor up to cycle 31

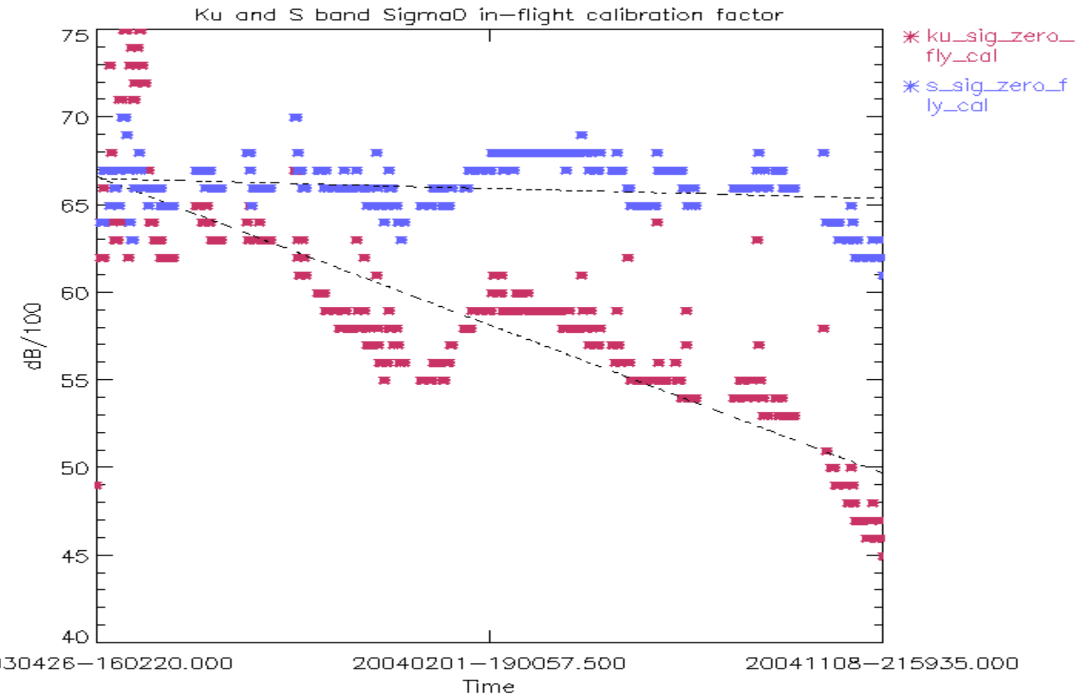

Figure 29: Ku and S Band in-flight Sigma0 calibration factor up to cycle 31

9.2 Products Monitoring

9.2.1 AVAILABILITY OF DATA

Hereafter the percentage of the different levels of products availability is reported for different cycles up to number 31. Considering as reference the instrument unavailability, it is possible to notice that in the last months the situation is greatly improved for all levels of products.

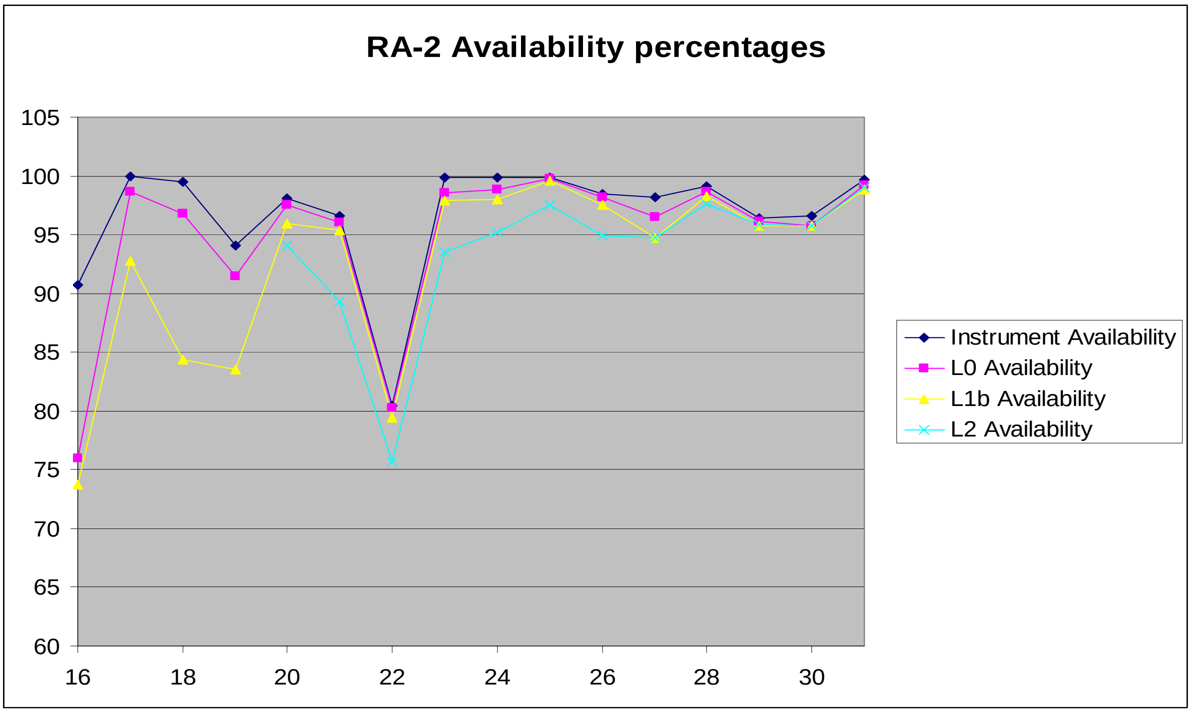

Figure 30: Percentage of Products unavailability up to cycle 31

9.2.2 RA-2 ALTIMETER PARAMETERS

Hereafter a summary of the main Altimetric parameters performances is reported; these results have been obtained with the editing criteria mentioned in par. 8.3.

9.2.2.1 Altimeter range

No current results for the time being. The monitoring of the RA-2 FD altimetric range shall be done once the NRT products shall be upgraded with the DORIS navigator NRT orbital information.

9.2.2.2 Significant Wave Height

The SWH in both bands shows a small drop around the beginning of July 2004 which has been already mentioned in par 8.2.2. After a detailed analysis that drop can be now interpreted more like a smoother decrease which can be correlated to a seasonal variability as it could be observed during the year 2003.

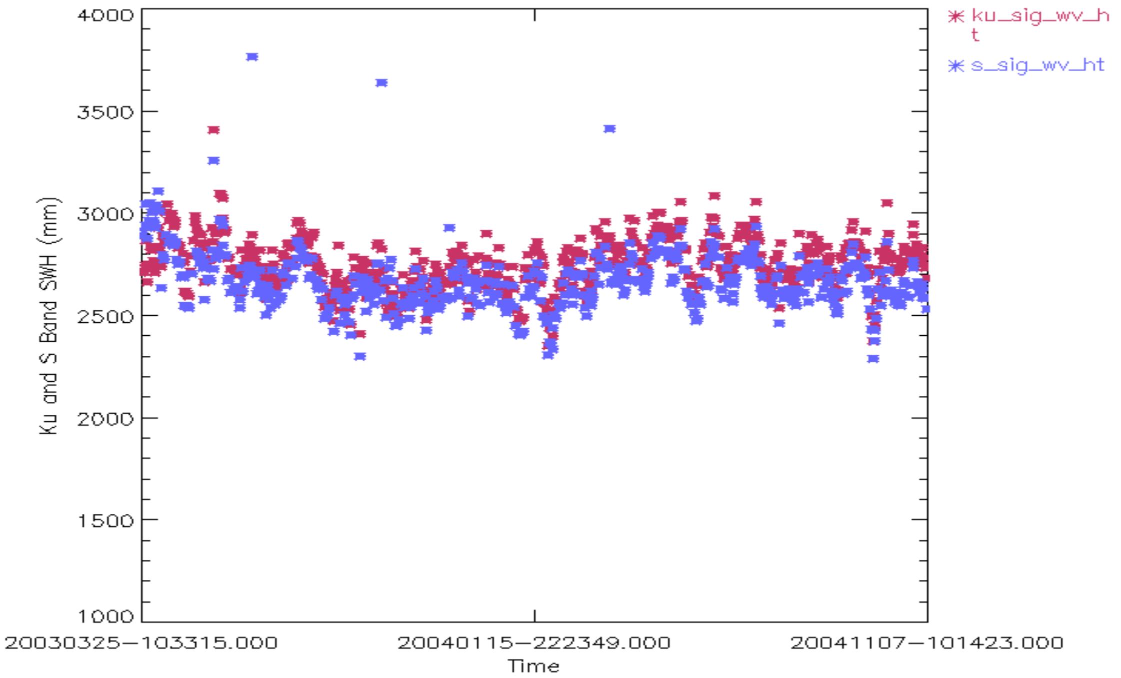

Figure 31: Ku and S SWH daily average up to cycle 31 (mm)

On the other hand, the S-Band SWH shows a drop on April the 9th 2003 corresponding to the operational up-load of IPF version 4.54; furthermore the high daily means reported (sometimes plotted outside the figure range) are due to the so-called S-Band anomaly (ref. par.7.1.7).

9.2.2.3 Backscatter coefficient – Wind Speed

The Ku-Band Sigma_0 trend, reported hereafter, is characterized by a jump of in average 3.24 dBs concomitant with the operational up-load of IPF version 4.54 occurred on the 9th of April 2004. To be said that this change is due to the upload of a new RA2_CHD_AX ADF file that artificially shifted the RA-2 real Sigma_0 in order to align it with ERS-2 Sigma_0 and make it coherent with the Witter and Chelton empirical wind model. A similar change in trend, but in the opposite direction, is also visible in the Wind Speed trend reported afterwards.

Beyond the huge jump occurred in April 2003, the S-Band Sigma_0 reports a smaller jump occurring on November the 26th 2003. Following the installation of the IPF processing chain V4.56, the average values of the RA-2 S-Band backscattering parameter, shows an increase of ~0.65 dBs, the new S-band sigma0 being higher with respect to the previous versions. See chapter 8.5.4.

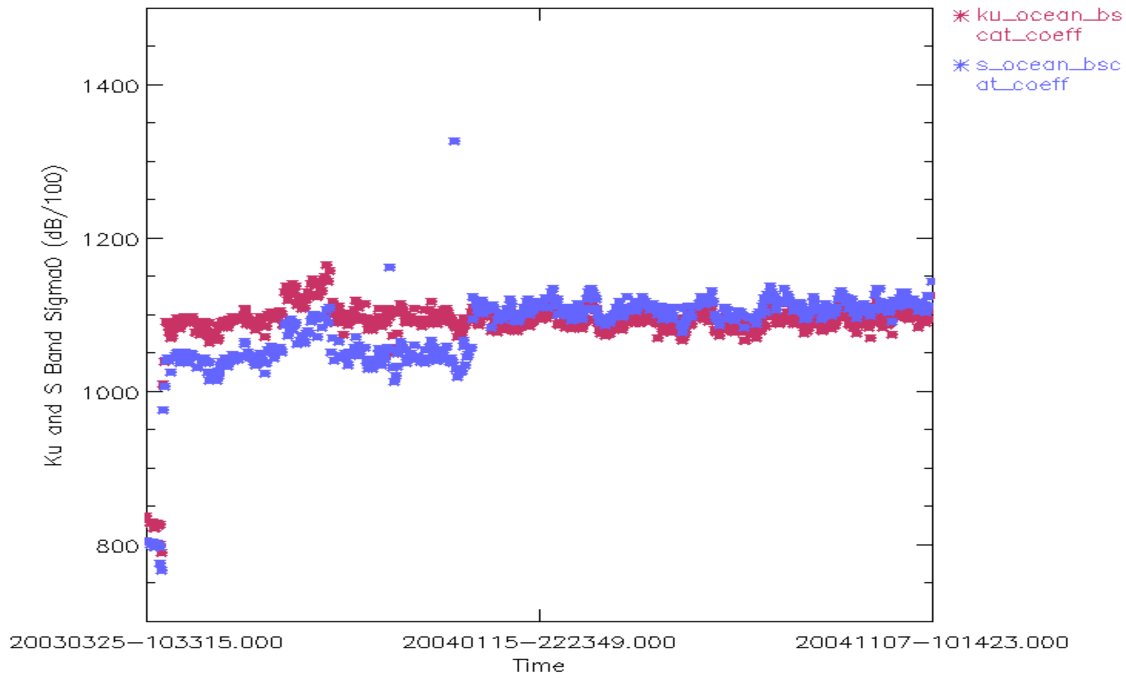

Figure 32: Ku and S band Backscattering daily averages up to cycle 31 (dB/100)

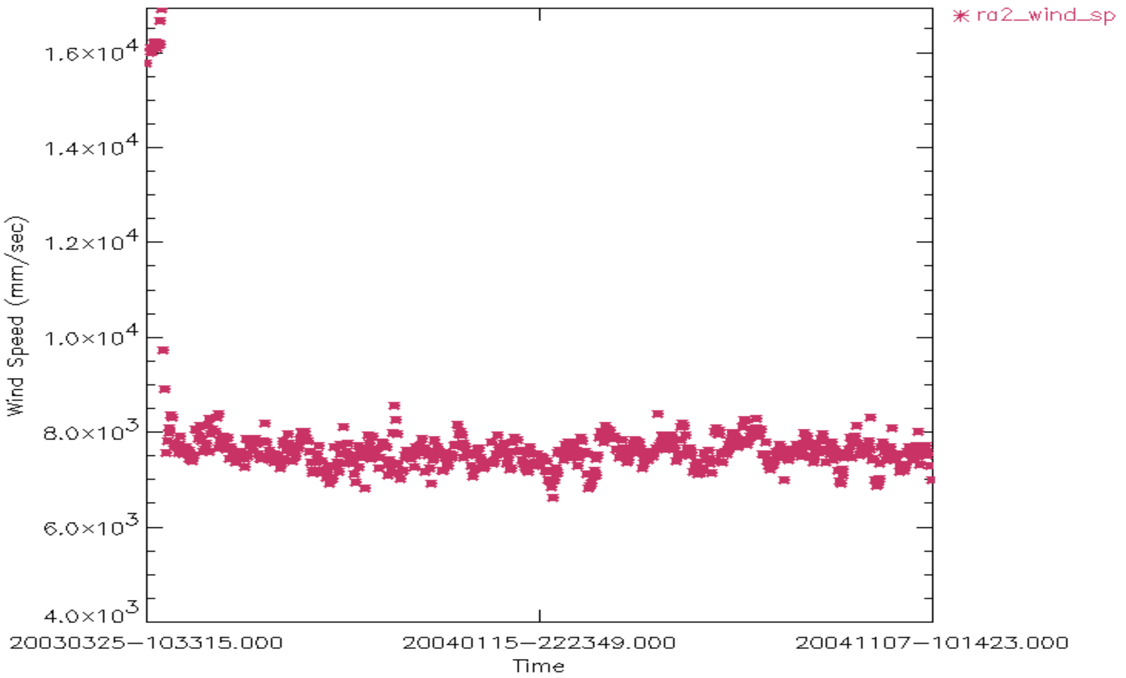

Figure 33: Wind Speed daily averages up to cycle 31 (mm/s)

10 PARTICULAR INVESTIGATIONS

During cycle 31 no special investigation has been performed.