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ENVISAT CYCLIC ALTIMETRIC REPORT

CYCLE 32 from 09-11-2004 to 13-12-2004

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 32.

This report covers the period from the 9th of November 2004 and the 13th of December 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, November 2004
[R – 2] ENVISAT Microwave Radiometer Assessment Report Cycle 032, 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 November 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 # 127-131, 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 two instrument anomalies 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.
14083	14183.2	1974.414	35584	35579.03	35603.77	99.6735	93.7899	93.7908	93.7867
14183.2	14283.4	2121.042	12821.2	12800.35	22181.88	99.6493	97.5294	97.5328	95.9817
14283.4	14383.6	90846.35	934.22	932.153	25095.44	84.9791	84.8246	84.825	80.8297
14383.6	14483.8	20786.75	27183.6	27168.83	27195.84	96.563	92.0684	92.0708	92.0664
14483.8	14584	2152.516	12595.4	12594.33	17675.99	99.6441	97.5615	97.5617	96.7215

Table 1: RA-2 L0, L1b and L2 FGD Data products availability summary for cycle 32

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.
14083	14183.2	0.001	34825	100	94.2419
14183.2	14283.4	0.001	12072	100	98.004
14283.4	14383.6	0.001	0	100	100
14383.6	14483.8	0	47.999	100	99.9921
14483.8	14584	0.001	6648	100	98.9008

Table 2: MWR L0 Data products availability summary for cycle 32

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.
14083	14183.2	0	72813	100	93.9804
14183.2	14283.4	0	29010	100	97.6017
14283.4	14383.6	0	3310.999	100	99.7263
14383.6	14483.8	0	4718.998	100	99.6099
14483.8	14584	0	18679	100	98.4558

Table 3: DORIS L0 Data products availability summary for cycle 32

5.3 *Orbit quality*

During cycle 32 the orbit was maintained within the +/- 1km to the reference ground track.

On the 12-November-2004, a 1-burn SFCM orbit maintenance 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	2004/11/12-02:07:25	0.0198 m/sec	0.0195 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 32, was unavailable twice in the following time frames:
Start: 23 Nov 2004 13:25:58 Orbit = 14292 RA-2 in Reset-Wait due to many SEUs
Stop: 24 Nov 2004 14:10:10 Orbit = 14307

Start: 1 Dec 2004 10:22:30 Orbit = 14405 RA-2 switch-down due to more than 2 Format Header
Stop: 1 Dec 2004 15:34:29 Orbit = 14408 Errors

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.

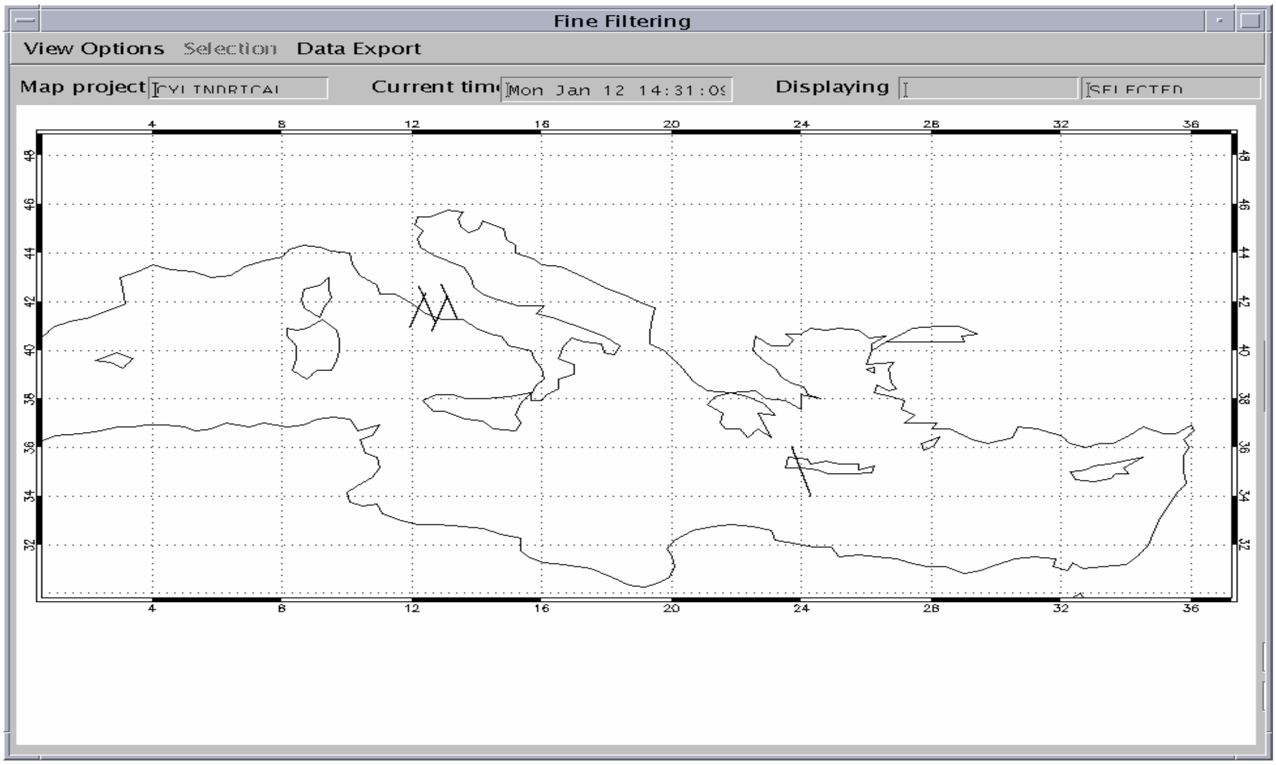

Figure 1: Transponder Acquisition sites for cycle 32

6.2 MWR Events

The MWR, during cycle 32 was never unavailable.

6.3 DORIS Events

The DORIS during cycle 32 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 32 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 32 the number of valid IF masks has been of 21, representing about the 30% 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).

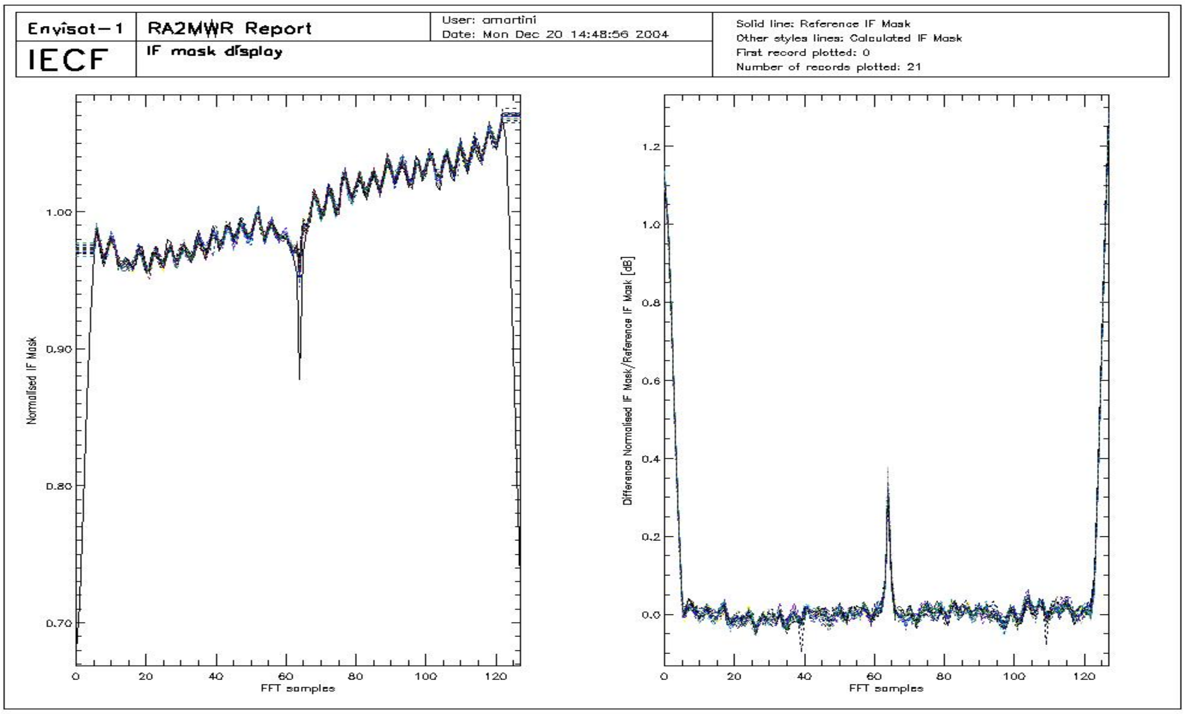

Figure 2: Valid IF masks retrieved daily during cycle 32 plotted together with the on-ground reference.

7.1.2 USO

In Figure 3 the USO clock period trend retrieved for cycle 32 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 1 ps 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.

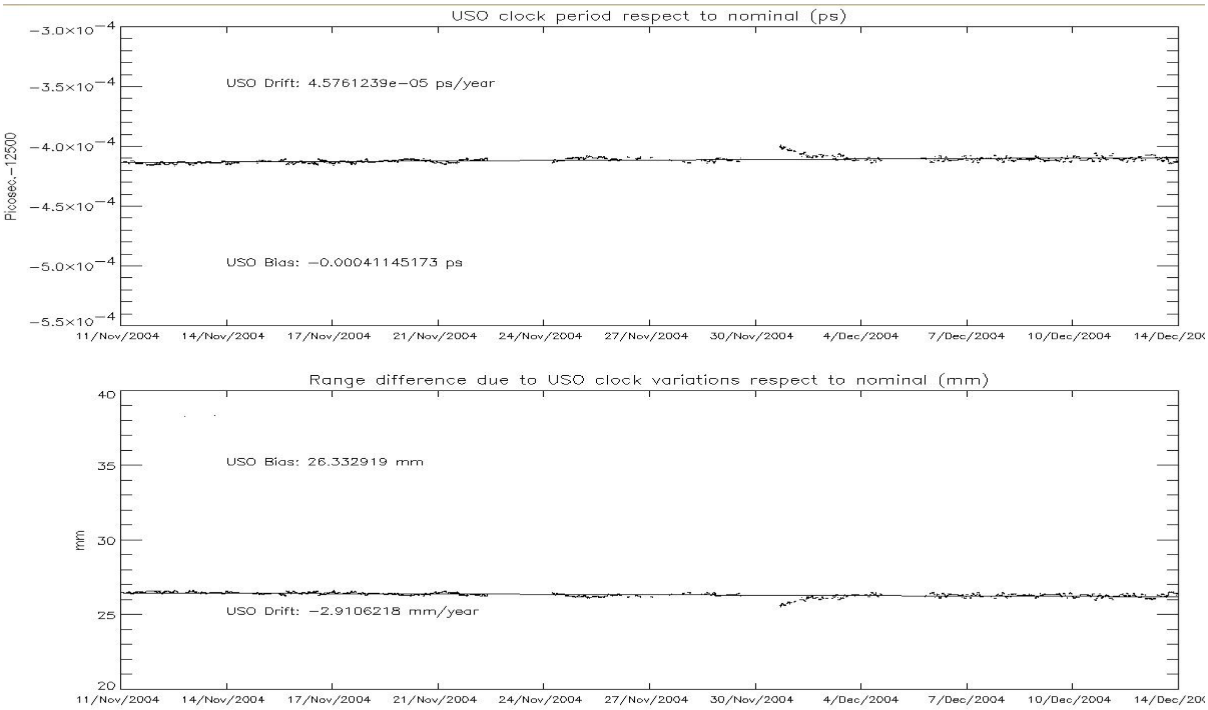

Figure 3: USO clock period for cycle 32

7.1.3 TRACKING CAPABILITY

In Figure 4 and Figure 5, the Chirp ID is plotted respectively for ascending and descending passes of cycle 32. 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).

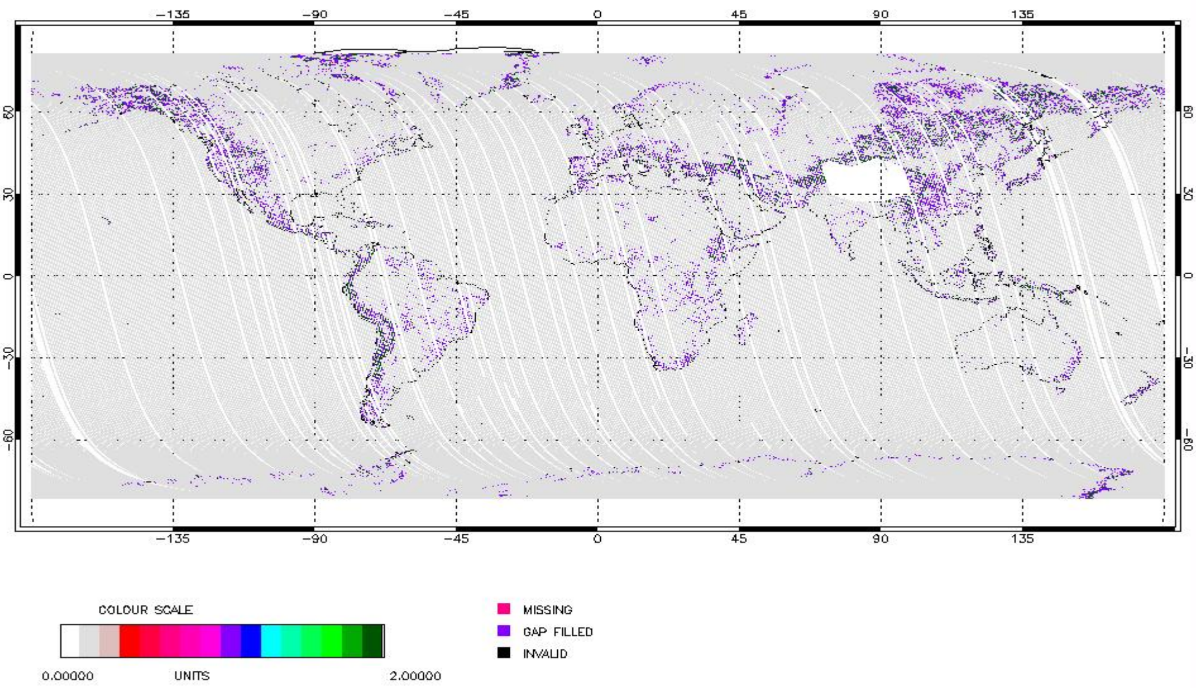

Figure 4: RA-2 Chirp ID for ascending passes during cycle 32

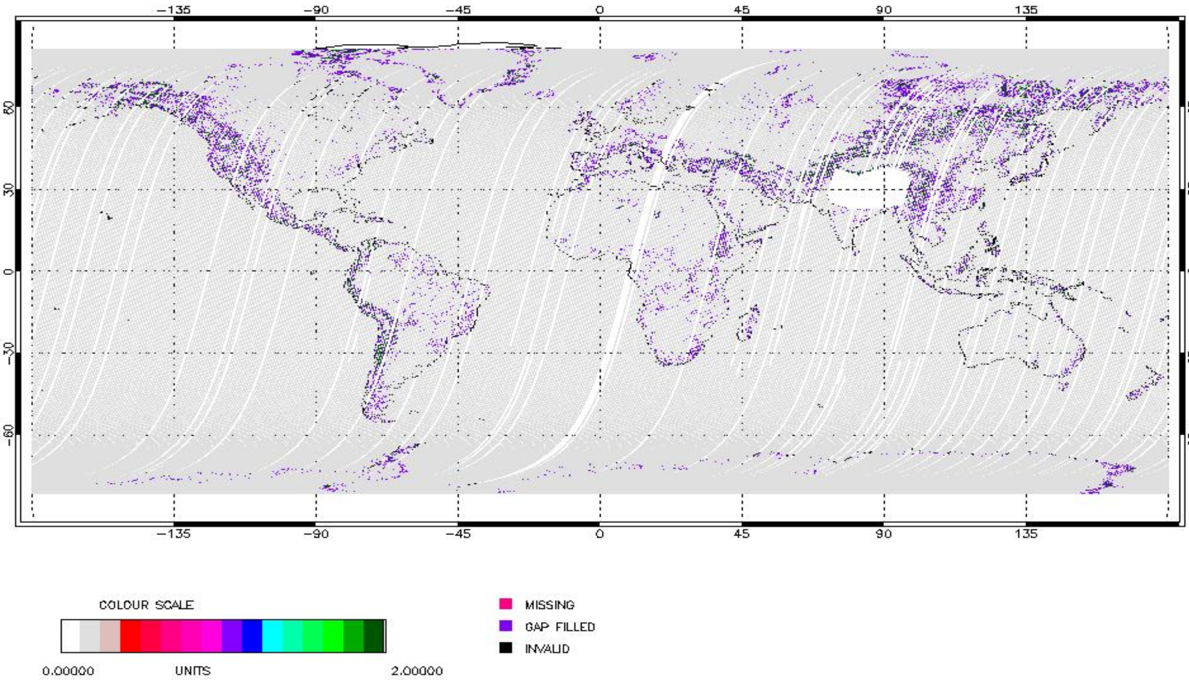

Figure 5: RA-2 Chirp ID for descending passes during cycle 32

The corresponding percentages of acquisition in the different resolutions subdivided by surface type are given in Table 4:

Surface type	320 MHz	80 MHz	20MHz
Open Ocean	99.958%	0.036%	0.006%
Costal Water (ocean depth < 200 m)	97.81%	1.82%	0.37%
Sea Ice	99.07%	0.81%	0.12%
Ice Sheet	96.83%	2.58%	0.59%
Land	83.67%	12.04%	4.29%
All world	95.47%	3.46%	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 32 only three of the four planned Sigma_0 Transponder acquisitions were performed after the Transponder recovery. All of them were executed in Low Resolution since a problem in the Mission Planning System still persists that prevents to plan them in high resolution without risking not to acquire the transponder signature. The dates and times of the acquisitions are reported hereafter:
23-Nov-2004 at 09:41:54
30-Nov-2004 at 20:39:21
09-Dec-2004 at 09:39:02
The received data have not yet been processed.

On the other hand, all the measurements acquired before the 23rd of November 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, 12.4819	Low	1,504	0,0772
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. The reason of this behavior is at the moment under investigation.

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 only once they come over the 20 microseconds (absolute value) warning threshold; however, during the last ten days of the cycle, the variability of the deviations has increased reporting many peaks just under the 20 microseconds threshold. In the lower panel the ICU clock step for the same period is shown and it is possible to notice that in correspondence with the peak reported in the higher panel the clock step value changes. This allows to compensate for the extrapolation deviations and to go back to a nominal situation.

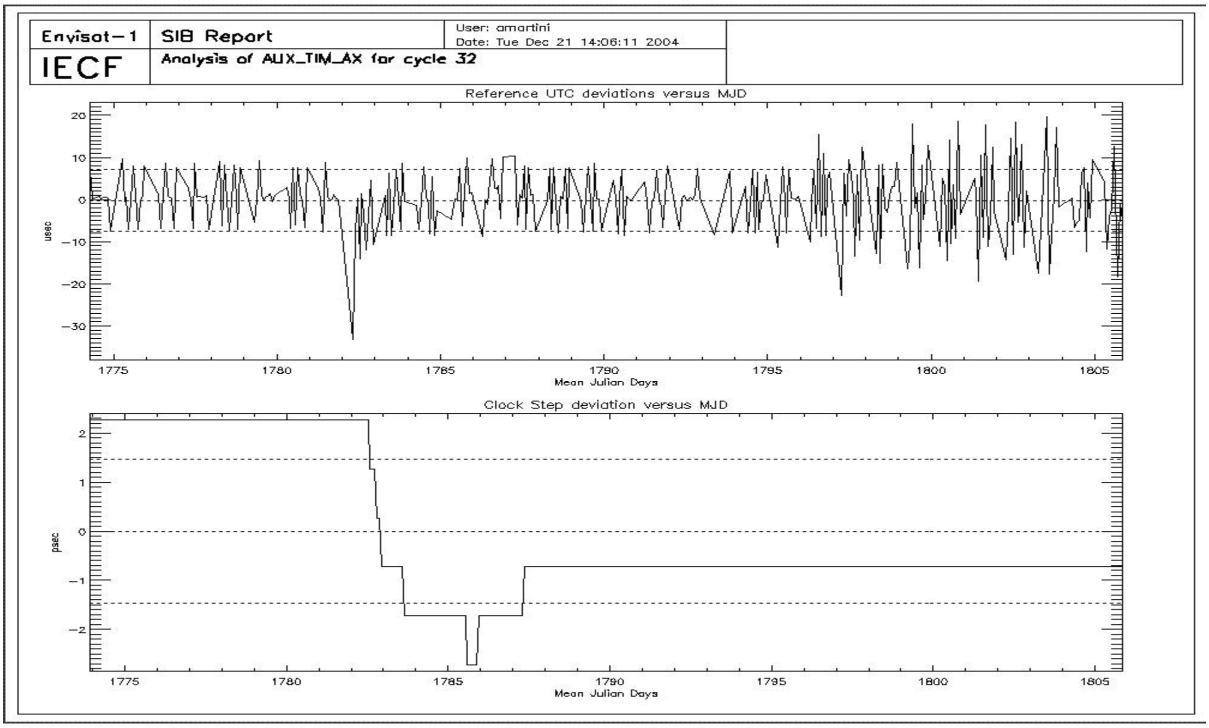

Figure 6: UTC deviations and ICU clock period for cycle 32

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 mid-2005 (ref. 5.4.4).
In particular for this cycle two event of low mispointing values are visible in the plot in correspondence with the occurred instrument anomalies as reported in par. 6.1. 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.

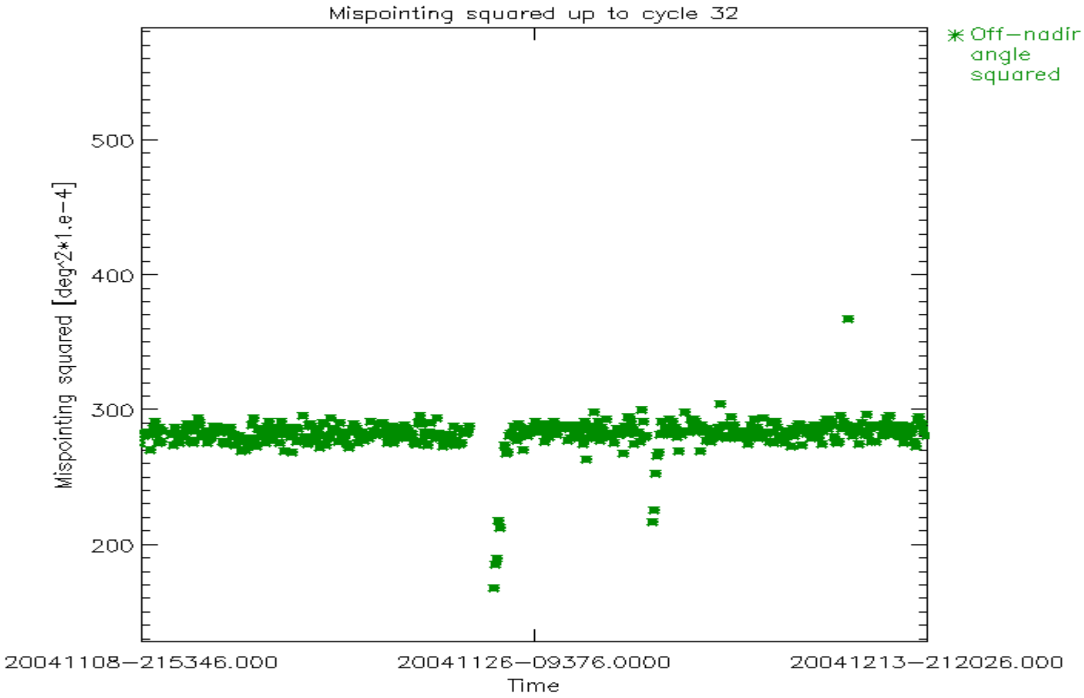

Figure 7: Smoothed mispointing squared trend for cycle 32 (deg^2*10^4)

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 32. This corresponds to a total percentage of about 1.9% 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_2PNPDK20041125_072040_000040092032_00235_14317_2033.N1	25-Nov-04	07:20:40.307739	25-Nov-04	08:27:29.537899
RA2_FGD_2PNPDK20041125_082628_000061652032_00236_14318_2036.N1	25-Nov-04	08:26:28.323602	25-Nov-04	10:09:13.143699
RA2_FGD_2PNPDK20041125_100807_000059362032_00237_14319_2037.N1	25-Nov-04	10:08:07.473402	25-Nov-04	11:47:03.923508
RA2_FGD_2PNPDK20041125_114558_000061482032_00238_14320_2038.N1	25-Nov-04	11:45:58.253202	25-Nov-04	13:28:26.363300
RA2_FGD_2PNPDK20041125_132724_000058622032_00239_14321_2039.N1	25-Nov-04	13:27:24.035003	25-Nov-04	15:05:05.847109
RA2_FGD_2PNPDK20041125_150416_000052282032_00240_14322_2040.N1	25-Nov-04	15:04:16.886818	25-Nov-04	16:31:24.832917
RA2_FGD_2PNPDK20041130_172228_000060592032_00313_14395_2101.N1	30-Nov-04	17:22:28.760367	30-Nov-04	19:03:27.750470
RA2_FGD_2PNPDK20041130_190215_000058302032_00314_14396_2102.N1	30-Nov-04	19:02:15.396169	30-Nov-04	20:39:25.726127
RA2_FGD_2PNPDE20041203_015046_000045162032_00346_14428_1713.N1	03-Dec-04	01:50:46.813137	03-Dec-04	03:06:02.913254

Table 6: List of L2 FGD Files affected by S-Band anomaly during cycle 32

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 32 (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 hundreds of a dB over the cycle.

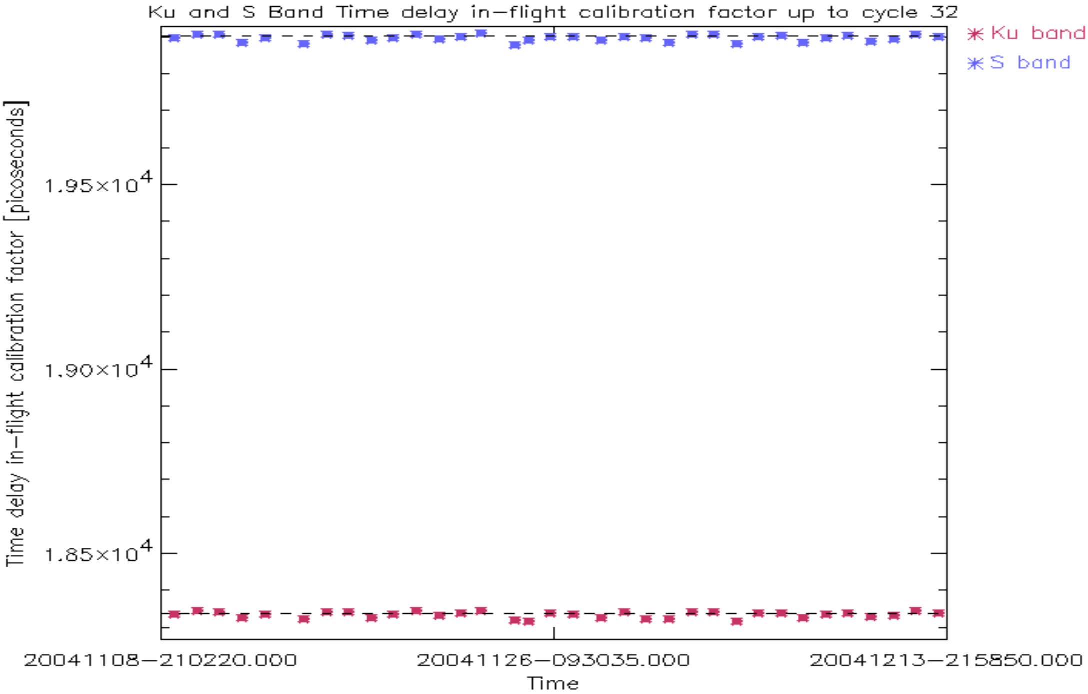

Figure 8: Ku and S Band in-flight time delay calibration factor for cycle 32

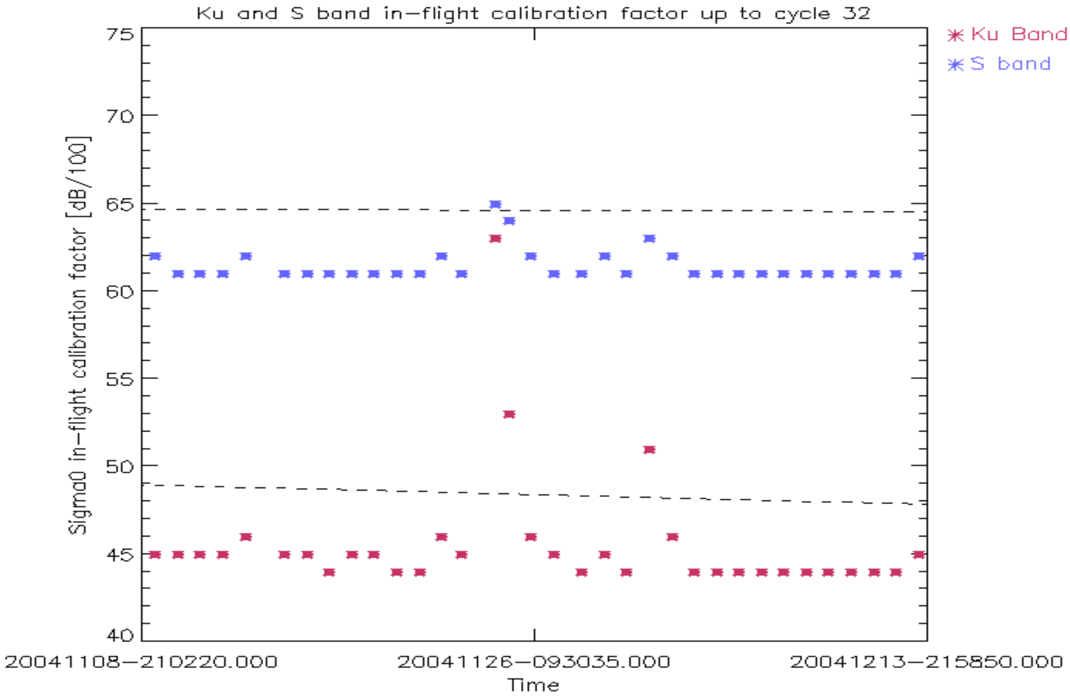

Figure 9: Ku and S Band in-flight Sigma0 calibration factor for cycle 32

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 Table 7 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.

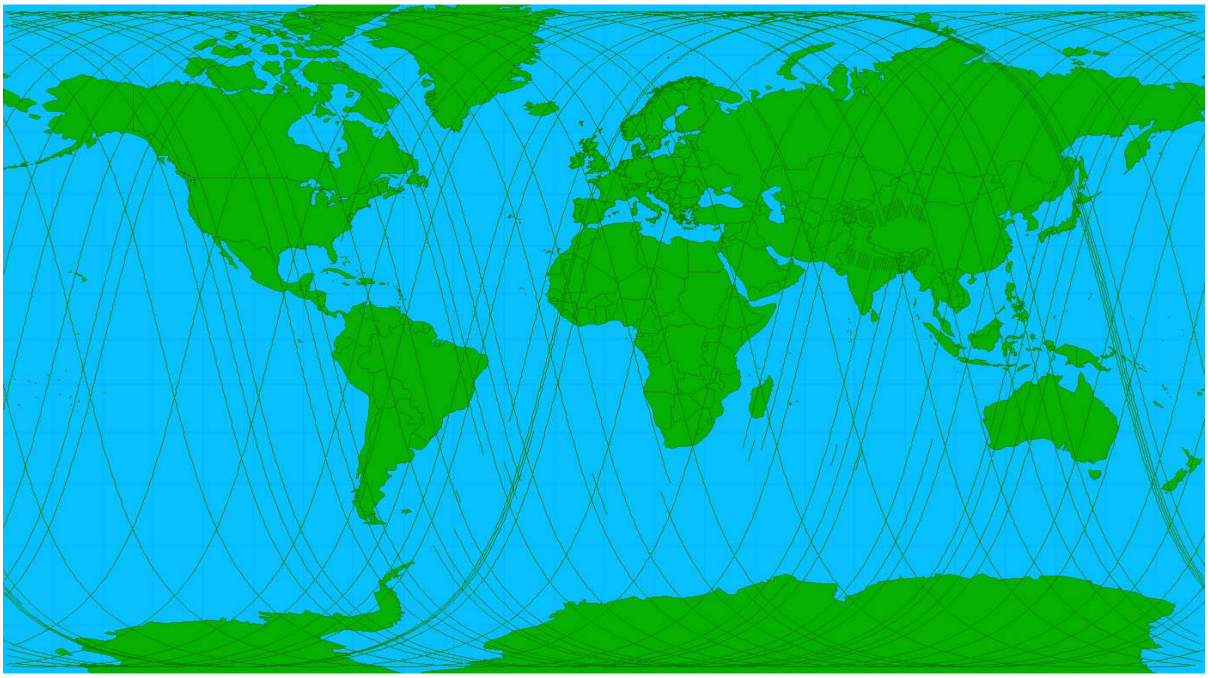

Figure 10: RA-2 L0 unavailable products for cycle 32

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
09-Nov-04	05:23:56	09-Nov-04	05:25:14	78	14087	14087	PDS_UNKNOWN_FAILURE
09-Nov-04	16:36:43	09-Nov-04	16:38:01	78	14094	14094	PDS_UNKNOWN_FAILURE
09-Nov-04	21:15:17	10-Nov-04	04:50:33	27316	14096	14101	PDS_UNKNOWN_FAILURE
10-Nov-04	04:53:01	10-Nov-04	06:51:00	7079	14101	14102	PDS_UNKNOWN_FAILURE
10-Nov-04	12:57:11	10-Nov-04	13:00:03	172	14106	14106	PDS_UNKNOWN_FAILURE
10-Nov-04	16:04:40	10-Nov-04	16:05:58	78	14108	14108	PDS_UNKNOWN_FAILURE
11-Nov-04	04:21:24	11-Nov-04	04:22:41	77	14115	14115	PDS_UNKNOWN_FAILURE
11-Nov-04	15:30:51	11-Nov-04	15:30:53	2	14122	14122	PDS_UNKNOWN_FAILURE
11-Nov-04	15:33:54	11-Nov-04	15:35:12	78	14122	14122	PDS_UNKNOWN_FAILURE
12-Nov-04	05:28:54	12-Nov-04	05:30:12	78	14130	14130	PDS_UNKNOWN_FAILURE
12-Nov-04	16:42:07	12-Nov-04	16:43:24	77	14137	14137	PDS_UNKNOWN_FAILURE
13-Nov-04	04:58:39	13-Nov-04	04:59:57	78	14144	14144	PDS_UNKNOWN_FAILURE
13-Nov-04	16:10:22	13-Nov-04	16:11:40	78	14151	14151	PDS_UNKNOWN_FAILURE
14-Nov-04	04:23:55	14-Nov-04	04:23:58	3	14158	14158	PDS_UNKNOWN_FAILURE
14-Nov-04	04:27:09	14-Nov-04	04:28:26	77	14158	14158	PDS_UNKNOWN_FAILURE
14-Nov-04	15:36:30	14-Nov-04	15:36:32	2	14165	14165	PDS_UNKNOWN_FAILURE
14-Nov-04	15:39:30	14-Nov-04	15:40:48	78	14165	14165	PDS_UNKNOWN_FAILURE
16-Nov-04	00:50:13	16-Nov-04	02:24:10	5637	14184	14185	PDS_UNKNOWN_FAILURE
16-Nov-04	05:02:04	16-Nov-04	05:02:06	2	14187	14187	PDS_UNKNOWN_FAILURE
16-Nov-04	05:04:16	16-Nov-04	05:05:35	79	14187	14187	PDS_UNKNOWN_FAILURE
16-Nov-04	16:16:17	16-Nov-04	16:17:35	78	14194	14194	PDS_UNKNOWN_FAILURE
17-Nov-04	04:32:54	17-Nov-04	04:34:12	78	14201	14201	PDS_UNKNOWN_FAILURE
17-Nov-04	15:45:06	17-Nov-04	15:46:24	78	14208	14208	PDS_UNKNOWN_FAILURE

18-Nov-04	04:00:56	18-Nov-04	04:02:13	77	14215	14215	PDS_UNKNOWN_FAILURE
18-Nov-04	12:05:01	18-Nov-04	12:07:40	159	14220	14220	PDS_UNKNOWN_FAILURE
18-Nov-04	15:13:17	18-Nov-04	15:14:35	78	14222	14222	PDS_UNKNOWN_FAILURE
19-Nov-04	05:07:41	19-Nov-04	05:07:44	3	14230	14230	PDS_UNKNOWN_FAILURE
19-Nov-04	05:09:54	19-Nov-04	05:11:12	78	14230	14230	PDS_UNKNOWN_FAILURE
19-Nov-04	16:22:12	19-Nov-04	16:23:30	78	14237	14237	PDS_UNKNOWN_FAILURE
20-Nov-04	04:38:39	20-Nov-04	04:39:57	78	14244	14244	PDS_UNKNOWN_FAILURE
20-Nov-04	11:05:30	20-Nov-04	11:36:12	1842	14248	14248	PDS_UNKNOWN_FAILURE
20-Nov-04	15:47:53	20-Nov-04	15:47:56	3	14251	14251	PDS_UNKNOWN_FAILURE
20-Nov-04	15:50:42	20-Nov-04	15:52:00	78	14251	14251	PDS_UNKNOWN_FAILURE
21-Nov-04	04:06:48	21-Nov-04	04:08:06	78	14258	14258	PDS_UNKNOWN_FAILURE
21-Nov-04	11:05:20	21-Nov-04	12:13:24	4084	14262	14263	PDS_UNKNOWN_FAILURE
21-Nov-04	15:19:12	21-Nov-04	15:20:30	78	14265	14265	PDS_UNKNOWN_FAILURE
23-Nov-04	04:44:24	23-Nov-04	04:45:42	78	14287	14287	PDS_UNKNOWN_FAILURE
23-Nov-04	13:25:47	23-Nov-04	13:25:58	11	14292	14292	PDS_UNKNOWN_FAILURE
23-Nov-04	13:25:58	23-Nov-04	15:53:41	8863	14292	14294	UNAV_RA2
23-Nov-04	15:56:18	24-Nov-04	04:09:56	44018	14294	14301	UNAV_RA2
24-Nov-04	04:12:40	24-Nov-04	14:10:10	35850	14301	14307	UNAV_RA2
24-Nov-04	14:10:10	24-Nov-04	14:11:16	66	14307	14307	PDS_UNKNOWN_FAILURE
25-Nov-04	05:18:56	25-Nov-04	05:18:58	2	14316	14316	PDS_UNKNOWN_FAILURE
25-Nov-04	05:21:08	25-Nov-04	05:22:26	78	14316	14316	PDS_UNKNOWN_FAILURE
25-Nov-04	16:34:02	25-Nov-04	16:35:20	78	14323	14323	PDS_UNKNOWN_FAILURE
26-Nov-04	04:50:09	26-Nov-04	04:51:27	78	14330	14330	PDS_UNKNOWN_FAILURE
26-Nov-04	16:01:53	26-Nov-04	16:03:11	78	14337	14337	PDS_UNKNOWN_FAILURE
27-Nov-04	04:18:32	27-Nov-04	04:19:50	78	14344	14344	PDS_UNKNOWN_FAILURE
27-Nov-04	15:31:02	27-Nov-04	15:32:19	77	14351	14351	PDS_UNKNOWN_FAILURE
28-Nov-04	05:26:26	28-Nov-04	05:27:44	78	14359	14359	PDS_UNKNOWN_FAILURE
28-Nov-04	16:39:26	28-Nov-04	16:40:43	77	14366	14366	PDS_UNKNOWN_FAILURE
30-Nov-04	04:24:17	30-Nov-04	04:25:35	78	14387	14387	PDS_UNKNOWN_FAILURE
30-Nov-04	15:33:41	30-Nov-04	15:33:43	2	14394	14394	PDS_UNKNOWN_FAILURE
30-Nov-04	15:36:43	30-Nov-04	15:38:01	78	14394	14394	PDS_UNKNOWN_FAILURE
01-Dec-04	03:50:51	01-Dec-04	03:50:54	3	14401	14401	PDS_UNKNOWN_FAILURE
01-Dec-04	03:52:07	01-Dec-04	03:53:25	78	14401	14401	PDS_UNKNOWN_FAILURE
01-Dec-04	10:22:28	01-Dec-04	10:22:30	2	14405	14405	PDS_UNKNOWN_FAILURE
01-Dec-04	10:22:30	01-Dec-04	15:34:29	18719	14405	14408	UNAV_RA2
01-Dec-04	15:34:29	01-Dec-04	15:35:35	66	14408	14408	PDS_UNKNOWN_FAILURE
01-Dec-04	16:44:50	01-Dec-04	16:46:07	77	14409	14409	PDS_UNKNOWN_FAILURE
02-Dec-04	05:01:28	02-Dec-04	05:02:46	78	14416	14416	PDS_UNKNOWN_FAILURE
02-Dec-04	16:13:20	02-Dec-04	16:14:38	78	14423	14423	PDS_UNKNOWN_FAILURE
02-Dec-04	19:40:01	02-Dec-04	20:45:09	3908	14425	14425	PDS_UNKNOWN_FAILURE
03-Dec-04	00:13:39	03-Dec-04	01:50:46	5827	14427	14428	PDS_UNKNOWN_FAILURE
03-Dec-04	03:06:01	03-Dec-04	04:26:47	4846	14429	14430	PDS_UNKNOWN_FAILURE
03-Dec-04	04:30:01	03-Dec-04	06:28:14	7093	14430	14431	PDS_UNKNOWN_FAILURE
03-Dec-04	15:39:19	03-Dec-04	15:39:21	2	14437	14437	PDS_UNKNOWN_FAILURE

03-Dec-04	15:42:18	03-Dec-04	15:43:36	78	14437	14437	PDS_UNKNOWN_FAILURE
04-Dec-04	03:55:57	04-Dec-04	03:55:59	2	14444	14444	PDS_UNKNOWN_FAILURE
04-Dec-04	03:57:59	04-Dec-04	03:59:17	78	14444	14444	PDS_UNKNOWN_FAILURE
04-Dec-04	15:10:19	04-Dec-04	15:11:37	78	14451	14451	PDS_UNKNOWN_FAILURE
04-Dec-04	20:15:19	04-Dec-04	21:29:01	4422	14454	14454	PDS_UNKNOWN_FAILURE
05-Dec-04	05:07:05	05-Dec-04	05:08:22	77	14459	14459	PDS_UNKNOWN_FAILURE
05-Dec-04	16:19:14	05-Dec-04	16:20:32	78	14466	14466	PDS_UNKNOWN_FAILURE
06-Dec-04	04:35:46	06-Dec-04	04:37:03	77	14473	14473	PDS_UNKNOWN_FAILURE
06-Dec-04	15:47:53	06-Dec-04	15:49:11	78	14480	14480	PDS_UNKNOWN_FAILURE
07-Dec-04	04:03:51	07-Dec-04	04:05:09	78	14487	14487	PDS_UNKNOWN_FAILURE
07-Dec-04	11:23:50	07-Dec-04	12:10:30	2800	14491	14492	PDS_UNKNOWN_FAILURE
07-Dec-04	15:16:13	07-Dec-04	15:17:31	78	14494	14494	PDS_UNKNOWN_FAILURE
08-Dec-04	05:10:28	08-Dec-04	05:10:31	3	14502	14502	PDS_UNKNOWN_FAILURE
08-Dec-04	05:12:41	08-Dec-04	05:13:59	78	14502	14502	PDS_UNKNOWN_FAILURE
08-Dec-04	14:56:10	08-Dec-04	14:58:02	112	14508	14508	PDS_UNKNOWN_FAILURE
08-Dec-04	16:25:08	08-Dec-04	16:26:26	78	14509	14509	PDS_UNKNOWN_FAILURE
08-Dec-04	16:31:56	08-Dec-04	16:33:37	101	14509	14509	PDS_UNKNOWN_FAILURE
08-Dec-04	18:09:32	08-Dec-04	18:13:08	216	14510	14510	PDS_UNKNOWN_FAILURE
08-Dec-04	19:49:12	08-Dec-04	19:52:12	180	14511	14511	PDS_UNKNOWN_FAILURE
08-Dec-04	22:42:03	08-Dec-04	22:45:12	189	14512	14512	PDS_UNKNOWN_FAILURE
09-Dec-04	00:23:44	09-Dec-04	00:26:44	180	14513	14513	PDS_UNKNOWN_FAILURE
09-Dec-04	04:41:30	09-Dec-04	04:42:48	78	14516	14516	PDS_UNKNOWN_FAILURE
09-Dec-04	04:58:37	09-Dec-04	05:00:23	106	14516	14516	PDS_UNKNOWN_FAILURE
09-Dec-04	06:38:48	09-Dec-04	06:40:33	105	14517	14517	PDS_UNKNOWN_FAILURE
09-Dec-04	11:06:23	09-Dec-04	11:07:20	57	14520	14520	PDS_UNKNOWN_FAILURE
09-Dec-04	12:45:43	09-Dec-04	12:48:11	148	14521	14521	PDS_UNKNOWN_FAILURE
09-Dec-04	14:25:27	09-Dec-04	14:26:10	43	14522	14522	PDS_UNKNOWN_FAILURE
09-Dec-04	15:50:44	09-Dec-04	15:50:47	3	14523	14523	PDS_UNKNOWN_FAILURE
09-Dec-04	15:53:28	09-Dec-04	15:54:46	78	14523	14523	PDS_UNKNOWN_FAILURE
09-Dec-04	16:01:38	09-Dec-04	16:05:21	223	14523	14523	PDS_UNKNOWN_FAILURE
09-Dec-04	17:38:19	09-Dec-04	17:42:11	232	14524	14524	PDS_UNKNOWN_FAILURE
09-Dec-04	19:19:00	09-Dec-04	19:20:47	107	14525	14525	PDS_UNKNOWN_FAILURE
10-Dec-04	01:32:30	10-Dec-04	01:33:28	58	14528	14528	PDS_UNKNOWN_FAILURE
10-Dec-04	04:09:42	10-Dec-04	04:11:00	78	14530	14530	PDS_UNKNOWN_FAILURE
10-Dec-04	04:27:29	10-Dec-04	04:29:05	96	14530	14530	PDS_UNKNOWN_FAILURE
10-Dec-04	08:55:22	10-Dec-04	08:58:10	168	14533	14533	PDS_UNKNOWN_FAILURE
10-Dec-04	10:34:24	10-Dec-04	12:16:52	6148	14534	14535	PDS_UNKNOWN_FAILURE
10-Dec-04	13:54:02	10-Dec-04	13:55:07	65	14536	14536	PDS_UNKNOWN_FAILURE
10-Dec-04	15:22:07	10-Dec-04	15:23:25	78	14537	14537	PDS_UNKNOWN_FAILURE
10-Dec-04	15:32:02	10-Dec-04	15:34:46	164	14537	14537	PDS_UNKNOWN_FAILURE
11-Dec-04	05:16:05	11-Dec-04	05:16:07	2	14545	14545	PDS_UNKNOWN_FAILURE
11-Dec-04	05:18:17	11-Dec-04	05:19:35	78	14545	14545	PDS_UNKNOWN_FAILURE
11-Dec-04	16:31:02	11-Dec-04	16:32:20	78	14552	14552	PDS_UNKNOWN_FAILURE
12-Dec-04	04:47:14	12-Dec-04	04:48:32	78	14559	14559	PDS_UNKNOWN_FAILURE

12-Dec-04	15:59:03	12-Dec-04	16:00:20	77	14566	14566	PDS_UNKNOWN_FAILURE

Table 7: List of gaps for RA-2 L0 products during cycle 32

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

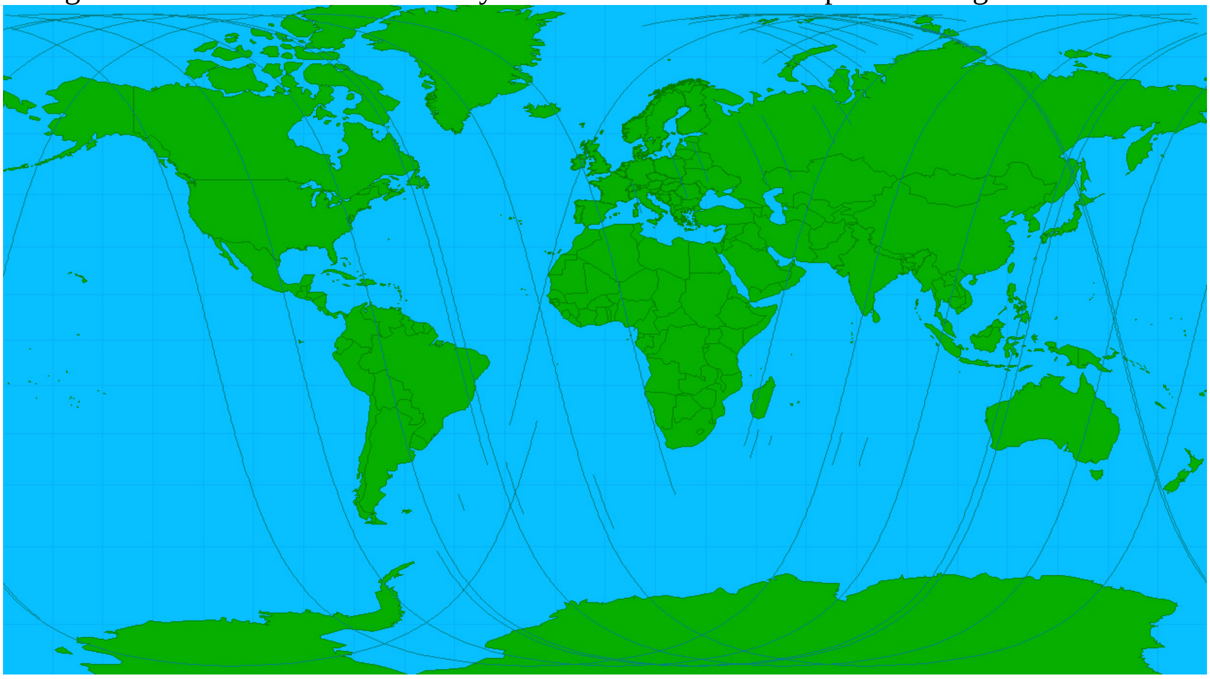

Figure 11: MWR L0 unavailable products for cycle 32

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
09-Nov-04	21:14:24	10-Nov-04	06:50:49	34585	14096	14102	PDS_UNKNOWN_FAILURE
10-Nov-04	12:56:01	10-Nov-04	13:00:01	240	14106	14106	PDS_UNKNOWN_FAILURE
16-Nov-04	00:49:26	16-Nov-04	02:23:50	5664	14184	14185	PDS_UNKNOWN_FAILURE
17-Nov-04	20:47:30	17-Nov-04	20:49:54	144	14211	14211	PDS_UNKNOWN_FAILURE
18-Nov-04	12:03:55	18-Nov-04	12:07:31	216	14220	14220	PDS_UNKNOWN_FAILURE
20-Nov-04	11:04:24	20-Nov-04	11:36:24	1920	14248	14248	PDS_UNKNOWN_FAILURE
21-Nov-04	11:04:26	21-Nov-04	12:13:14	4128	14262	14263	PDS_UNKNOWN_FAILURE
30-Nov-04	06:21:10	30-Nov-04	06:21:58	48	14388	14388	PDS_UNKNOWN_FAILURE
07-Dec-04	11:23:02	07-Dec-04	12:10:14	2832	14491	14492	PDS_UNKNOWN_FAILURE
08-Dec-04	14:55:05	08-Dec-04	14:57:53	168	14508	14508	PDS_UNKNOWN_FAILURE
08-Dec-04	16:31:05	08-Dec-04	16:33:29	144	14509	14509	PDS_UNKNOWN_FAILURE
08-Dec-04	18:08:41	08-Dec-04	18:13:05	264	14510	14510	PDS_UNKNOWN_FAILURE
08-Dec-04	19:48:17	08-Dec-04	19:51:53	216	14511	14511	PDS_UNKNOWN_FAILURE
08-Dec-04	22:41:05	08-Dec-04	22:45:05	240	14512	14512	PDS_UNKNOWN_FAILURE
09-Dec-04	00:22:42	09-Dec-04	00:26:42	240	14513	14513	PDS_UNKNOWN_FAILURE
09-Dec-04	04:57:30	09-Dec-04	05:00:18	168	14516	14516	PDS_UNKNOWN_FAILURE
09-Dec-04	06:37:54	09-Dec-04	06:40:18	144	14517	14517	PDS_UNKNOWN_FAILURE
09-Dec-04	11:05:31	09-Dec-04	11:07:07	96	14520	14520	PDS_UNKNOWN_FAILURE
09-Dec-04	12:44:43	09-Dec-04	12:47:55	192	14521	14521	PDS_UNKNOWN_FAILURE

09-Dec-04	14:24:19	09-Dec-04	14:25:55	96	14522	14522	PDS_UNKNOWN_FAILURE
09-Dec-04	16:00:43	09-Dec-04	16:05:07	264	14523	14523	PDS_UNKNOWN_FAILURE
09-Dec-04	17:37:31	09-Dec-04	17:41:55	264	14524	14524	PDS_UNKNOWN_FAILURE
09-Dec-04	19:17:55	09-Dec-04	19:20:43	168	14525	14525	PDS_UNKNOWN_FAILURE
10-Dec-04	01:31:56	10-Dec-04	01:33:08	72	14528	14528	PDS_UNKNOWN_FAILURE
10-Dec-04	04:26:20	10-Dec-04	04:28:44	144	14530	14530	PDS_UNKNOWN_FAILURE
10-Dec-04	08:54:21	10-Dec-04	08:57:57	216	14533	14533	PDS_UNKNOWN_FAILURE
10-Dec-04	10:33:33	10-Dec-04	10:36:45	192	14534	14534	PDS_UNKNOWN_FAILURE
10-Dec-04	12:13:09	10-Dec-04	12:16:45	216	14535	14535	PDS_UNKNOWN_FAILURE
10-Dec-04	13:53:09	10-Dec-04	13:54:45	96	14536	14536	PDS_UNKNOWN_FAILURE
10-Dec-04	15:31:09	10-Dec-04	15:34:45	216	14537	14537	PDS_UNKNOWN_FAILURE

Table 8: List of gaps for MWR L0 products during cycle 32

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.

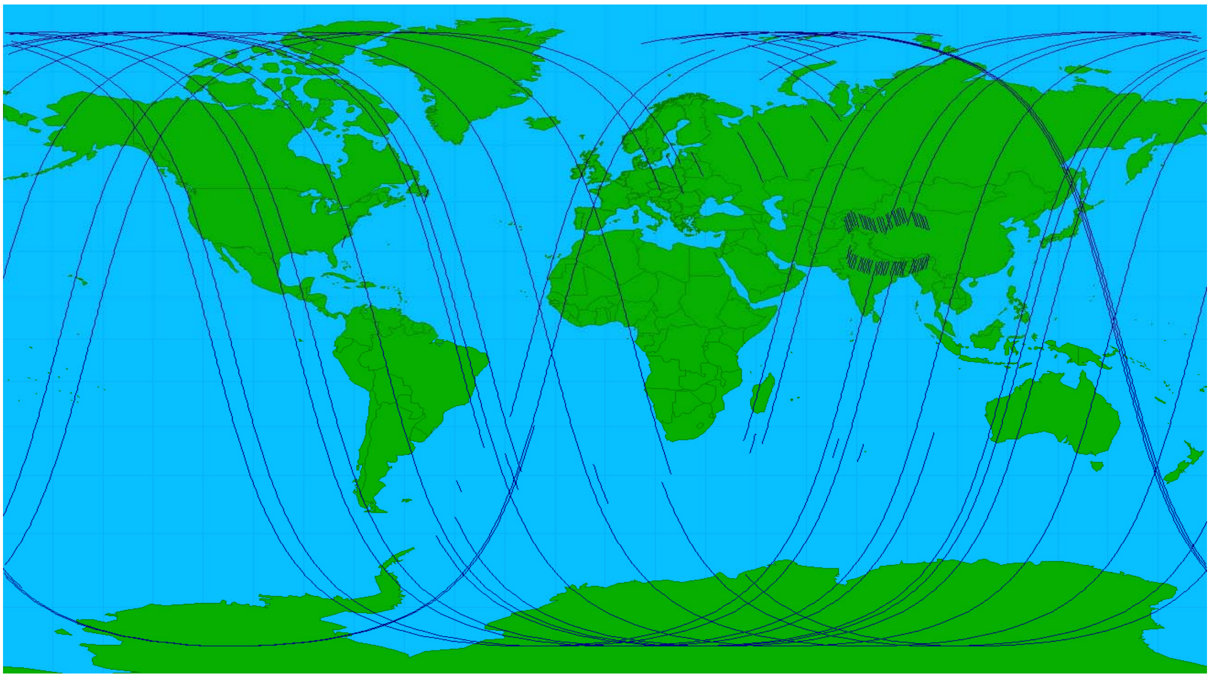

Figure 12: RA-2 L1b unavailable products for cycle 32

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
09-Nov-04	05:23:56	09-Nov-04	05:25:14	78	14087	14087	PDS_UNKNOWN_FAILURE
09-Nov-04	16:36:43	09-Nov-04	16:38:01	78	14094	14094	PDS_UNKNOWN_FAILURE
09-Nov-04	21:15:18	10-Nov-04	04:50:33	27315	14096	14101	PDS_UNKNOWN_FAILURE
10-Nov-04	04:53:01	10-Nov-04	06:51:00	7079	14101	14102	PDS_UNKNOWN_FAILURE
10-Nov-04	12:57:12	10-Nov-04	13:00:03	171	14106	14106	PDS_UNKNOWN_FAILURE
10-Nov-04	16:04:40	10-Nov-04	16:05:58	78	14108	14108	PDS_UNKNOWN_FAILURE

11-Nov-04	04:21:24	11-Nov-04	04:22:41	77	14115	14115	PDS_UNKNOWN_FAILURE
11-Nov-04	15:33:54	11-Nov-04	15:35:12	78	14122	14122	PDS_UNKNOWN_FAILURE
12-Nov-04	05:28:54	12-Nov-04	05:30:12	78	14130	14130	PDS_UNKNOWN_FAILURE
12-Nov-04	16:42:07	12-Nov-04	16:43:24	77	14137	14137	PDS_UNKNOWN_FAILURE
12-Nov-04	16:43:24	12-Nov-04	16:43:25	1	14137	14137	PDS_UNKNOWN_FAILURE
13-Nov-04	04:58:39	13-Nov-04	04:59:57	78	14144	14144	PDS_UNKNOWN_FAILURE
13-Nov-04	04:59:57	13-Nov-04	05:00:00	3	14144	14144	PDS_UNKNOWN_FAILURE
13-Nov-04	16:10:22	13-Nov-04	16:11:40	78	14151	14151	PDS_UNKNOWN_FAILURE
14-Nov-04	04:27:09	14-Nov-04	04:28:26	77	14158	14158	PDS_UNKNOWN_FAILURE
14-Nov-04	15:39:30	14-Nov-04	15:40:48	78	14165	14165	PDS_UNKNOWN_FAILURE
15-Nov-04	03:55:03	15-Nov-04	03:56:21	78	14172	14172	PDS_UNKNOWN_FAILURE
15-Nov-04	15:07:22	15-Nov-04	15:08:40	78	14179	14179	PDS_UNKNOWN_FAILURE
16-Nov-04	00:50:14	16-Nov-04	02:23:59	5625	14184	14185	PDS_UNKNOWN_FAILURE
16-Nov-04	05:04:16	16-Nov-04	05:05:35	79	14187	14187	PDS_UNKNOWN_FAILURE
16-Nov-04	16:16:17	16-Nov-04	16:17:35	78	14194	14194	PDS_UNKNOWN_FAILURE
17-Nov-04	04:32:54	17-Nov-04	04:34:12	78	14201	14201	PDS_UNKNOWN_FAILURE
17-Nov-04	15:45:06	17-Nov-04	15:46:24	78	14208	14208	PDS_UNKNOWN_FAILURE
18-Nov-04	04:00:56	18-Nov-04	04:02:13	77	14215	14215	PDS_UNKNOWN_FAILURE
18-Nov-04	12:05:02	18-Nov-04	12:07:40	158	14220	14220	PDS_UNKNOWN_FAILURE
18-Nov-04	15:13:17	18-Nov-04	15:14:35	78	14222	14222	PDS_UNKNOWN_FAILURE
19-Nov-04	05:09:54	19-Nov-04	05:11:12	78	14230	14230	PDS_UNKNOWN_FAILURE
19-Nov-04	16:22:12	19-Nov-04	16:23:30	78	14237	14237	PDS_UNKNOWN_FAILURE
20-Nov-04	04:38:39	20-Nov-04	04:39:57	78	14244	14244	PDS_UNKNOWN_FAILURE
20-Nov-04	11:05:31	20-Nov-04	11:36:12	1841	14248	14248	PDS_UNKNOWN_FAILURE
20-Nov-04	15:47:54	20-Nov-04	15:47:56	2	14251	14251	PDS_UNKNOWN_FAILURE
20-Nov-04	15:50:42	20-Nov-04	15:52:00	78	14251	14251	PDS_UNKNOWN_FAILURE
21-Nov-04	04:06:48	21-Nov-04	04:08:06	78	14258	14258	PDS_UNKNOWN_FAILURE
21-Nov-04	11:05:21	21-Nov-04	12:13:24	4083	14262	14263	PDS_UNKNOWN_FAILURE
21-Nov-04	15:19:12	21-Nov-04	15:20:30	78	14265	14265	PDS_UNKNOWN_FAILURE
23-Nov-04	04:44:24	23-Nov-04	04:45:42	78	14287	14287	PDS_UNKNOWN_FAILURE
23-Nov-04	13:25:48	23-Nov-04	13:25:58	10	14292	14292	PDS_UNKNOWN_FAILURE
24-Nov-04	14:10:10	24-Nov-04	14:11:16	66	14307	14307	PDS_UNKNOWN_FAILURE
25-Nov-04	05:21:08	25-Nov-04	05:22:26	78	14316	14316	PDS_UNKNOWN_FAILURE
25-Nov-04	16:34:02	25-Nov-04	16:35:20	78	14323	14323	PDS_UNKNOWN_FAILURE
26-Nov-04	04:50:09	26-Nov-04	04:51:27	78	14330	14330	PDS_UNKNOWN_FAILURE
26-Nov-04	16:01:53	26-Nov-04	16:03:11	78	14337	14337	PDS_UNKNOWN_FAILURE
27-Nov-04	04:18:32	27-Nov-04	04:19:50	78	14344	14344	PDS_UNKNOWN_FAILURE
27-Nov-04	15:31:02	27-Nov-04	15:32:19	77	14351	14351	PDS_UNKNOWN_FAILURE
28-Nov-04	05:26:26	28-Nov-04	05:27:44	78	14359	14359	PDS_UNKNOWN_FAILURE
28-Nov-04	16:39:26	28-Nov-04	16:40:43	77	14366	14366	PDS_UNKNOWN_FAILURE
28-Nov-04	16:40:43	28-Nov-04	16:40:44	1	14366	14366	PDS_UNKNOWN_FAILURE
30-Nov-04	04:24:17	30-Nov-04	04:25:35	78	14387	14387	PDS_UNKNOWN_FAILURE
30-Nov-04	15:36:43	30-Nov-04	15:38:01	78	14394	14394	PDS_UNKNOWN_FAILURE
01-Dec-04	03:52:07	01-Dec-04	03:53:25	78	14401	14401	PDS_UNKNOWN_FAILURE

01-Dec-04	15:34:29	01-Dec-04	15:35:35	66	14408	14408	PDS_UNKNOWN_FAILURE
01-Dec-04	16:44:50	01-Dec-04	16:46:07	77	14409	14409	PDS_UNKNOWN_FAILURE
02-Dec-04	05:01:28	02-Dec-04	05:02:46	78	14416	14416	PDS_UNKNOWN_FAILURE
02-Dec-04	16:13:20	02-Dec-04	16:14:38	78	14423	14423	PDS_UNKNOWN_FAILURE
02-Dec-04	19:40:02	02-Dec-04	20:45:09	3907	14425	14425	PDS_UNKNOWN_FAILURE
03-Dec-04	00:13:40	03-Dec-04	01:50:46	5826	14427	14428	PDS_UNKNOWN_FAILURE
03-Dec-04	03:06:02	03-Dec-04	04:26:47	4845	14429	14430	PDS_UNKNOWN_FAILURE
03-Dec-04	04:30:01	03-Dec-04	06:28:14	7093	14430	14431	PDS_UNKNOWN_FAILURE
03-Dec-04	15:42:18	03-Dec-04	15:43:36	78	14437	14437	PDS_UNKNOWN_FAILURE
04-Dec-04	03:57:59	04-Dec-04	03:59:17	78	14444	14444	PDS_UNKNOWN_FAILURE
04-Dec-04	15:10:19	04-Dec-04	15:11:37	78	14451	14451	PDS_UNKNOWN_FAILURE
04-Dec-04	20:15:20	04-Dec-04	21:29:01	4421	14454	14454	PDS_UNKNOWN_FAILURE
05-Dec-04	05:07:05	05-Dec-04	05:08:22	77	14459	14459	PDS_UNKNOWN_FAILURE
05-Dec-04	16:19:14	05-Dec-04	16:20:32	78	14466	14466	PDS_UNKNOWN_FAILURE
07-Dec-04	04:03:51	07-Dec-04	04:05:09	78	14487	14487	PDS_UNKNOWN_FAILURE
07-Dec-04	11:23:51	07-Dec-04	12:10:30	2799	14491	14492	PDS_UNKNOWN_FAILURE
07-Dec-04	15:16:13	07-Dec-04	15:17:31	78	14494	14494	PDS_UNKNOWN_FAILURE
08-Dec-04	05:12:41	08-Dec-04	05:13:59	78	14502	14502	PDS_UNKNOWN_FAILURE
08-Dec-04	14:56:12	08-Dec-04	14:58:02	110	14508	14508	PDS_UNKNOWN_FAILURE
08-Dec-04	16:25:08	08-Dec-04	16:26:26	78	14509	14509	PDS_UNKNOWN_FAILURE
08-Dec-04	16:31:57	08-Dec-04	16:33:37	100	14509	14509	PDS_UNKNOWN_FAILURE
08-Dec-04	18:09:33	08-Dec-04	18:13:08	215	14510	14510	PDS_UNKNOWN_FAILURE
08-Dec-04	19:49:13	08-Dec-04	19:52:12	179	14511	14511	PDS_UNKNOWN_FAILURE
08-Dec-04	19:52:12	08-Dec-04	19:52:13	1	14511	14511	PDS_UNKNOWN_FAILURE
08-Dec-04	22:42:04	08-Dec-04	22:45:12	188	14512	14512	PDS_UNKNOWN_FAILURE
09-Dec-04	00:23:45	09-Dec-04	00:26:44	179	14513	14513	PDS_UNKNOWN_FAILURE
09-Dec-04	04:41:30	09-Dec-04	04:42:48	78	14516	14516	PDS_UNKNOWN_FAILURE
09-Dec-04	04:58:38	09-Dec-04	05:00:23	105	14516	14516	PDS_UNKNOWN_FAILURE
09-Dec-04	06:38:49	09-Dec-04	06:40:33	104	14517	14517	PDS_UNKNOWN_FAILURE
09-Dec-04	11:06:24	09-Dec-04	11:07:20	56	14520	14520	PDS_UNKNOWN_FAILURE
09-Dec-04	12:45:44	09-Dec-04	12:48:11	147	14521	14521	PDS_UNKNOWN_FAILURE
09-Dec-04	14:25:29	09-Dec-04	14:26:10	41	14522	14522	PDS_UNKNOWN_FAILURE
09-Dec-04	15:53:28	09-Dec-04	15:54:46	78	14523	14523	PDS_UNKNOWN_FAILURE
09-Dec-04	16:01:39	09-Dec-04	16:05:21	222	14523	14523	PDS_UNKNOWN_FAILURE
09-Dec-04	17:38:20	09-Dec-04	17:42:11	231	14524	14524	PDS_UNKNOWN_FAILURE
09-Dec-04	19:19:01	09-Dec-04	19:20:47	106	14525	14525	PDS_UNKNOWN_FAILURE
10-Dec-04	01:32:31	10-Dec-04	01:33:28	57	14528	14528	PDS_UNKNOWN_FAILURE
10-Dec-04	04:09:42	10-Dec-04	04:11:00	78	14530	14530	PDS_UNKNOWN_FAILURE
10-Dec-04	04:27:30	10-Dec-04	04:29:05	95	14530	14530	PDS_UNKNOWN_FAILURE
10-Dec-04	08:55:23	10-Dec-04	08:58:06	163	14533	14533	PDS_UNKNOWN_FAILURE
10-Dec-04	10:33:53	10-Dec-04	10:34:24	31	14534	14534	PDS_UNKNOWN_FAILURE
10-Dec-04	10:34:24	10-Dec-04	12:16:52	6148	14534	14535	PDS_UNKNOWN_FAILURE
10-Dec-04	13:54:03	10-Dec-04	13:55:07	64	14536	14536	PDS_UNKNOWN_FAILURE
10-Dec-04	15:22:07	10-Dec-04	15:23:25	78	14537	14537	PDS_UNKNOWN_FAILURE

10-Dec-04	15:32:03	10-Dec-04	15:34:46	163	14537	14537	PDS_UNKNOWN_FAILURE
11-Dec-04	05:18:17	11-Dec-04	05:19:35	78	14545	14545	PDS_UNKNOWN_FAILURE
11-Dec-04	16:31:02	11-Dec-04	16:32:20	78	14552	14552	PDS_UNKNOWN_FAILURE
12-Dec-04	04:47:14	12-Dec-04	04:48:32	78	14559	14559	PDS_UNKNOWN_FAILURE
12-Dec-04	15:59:03	12-Dec-04	16:00:20	77	14566	14566	PDS_UNKNOWN_FAILURE
12-Dec-04	16:00:20	12-Dec-04	16:00:21	1	14566	14566	PDS_UNKNOWN_FAILURE

Table 9: List of gaps for RA-2 L1b products during cycle 32

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 seemed to drop 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).

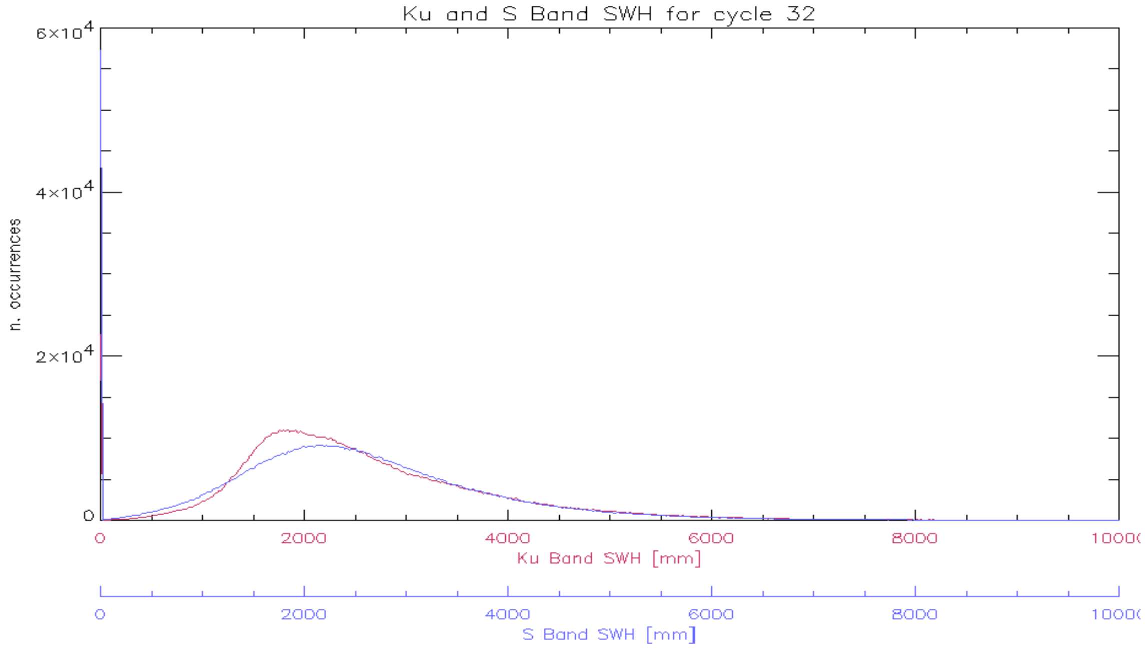

Figure 13: Histogram of Ku and S Band SWH for cycle 32 (mm)

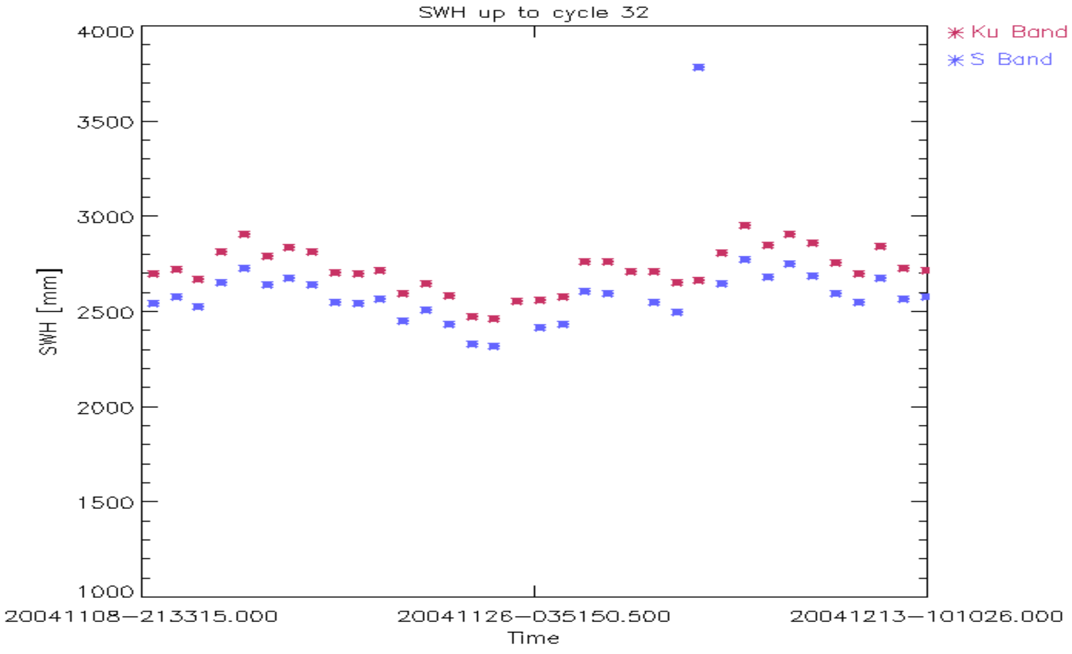

Figure 14: Ku and S SWH daily average for cycle 32 (mm)

8.2.3 BACKSCATTER COEFFICIENT – WIND SPEED

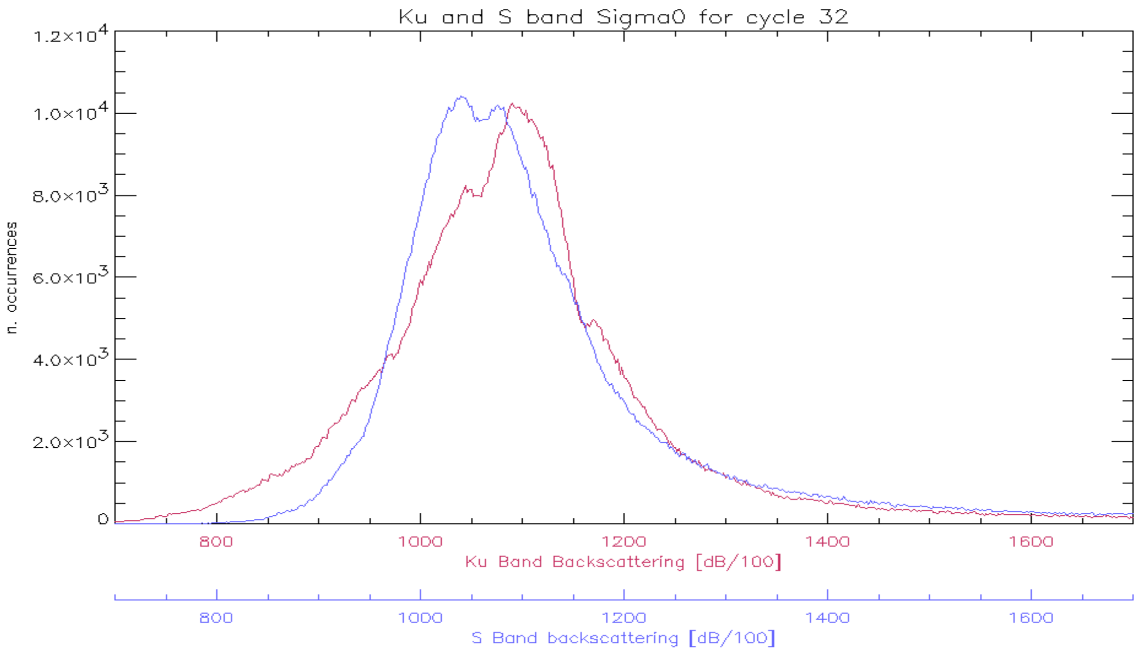

Figure 15: Histogram of Ku and S Band Backscattering Coefficient for cycle 32 (dB/100)

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.

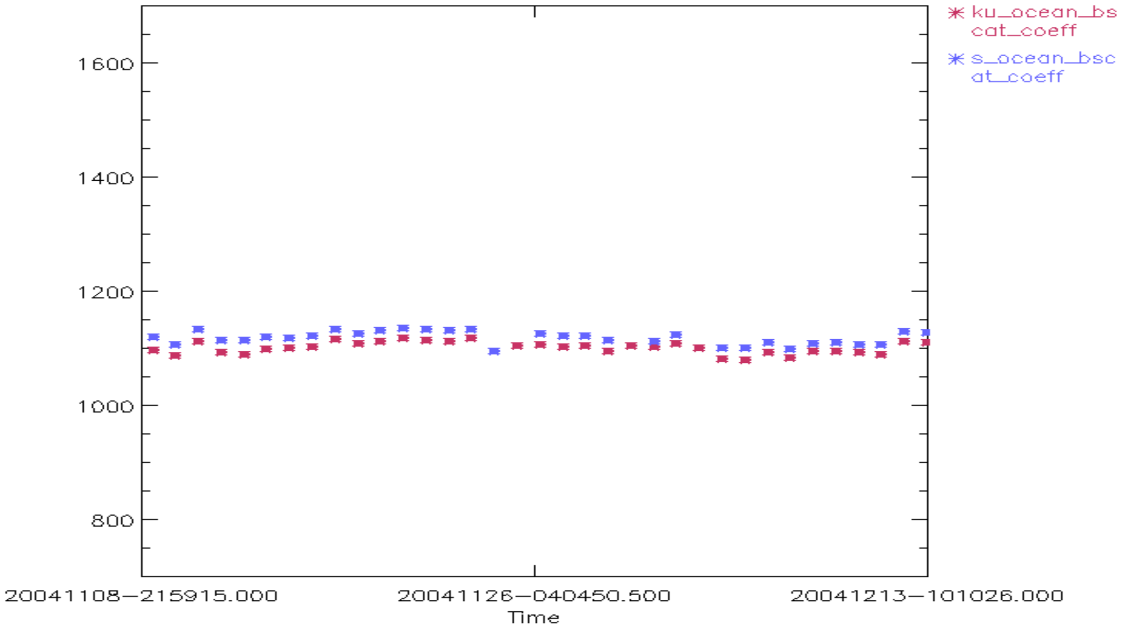

Figure 16: Ku and S Sigma_0 daily average for cycle 32 (dB/100)

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 are due to the so-called S-Band anomaly (ref. par. 7.1.7).

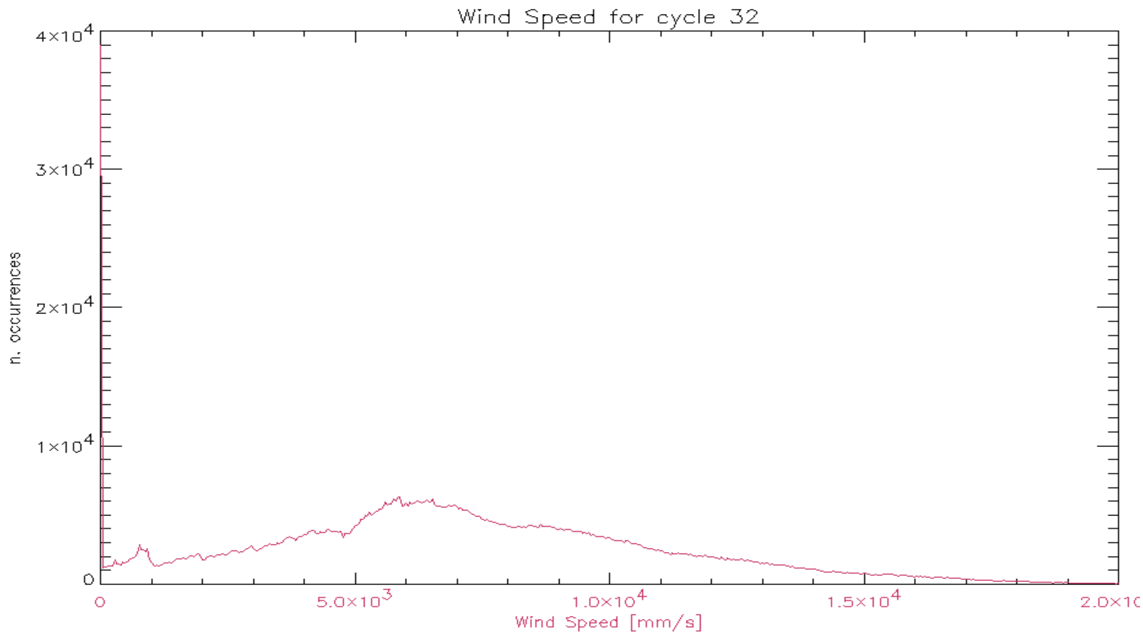

Figure 17: Histogram of Ku Wind Speed for cycle 32 (mm/s)

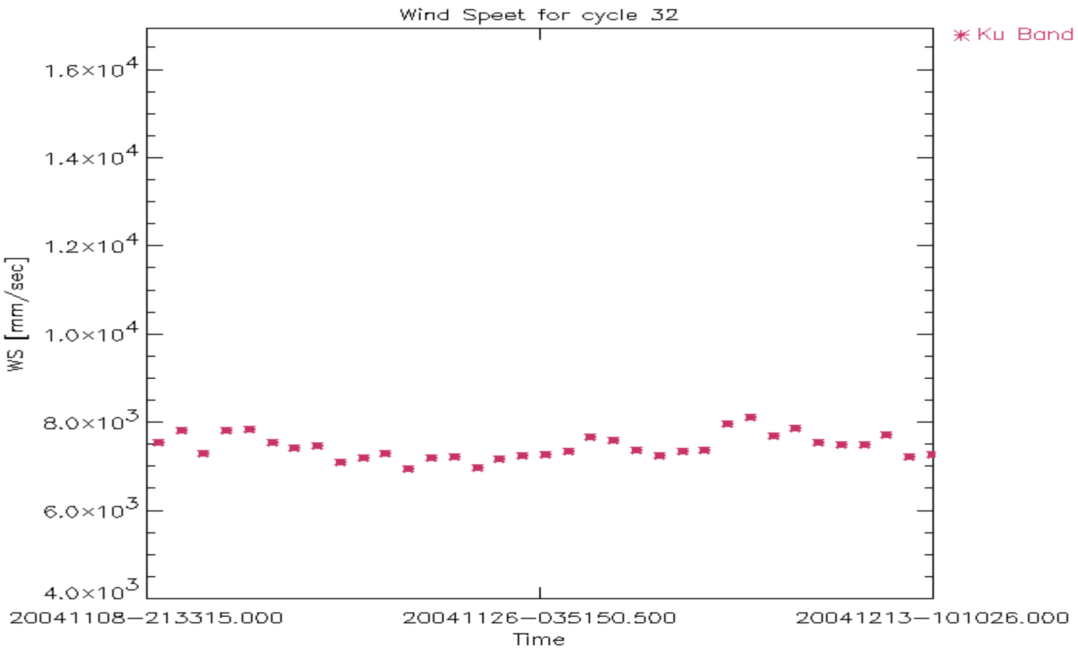

Figure 18: Ku Band Wind Speed daily average for cycle 32 (mm/s)

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 –2.91 mm per year. Eventually it could also be corrected for the cyclic average given bias (26.33 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 32 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 1B ground processing.

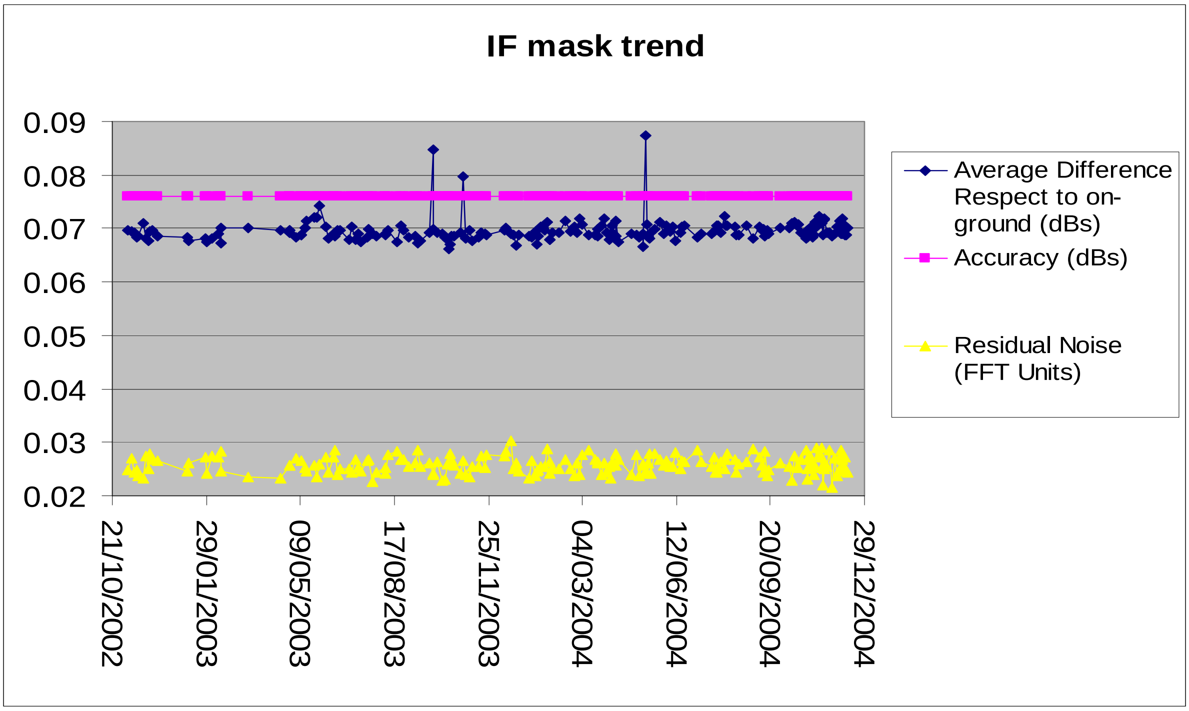

Figure 19: Evolution of the IF mask related parameters for valid IF masks retrieved up to cycle 32

9.1.2 USO

In Figure 20 the USO clock period trend retrieved until the end of cycle 32 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 31.69 mm and –4.72 mm/year as calculated with data covering the period 13 June 2003 to 13 December 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.

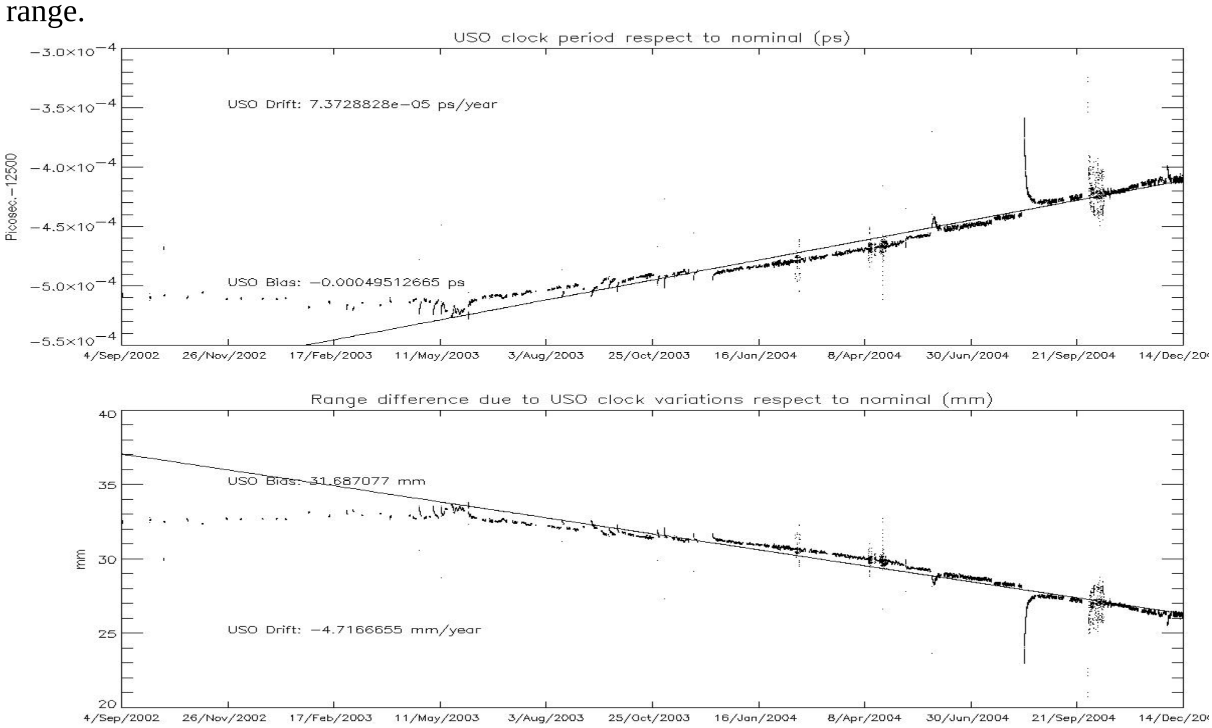

Figure 20: USO clock period until end of cycle 32

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.

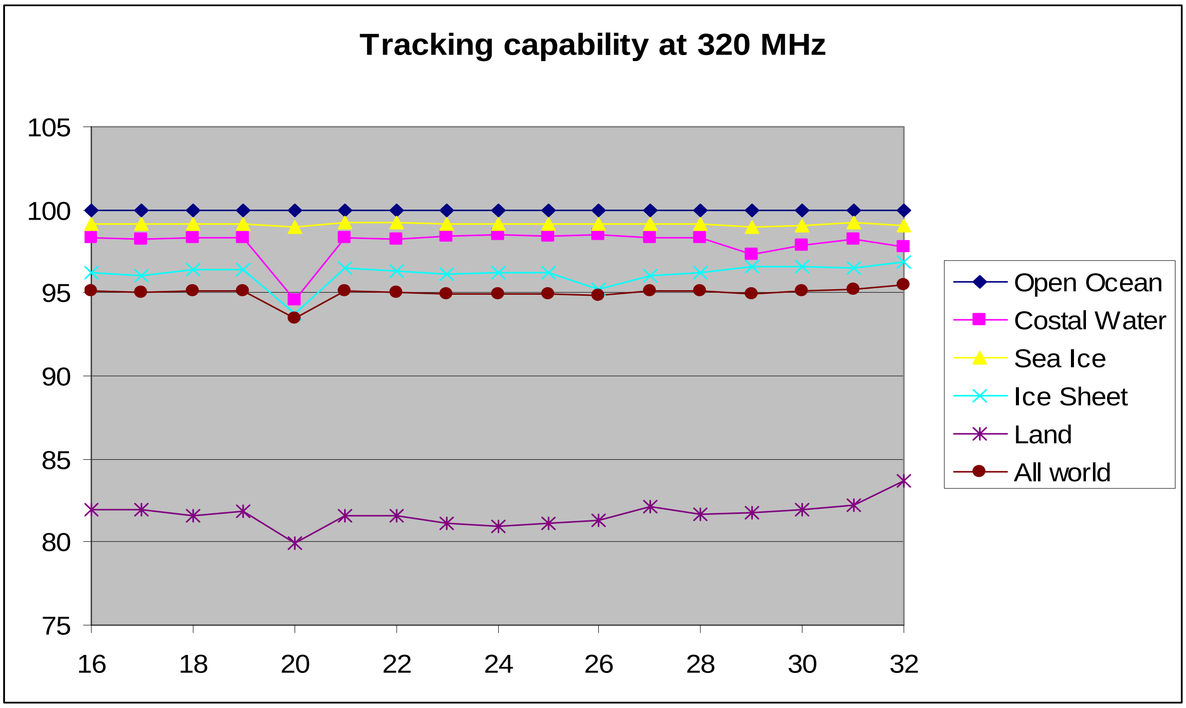

Figure 21: RA-2 Tracking percentage at 320MHz for different surfaces

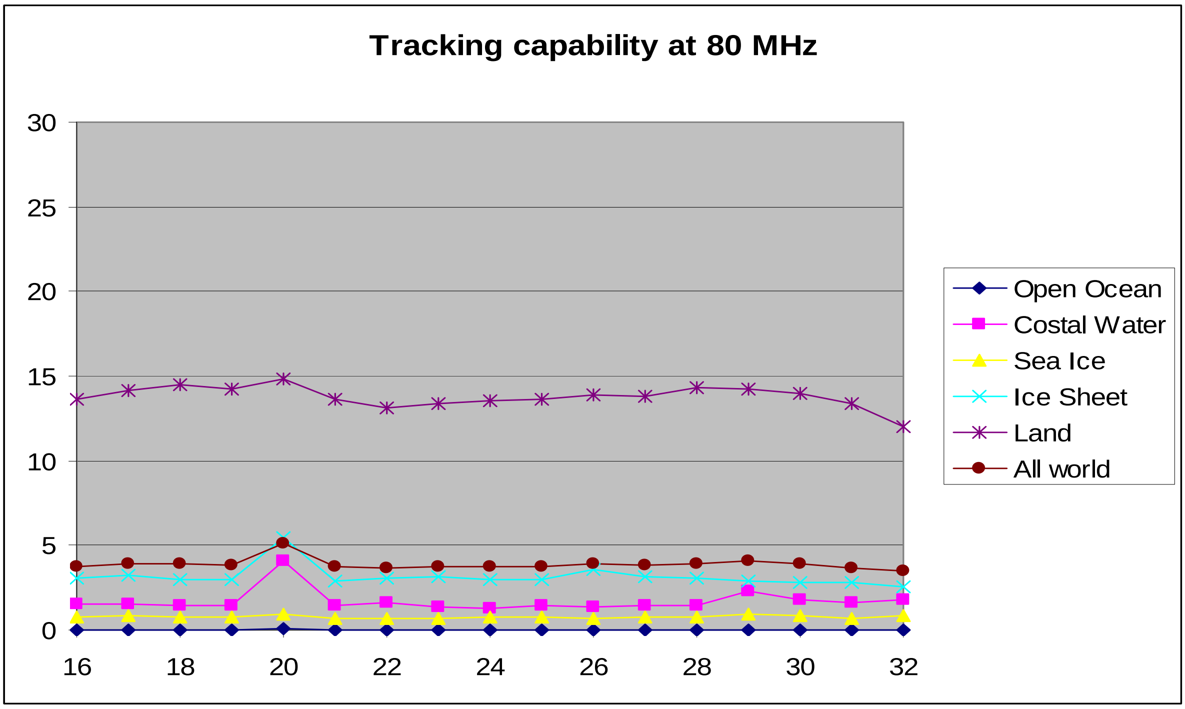

Figure 22: RA-2 Tracking percentage at 80MHz for different surfaces

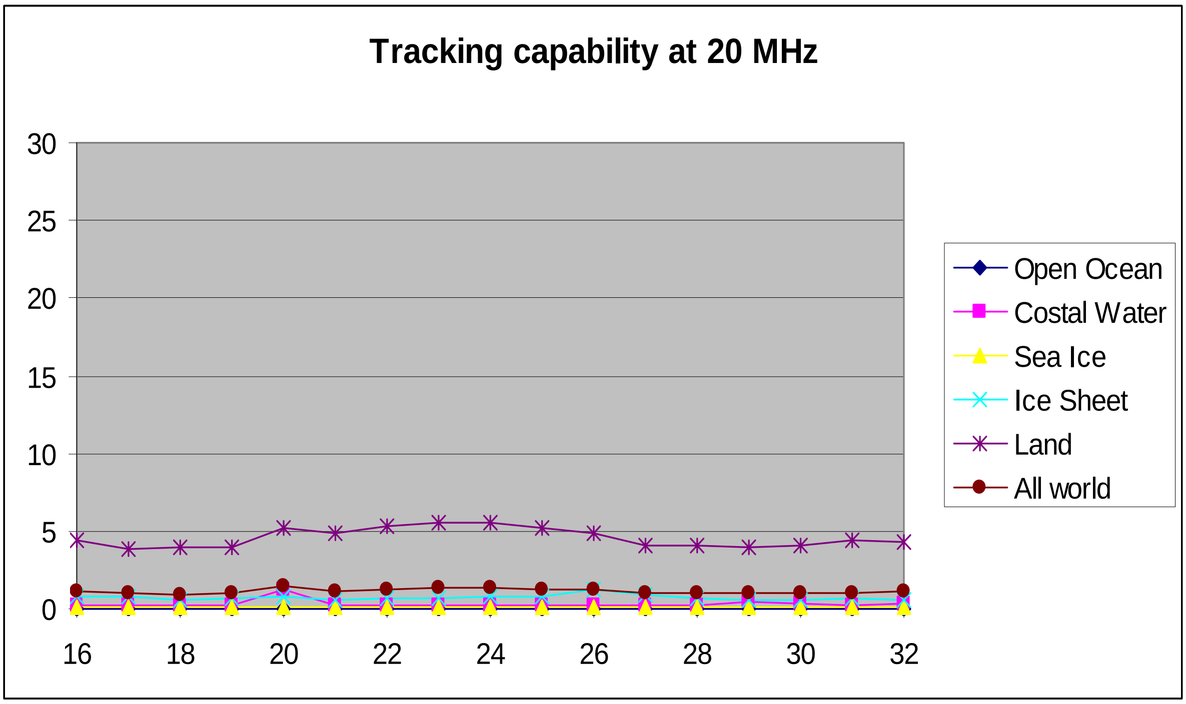

Figure 23: RA-2 Tracking percentage at 20MHz for different surfaces

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. Furthermore during the last ten days of the current cycle, the variability of the deviations has increased reporting many peaks just under the 20 microseconds threshold; this phenomenon will also be part of the 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.

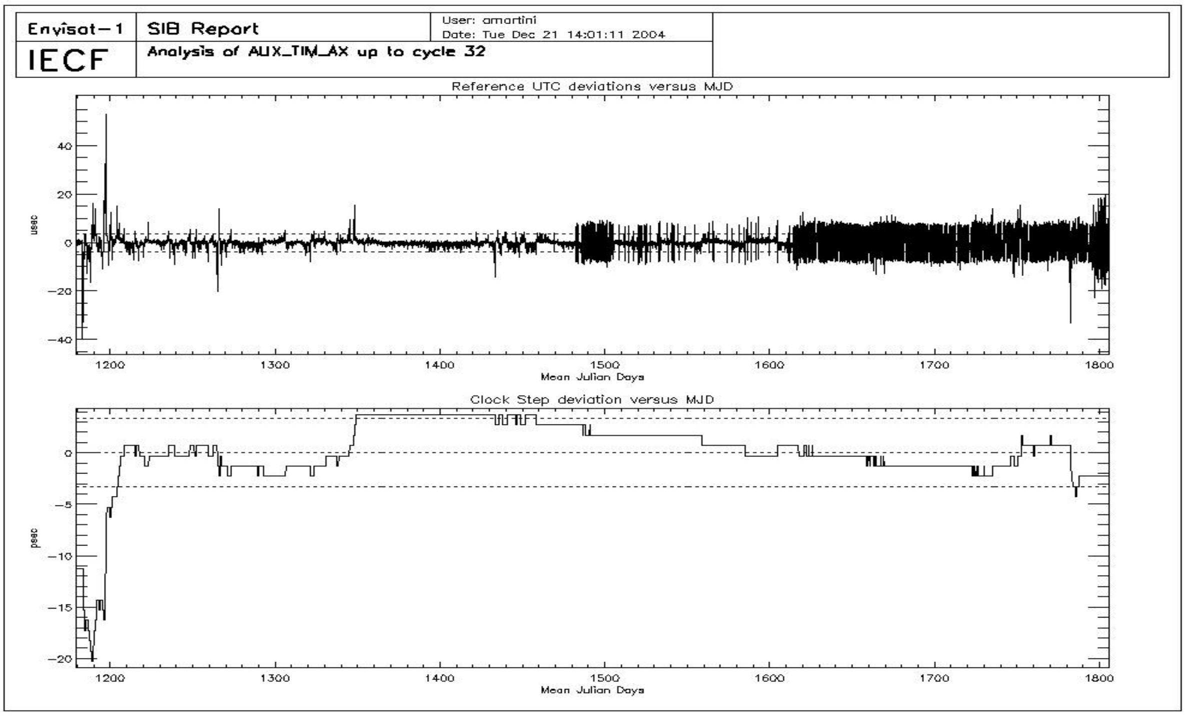

Figure 24: UTC deviations and ICU clock period up to cycle 32

9.1.5 MISPOINTING

In Figure 25 the overall mispointing squared trend (averaged over each orbit) is plotted for cycles 16 to 32. 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. After the drop a very tiny increase of the mispointing squared could eventually be detectable. The most probable cause of this phenomenon could be a change in the Intermediate Frequency Filter slope due to ageing effects.

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.

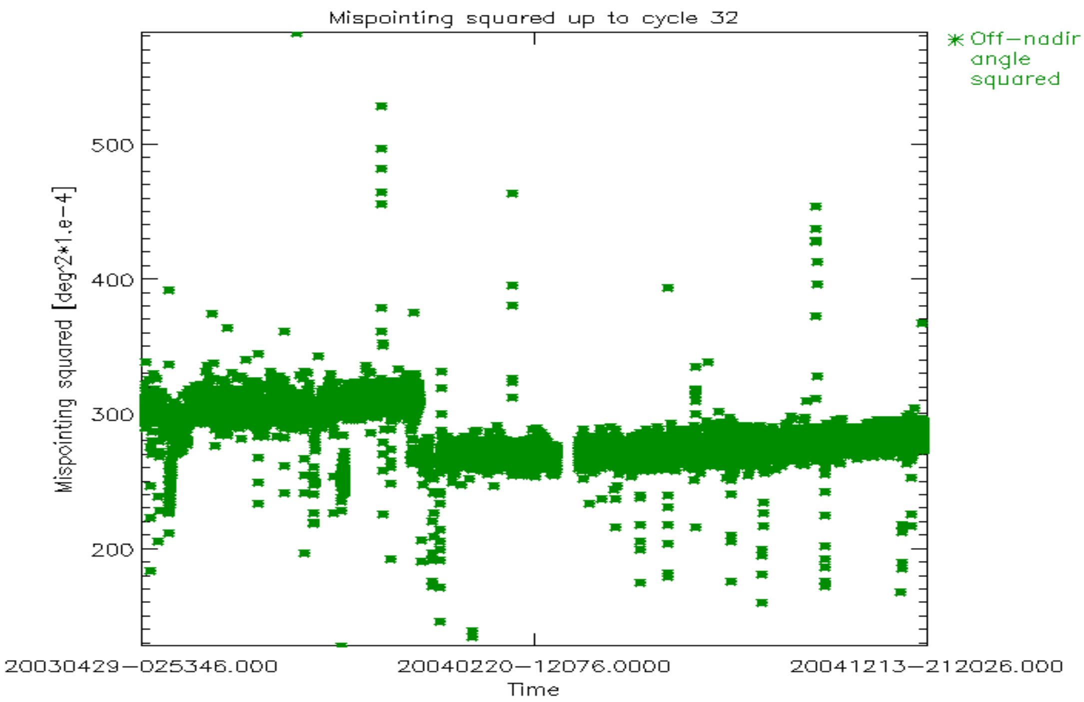

Figure 25: Smoothed mispointing squared trend until end of cycle 32 (deg^2*10e-4)

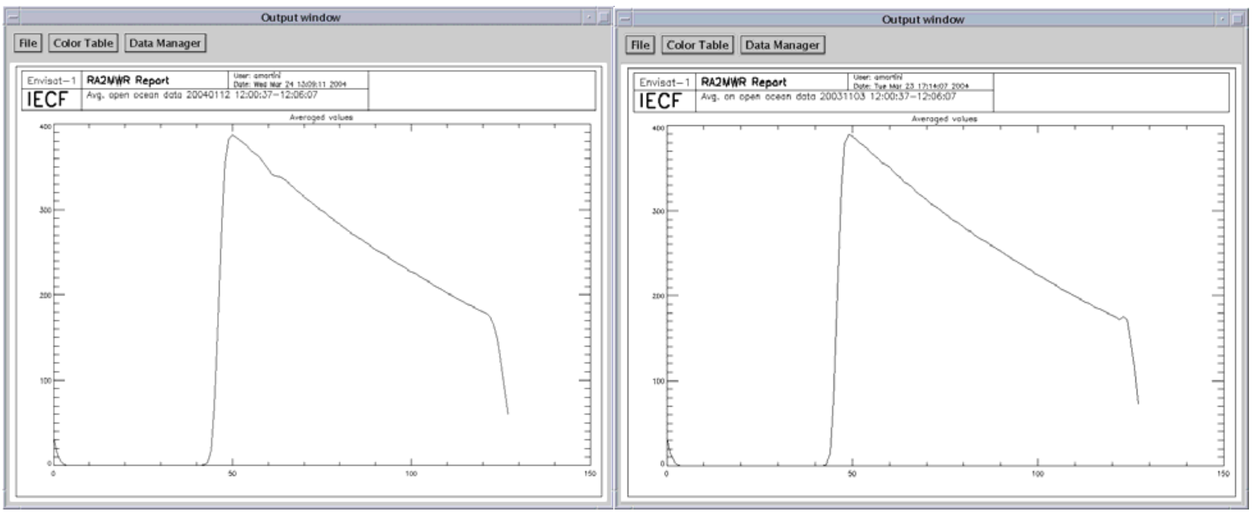

Figure 26: Open Ocean average waveforms before (left) and after an anomaly (right)

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.

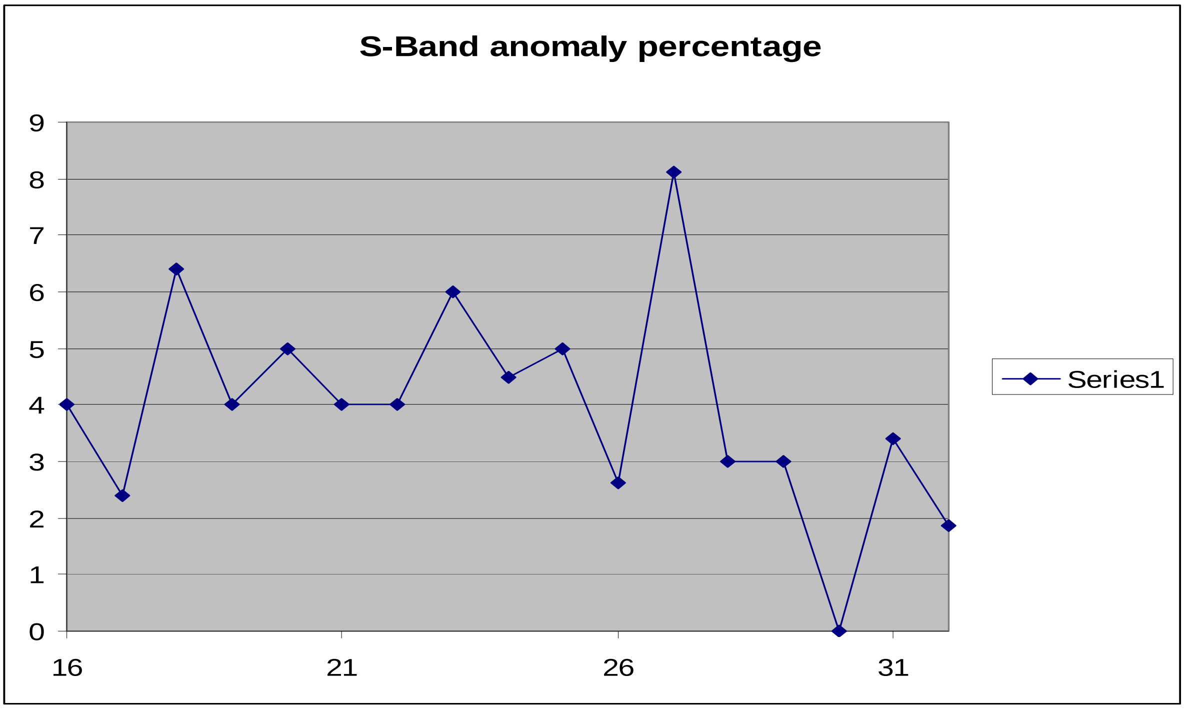

Figure 27: Percentage of data affected by the "S-Band Anomaly" for cycles 16-32

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, having demonstrated that the transmitted power did not decrease during the same time span. 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 32

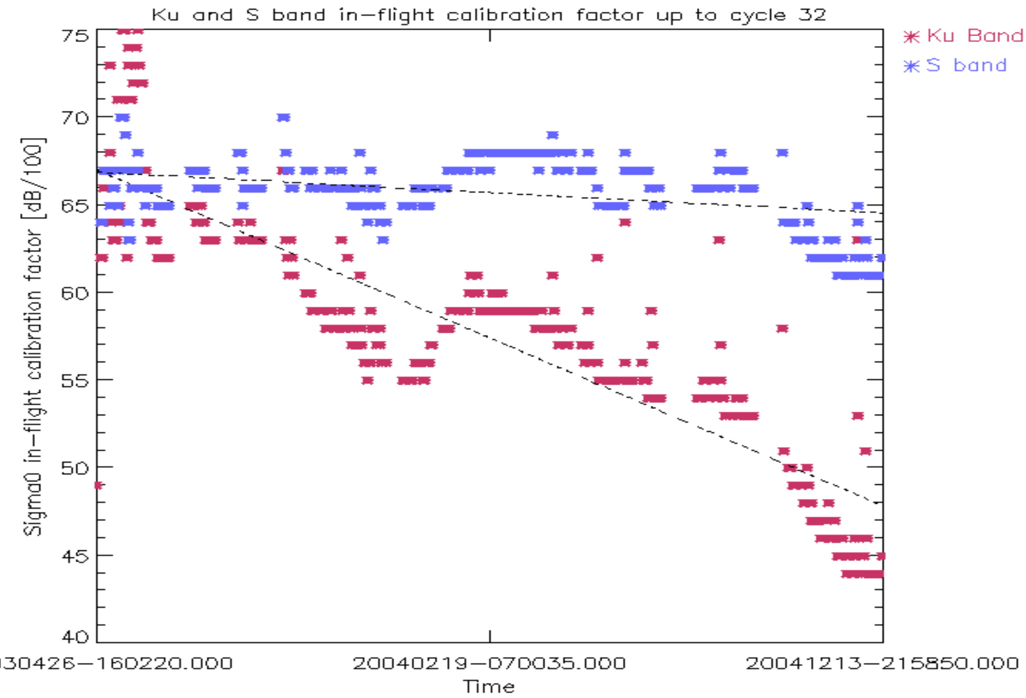

Figure 29: Ku and S Band in-flight Sigma0 calibration factor up to cycle 32

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 32. 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.

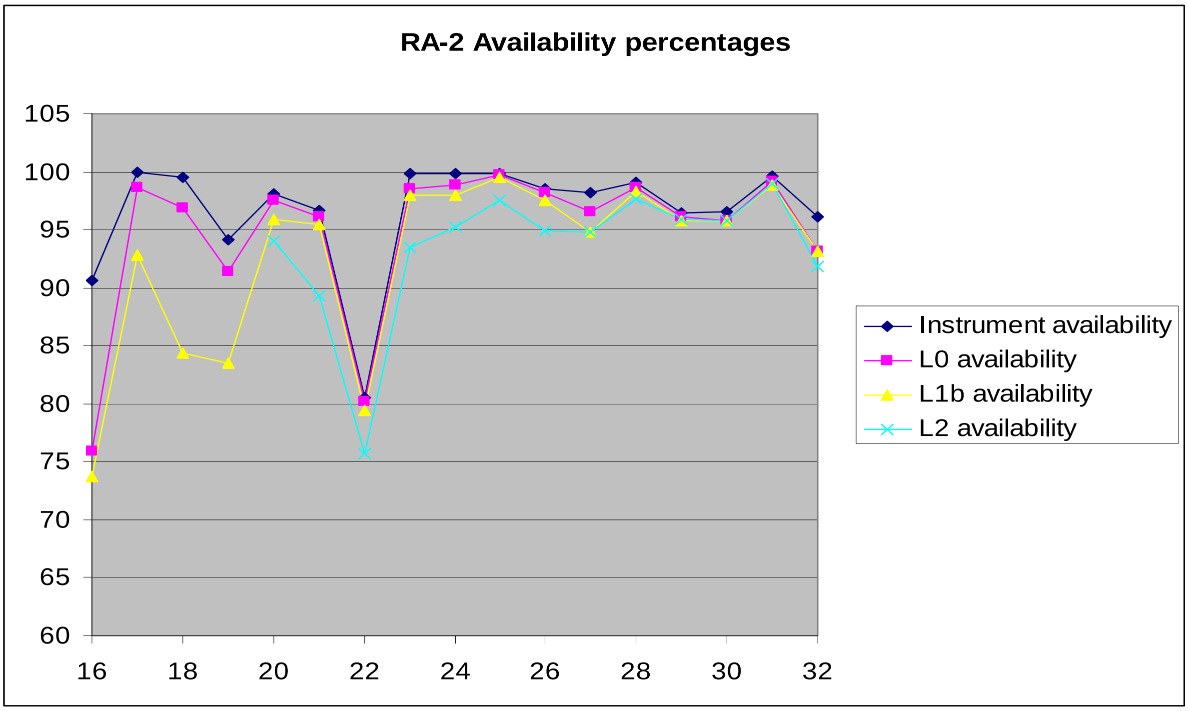

Figure 30: Percentage of Products unavailability up to cycle 32

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.

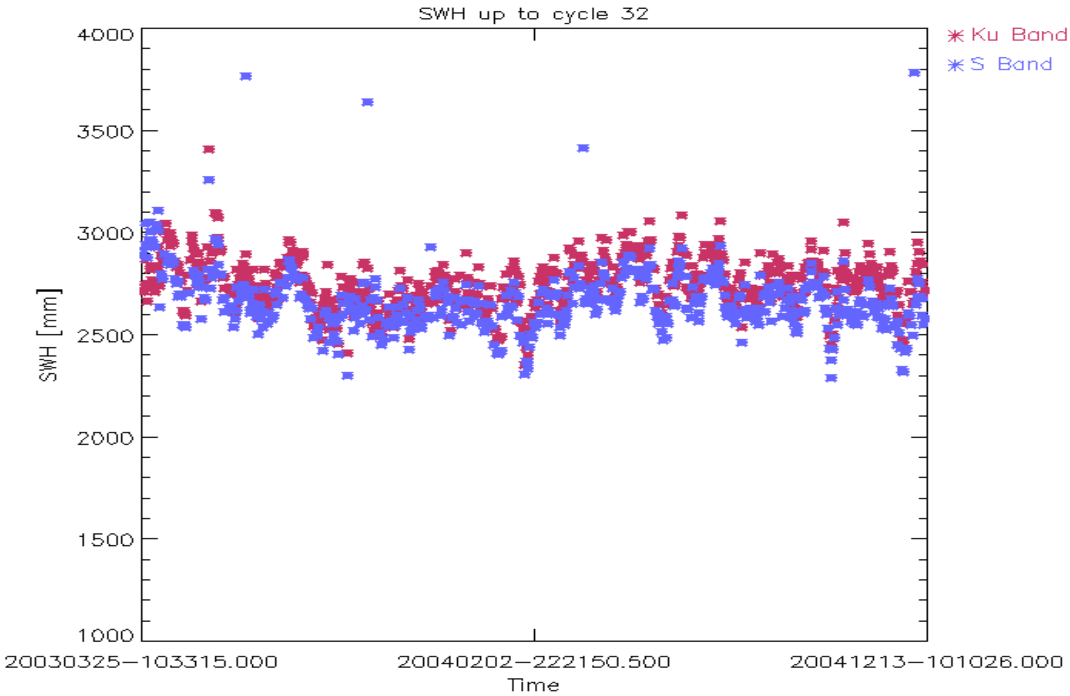

Figure 31: Ku and S SWH daily average up to cycle 32 (mm)

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.

When looking carefully a tiny increasing trend can be noticed that causes a change in the Ku-Band backscattering coefficient of about 0.2 dBs over the whole reported period. This could be due to the Ku-Band Sigma0 in-flight calibration factor behaviour which shows a decrease of 0.2 dBs over the same time frame. However, despite the jump, the same increasing trend can eventually be detected for the S-band backscattering coefficient while the S-Band Sigma0 in-flight calibration does not show a decreasing trend as the Ku-band one.

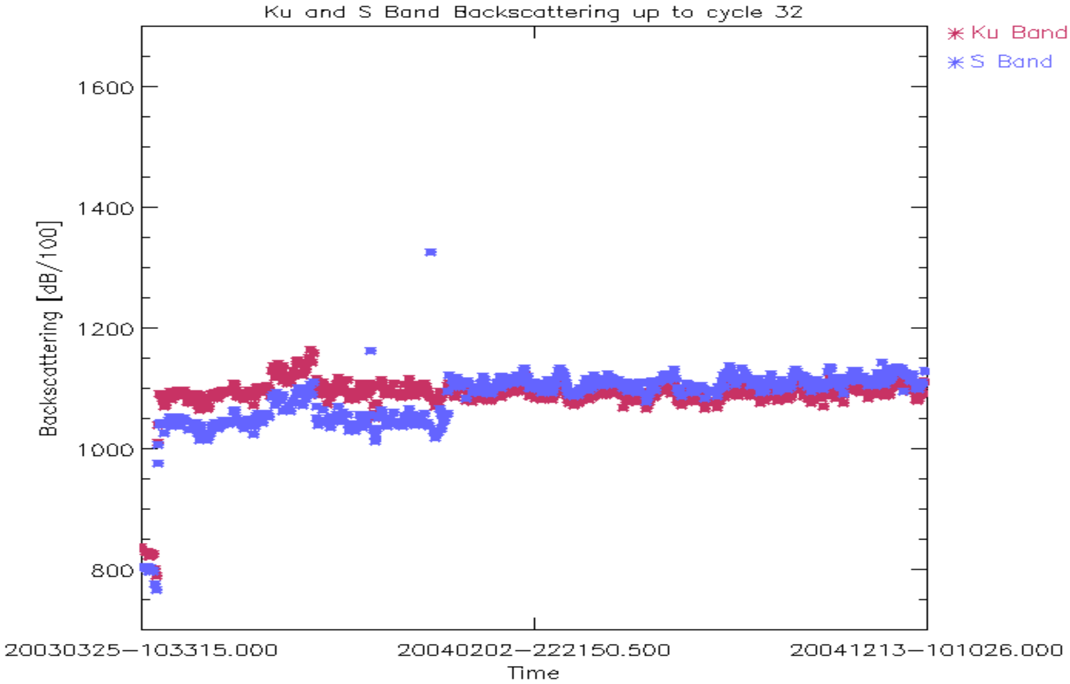

Figure 32: Ku and S band Backscattering daily averages up to cycle 32 (dB/100)

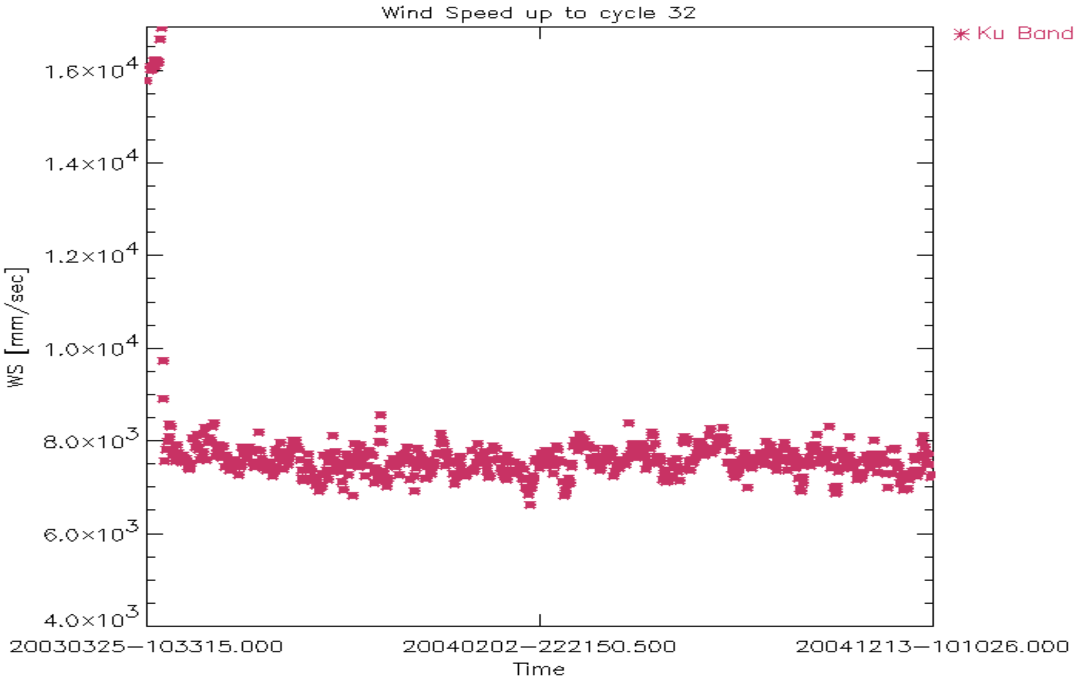

Figure 33: Wind Speed daily averages up to cycle 32 (mm/s)

10 PARTICULAR INVESTIGATIONS

During cycle 32 no special investigation has been performed.