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ENVISAT CYCLIC ALTIMETRIC REPORT

CYCLE 23

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 (RA2_FGD_2P) as well as on the main events occurred during cycle 23.

This reports covers the period from the 29th of December 2003 to the 2nd of February 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
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
SEU	Single Event
SFCM	Stellar Fine Control Mode
SPH	Specific Product header
SPSA	Signal Processing Sub-Assembly
S/W	Software
TM	Telemetry
TRP	Transponder
TWT	Traveling Wave Tube

4 REFERENCE DOCUMENTS

[R – 1] F-PAC MONTHLY REPORT, SALP-RP-M-OP-15183-CN, January 2004
[R – 2] ENVISAT Microwave Radiometer Assessment Report Cycle 023, CLS.DOS/04.038,http://earth.esa.int/pcs/envisat
[R – 3] Envisat RA-2 IF Mask weird behavior: Investigation Report
[R – 4] Instrument Performance Evaluation and Analysis Summary, PO-TR-ALS-RA-0042
[R – 5] Instrument Corrections Applied on RA-2 Level 1b products, Paper presented at the ENVISAT Calibration Review in September 2002
[R – 6] ENVISAT Phase E Cal/Val Acquisition Plan, ENVI-SPPA-EOPG-TN-03-0008
[R – 7] RA-2 S-Band Anomaly Investigation, PO-TN-ESA-RA-1331
[R – 8] RA-2 Performance Results, Paper presented at the ENVISAT Calibration Review in September 2002
[R – 9] ECMWF Report on ENVISAT RA- 2 for January 2003, Report on ENVISAT Radar Altimeter - 2 (RA- 2), Wind/ Wave Product with Height Information (RA2_ WWV_ 2P), http://earth.esa.int/pcs/envisat
[R – 10] Envisat GDR Quality Assessment Report, SALP-RP-P2-EX-21121-CLS015
[R – 11] Envisat RA-2 Range Instrumental correction: USO clock period variations and associated auxiliary file, ENVI-GSEG-EOPG-TN-03-0009
[R – 12] Defining a Rain flag for the Envisat altimeter, G. Quartly, study presented to the final CCVT plenary meeting, http://earth.esa.int/pcs/envisat/ra2/articles/
[R – 13] ENVISAT Weekly Mission Operations Reports # 82-86, 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/

5 GENERAL QUALITY ASSESSMENT

5.1 Instruments status

The RA-2 instrument has been victim of three instrument anomalies during this cycle, 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.
9574	9674.2	1012.027	545.538	559.403	98533.35	99.83267	99.74247	99.74017	83.54075
9674.2	9774.4	1077.687	726.955	723.537	19740.38	99.82181	99.70161	99.70218	96.55785
9774.4	9874.6	1070.929	9582.739	21824.62	40834.87	99.82293	98.23847	96.21435	93.07111
9874.6	9974.8	1047.384	26470.77	33227.54	23152.7	99.82682	95.45005	94.33286	95.99867
9974.8	10075	1089.384	553.766	559.152	9070.616	99.81988	99.72832	99.72742	98.32011

Table 1: RA-2 L0, L1b and L2 FGD Data products availability summary for cycle 23

During the first week of the cycle the availability of L2 products has been very low because on the 1st of January 2004 no L2 FGD data have been produced.

5.3 Orbit quality

On the 22nd January 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	2004/01/22-00:54:00	0.0237 m/sec	0.0236 m/sec	SFCM

On the 26th January 2004, a 1-burn SFCM orbit drift stop manoeuvre was executed after ASAR image acquisition over the Bam area (IRAN) to maintain the ground track within the reference

orbit. This orbit correction was the second of its kind since the beginning of the mission. The following table summarises the SFCM observed performance:

	Burn Start Time	Nominal Delta-V	Calibrated Delta-V	Mode
First burn	2004/01/26-23:25:38	-0.0086 m/sec	-0.0081 m/sec	SFCM

5.4 Ground Segment Processing Chain Status

5.4.1 IPF PROCESSING CHAIN

The current IPF version is V4.56 , operational at the Envisat PDHS-K and PDHS-E since November the 26th 2003, orbit 9094.

5.4.2 F-PAC PROCESSING CHAIN

Actual F-PAC CMA version is V6.2.1 installed on December the 3rd 2003. For what regards the Envisat products this version is equivalent to V6.1 installed on August the 4th 2003.

Jan. 20, 2004: Patch 3: to correct for an anomaly in Jason-1 JMR processing. No impacts on Envisat products

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
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 23, 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.

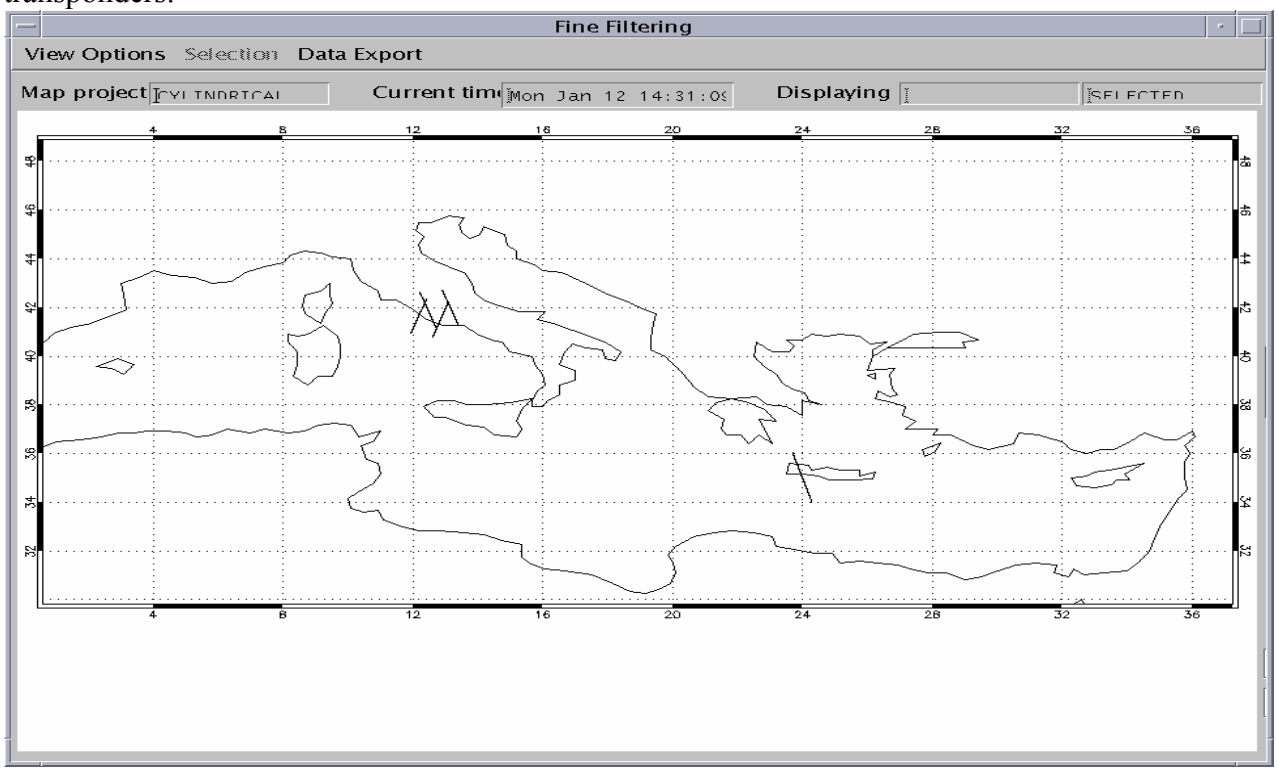
The cause of the problem is still unknown. The heater fuses as well as the hardware used to report on the status of the fuses are presently under examination.

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 per day over Himalayan region.
- 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.



6.2 MWR Events

The MWR, during cycle 23 was never unavailable.

6.3 DORIS Events

The DORIS during cycle 23 was never unavailable.

7 INSTRUMENT PERFORMANCES

7.1 RA-2 Calibration performances

7.1.1 IF FILTER SHAPE

In Figure 1 all valid IF masks retrieved by averaging the 100 seconds of data acquired daily during cycle 23 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 23 the number of valid IF masks has been of 11, representing the 31% 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).

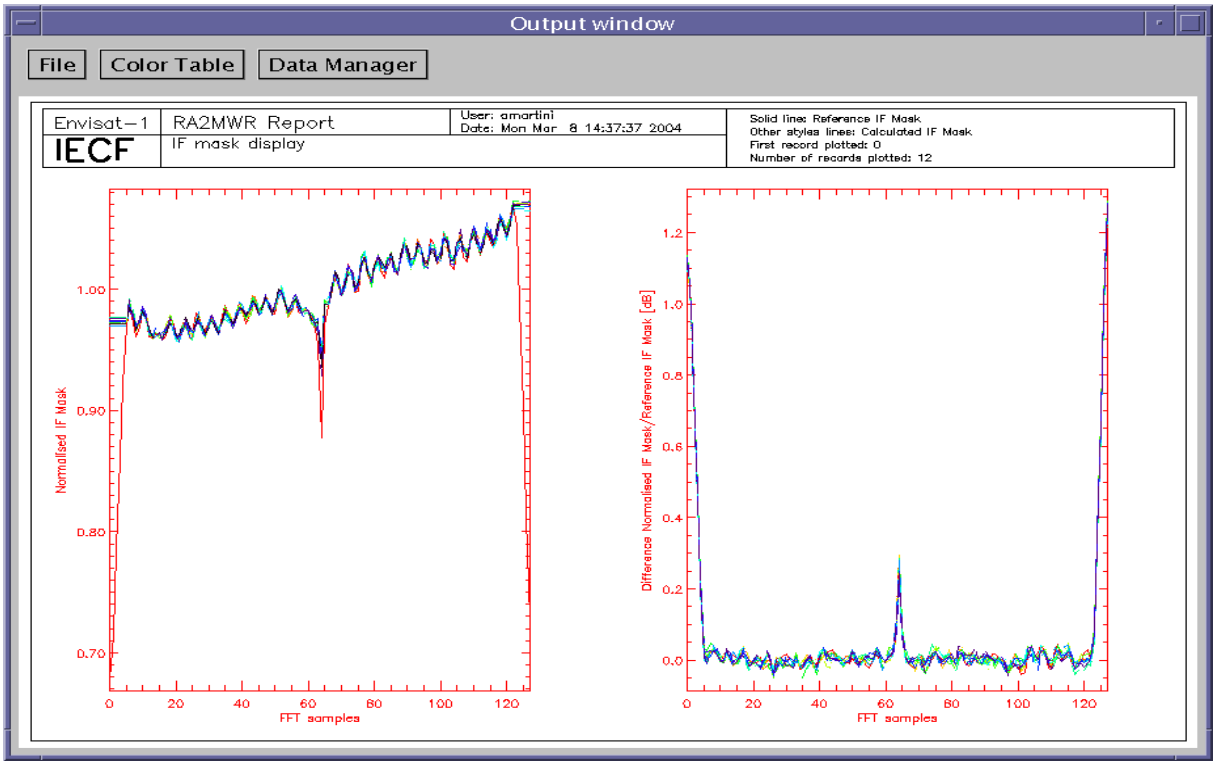


Figure 1: Valid IF masks retrieved daily during cycle 23 plotted together with the on-ground reference.

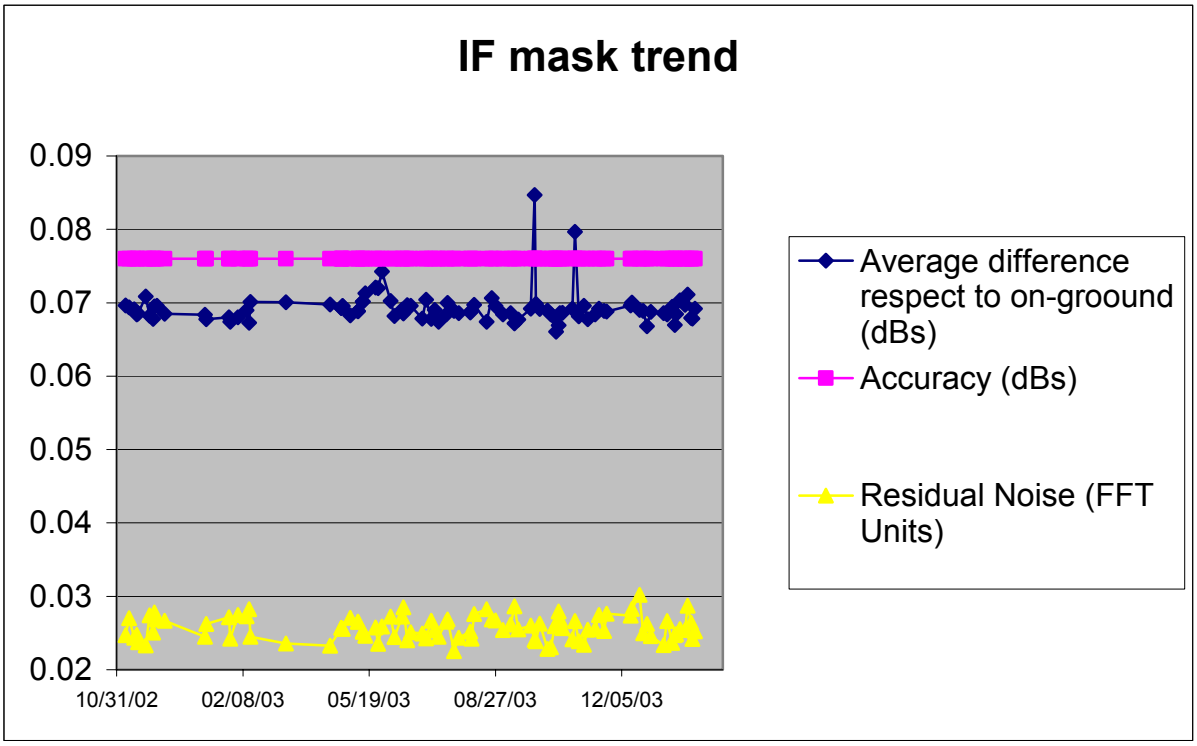


Figure 2: Evolution of the IF mask related parameters for valid IF masks retrieved until cycle 23.

In Figure 2 the evolution of the IF mask quality parameters evaluated as in [R – 4] is reported only for valid data. It can be observed that the difference with respect to the on-ground reference stays quite constant around 0.07 dBs. Two peaks are visible on the plot that correspond to the data acquired on September the 27th at 15:48 and on October the 29th at 15:42. The reason of this could be found in the instrument warming up considering that the IFCal acquisition has been made, in the two 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.

During cycle 23 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.

7.1.2 USO

In Figure 3 the USO clock period trend retrieved until end of cycle 23 is reported. In order to make the variability visible, the difference of the actual USO clock period with respect to the nominal one has been plotted, in the upper panel. In the lower panel the Range error due to the USO clock variability has been reported taking a satellite altitude of 800 Km as a nominal value.

Currently the nominal USO clock period (12500 ps) is used within the processing, this means that the data are not corrected for the bias and the drift correlated to the actual USO clock period. Those values, translated into altimetric range figures, are respectively of 32.54 mm and –2.1 mm/year as calculated with data covering the period 4 September 2002 to 2 February 2004. The given bias and drift have to subtracted from the original altimetric range.

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

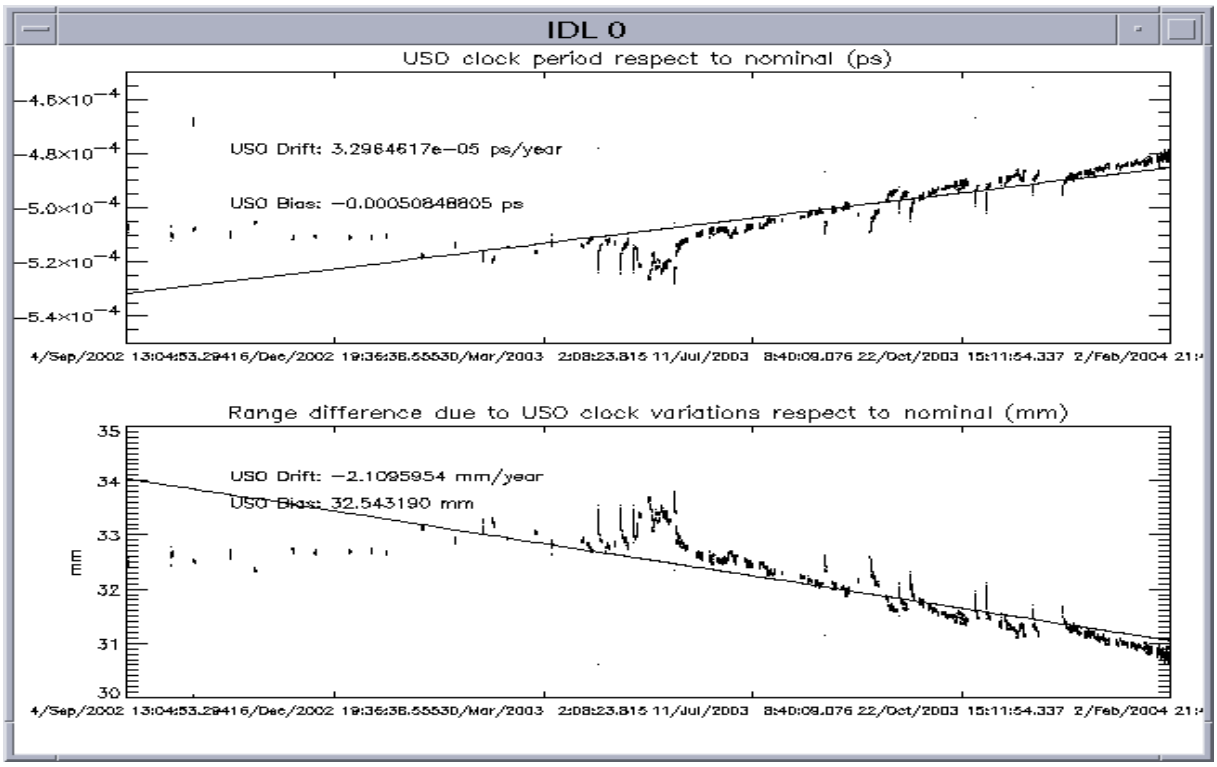


Figure 3: USO clock period trend until end of cycle 23

7.1.3 TRACKING CAPABILITY

In Figure 4 and Figure 5, the Chirp ID is plotted respectively for ascending and descending passes of cycle 23. 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).

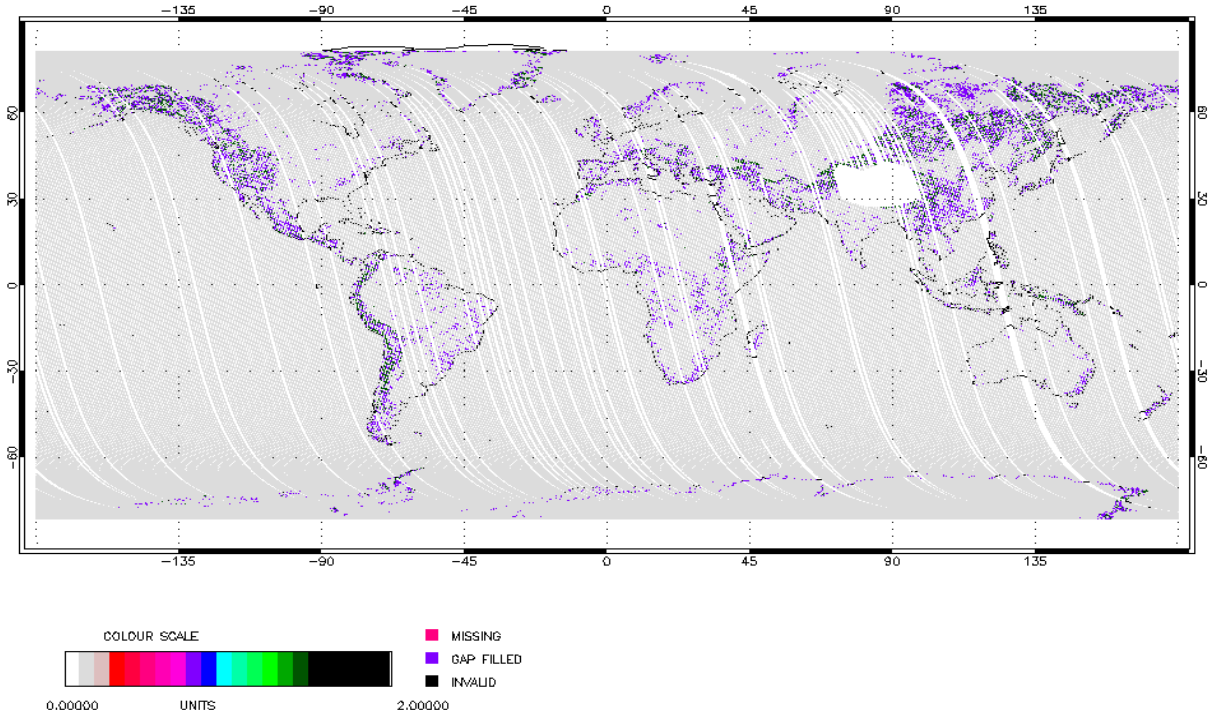


Figure 4: RA-2 Chirp ID for ascending passes during cycle 23

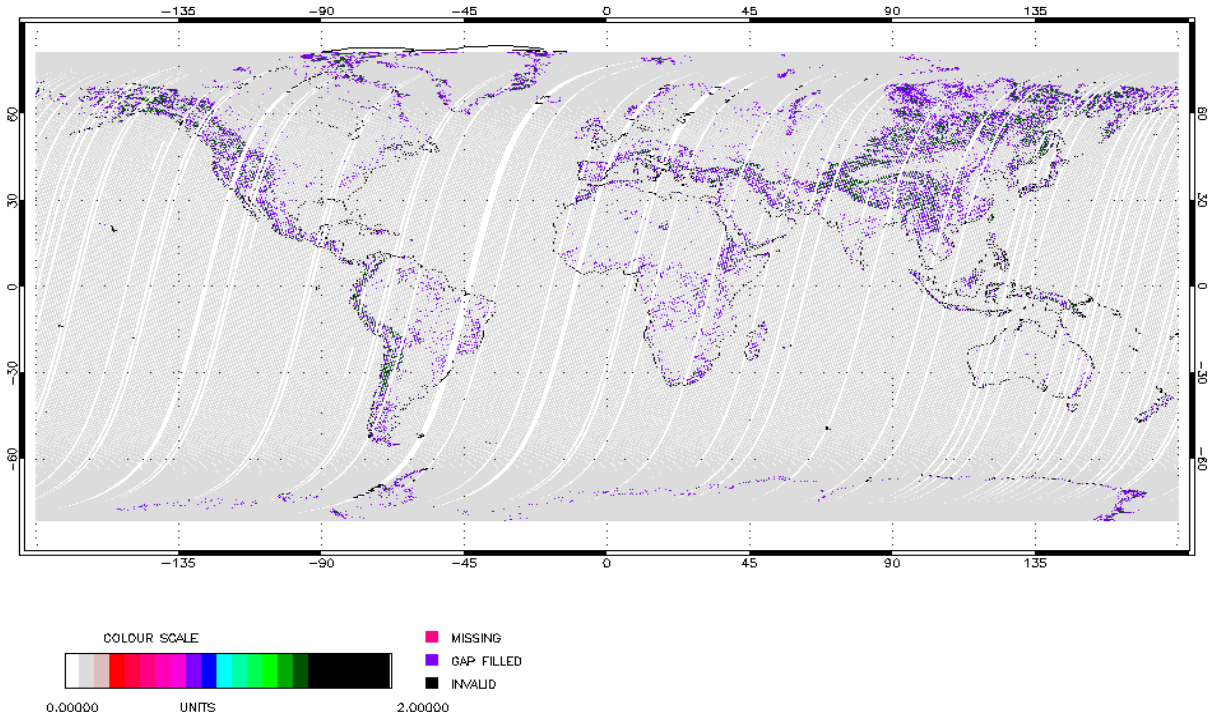


Figure 5: RA-2 Chirp ID for descending passes during cycle 23

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

Surface type	320 MHz	80 MHz	20MHz
Open Ocean	99.991%	0.008%	0.001%
Costal Water (ocean depth < 200 m)	98.41%	1.39%	0.20%
Sea Ice	99.17%	0.72%	0.11%
Ice Sheet	96.15%	3.15%	0.70%
Land	81.13%	13.34%	5.53%
All world	94.97%	3.72%	1.31%

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

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

Those figures completely satisfy the objectives of the Commissioning Phase "RSL and Tracking optimization" hereafter reported:

320MHz over Ocean > 99%
320 MHz within 15km of Land/Ocean boundary (Costal Water)
320 MHz over Sea Ice > 95%
320/80 MHz Fixed resolution at Ice Sheet Crossovers > 95%
320MHz over Ice Shelves > 95%

7.1.4 SIGMA0 TRANSPONDER

No data relative to the Sigma_0 Transponder calibration is available for cycle 23. The temporary sites have been identified and the acquisition of data in Preset Loop Output Mode has been planned and then regularly performed on the following date/UTC times:

01-JAN-2004 20:36:52
13-JAN-2004 09:41:52
20-JAN-2004 20:39:13
29-JAN-2004 09:39:00

However, due to a PDS problem, the corresponding level 1B data product are only available for the acquisitions on 01 and 29 January.

7.1.5 MISPOINTING

In Figure 6 the trend and the histogram of the mispointing squared (smoothed over 120 s) is reported in deg^2*10e-4
The average mispointing valueas extracted from the RA2_FGD_2P data products, around0.025 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-2004 (ref. 5.4.4).

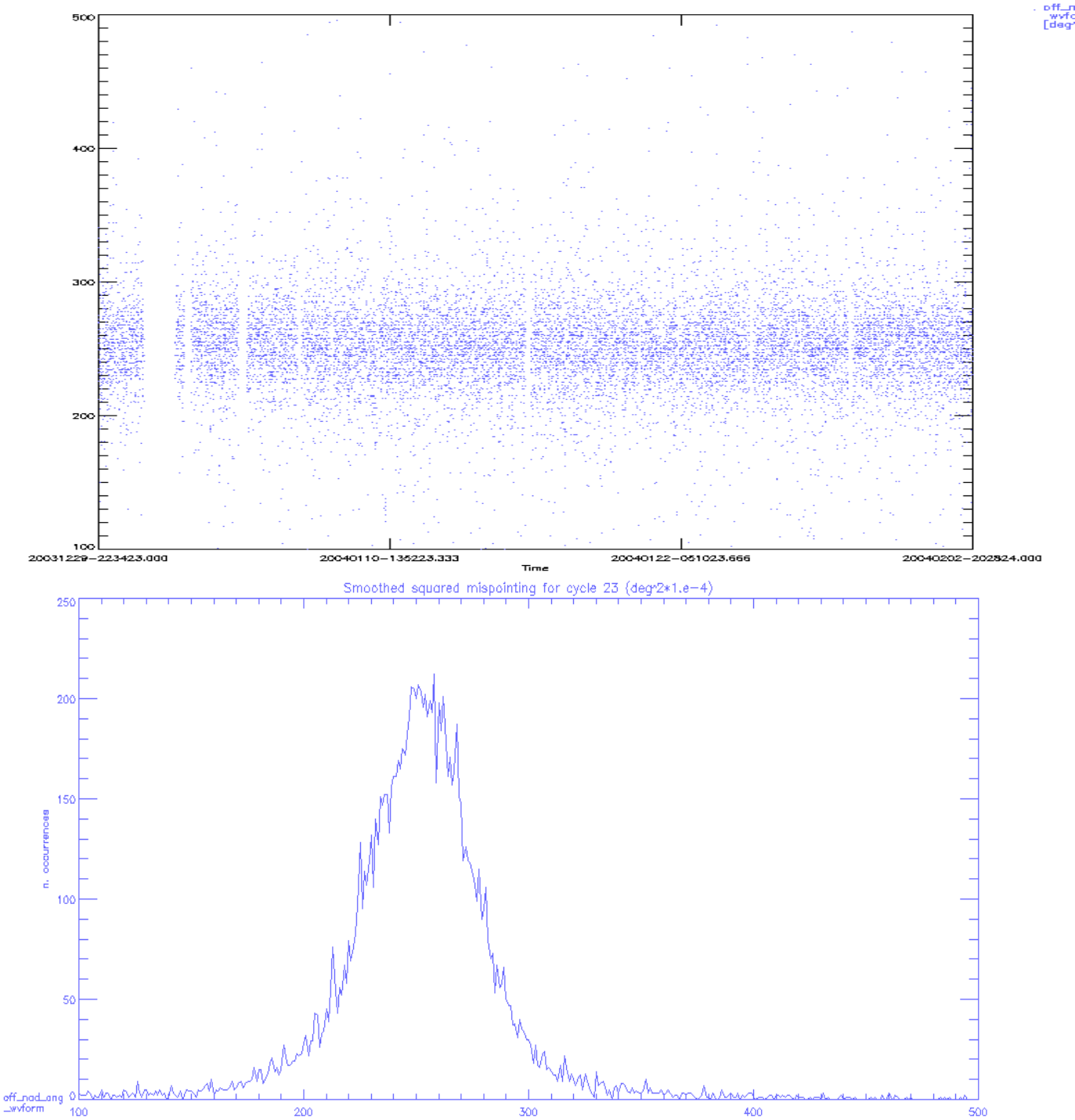


Figure 6: Smoothed mispointing squared trend and histogram for cycle 23 (deg^2*10^4)

It has been noticed over the last cycles, that the mispointing squared assumed lower values just after an instrument anomaly; showing an increasing trend until it reaches back a standard mispointing value.
Work is ongoing in order to understand the reason of this particular instrumental behavior.

7.1.6 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 23. This corresponds to a total percentage of about 6% 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.

File name	Start date	Start time	Stop date	Stop time
RA2_FGD_2PNPDK20040103_130523_000059412023_00067_09640_0675.N1	03-Jan-04	13:05:23.666619	03-Jan-04	14:44:24.572688
RA2_FGD_2PNPDK20040103_144331_000050732023_00068_09641_0676.N1	03-Jan-04	14:43:31.156389	03-Jan-04	16:08:04.256461
RA2_FGD_2PNPDK20040109_180928_000060882023_00156_09729_0758.N1	09-Jan-04	18:09:28.921861	09-Jan-04	19:50:56.875924
RA2_FGD_2PNPDK20040109_194906_000062412023_00157_09730_0759.N1	09-Jan-04	19:49:06.645627	09-Jan-04	21:33:07.217691
RA2_FGD_2PNPDE20040109_213132_000063412023_00158_09731_0346.N1	09-Jan-04	21:31:32.583392	09-Jan-04	23:17:13.415445
RA2_FGD_2PNPDE20040109_231641_000061312023_00159_09732_0348.N1	09-Jan-04	23:16:41.165142	10-Jan-04	00:58:52.565218
RA2_FGD_2PNPDE20040110_023950_000061972023_00161_09734_0350.N1	10-Jan-04	02:39:50.552685	10-Jan-04	04:23:07.678743
RA2_FGD_2PNPDE20040110_042207_000061062023_00162_09735_0351.N1	10-Jan-04	04:22:07.578447	10-Jan-04	06:03:53.356508
RA2_FGD_2PNPDK20040110_060252_000062132023_00163_09736_0764.N1	10-Jan-04	06:02:52.142211	10-Jan-04	07:46:24.864267
RA2_FGD_2PNPDK20040110_074514_000060612023_00164_09737_0765.N1	10-Jan-04	07:45:14.737971	10-Jan-04	09:26:15.956037
RA2_FGD_2PNPDK20040110_092502_000060462023_00165_09738_0766.N1	10-Jan-04	09:25:02.487740	10-Jan-04	11:05:48.109807
RA2_FGD_2PNPDK20040110_110448_000060682023_00166_09739_0767.N1	10-Jan-04	11:04:48.009508	10-Jan-04	12:45:55.911574
RA2_FGD_2PNPDK20040110_124459_000060282023_00167_09740_0768.N1	10-Jan-04	12:44:59.153277	10-Jan-04	14:25:26.951343
RA2_FGD_2PNPDK20040110_142430_000050042023_00168_09741_0769.N1	10-Jan-04	14:24:30.193045	10-Jan-04	15:47:54.225108
RA2_FGD_2PNPDK20040117_104612_000059752023_00266_09839_0855.N1	17-Jan-04	10:46:12.404747	17-Jan-04	12:25:47.844815
RA2_FGD_2PNPDK20040117_122513_000058912023_00267_09840_0856.N1	17-Jan-04	12:25:13.366518	17-Jan-04	14:03:24.142590
RA2_FGD_2PNPDK20040117_140309_000050922023_00268_09841_0857.N1	17-Jan-04	14:03:09.716289	17-Jan-04	15:28:01.754359
RA2_FGD_2PNPDE20040122_030344_000061732023_00333_09906_0416.N1	22-Jan-04	03:03:44.417065	22-Jan-04	04:46:37.035127
RA2_FGD_2PNPDE20040122_044511_000060912023_00334_09907_0417.N1	22-Jan-04	04:45:11.312830	22-Jan-04	06:26:42.608895
RA2_FGD_2PNPDK20040122_062640_000062472023_00335_09908_0928.N1	22-Jan-04	06:26:40.436598	22-Jan-04	08:10:47.692653
RA2_FGD_2PNPDK20040122_080942_000060672023_00336_09909_0929.N1	22-Jan-04	08:09:42.022349	22-Jan-04	09:50:48.810414
RA2_FGD_2PNPDK20040122_112745_000060552023_00338_09911_0921.N1	22-Jan-04	11:27:45.059893	22-Jan-04	13:08:39.593959
RA2_FGD_2PNPDK20040122_130739_000059312023_00339_09912_0922.N1	22-Jan-04	13:07:39.493663	22-Jan-04	14:46:30.373735
RA2_FGD_2PNPDK20040122_144535_000051172023_00340_09913_0923.N1	22-Jan-04	14:45:35.843441	22-Jan-04	16:10:52.389513
RA2_FGD_2PNPDK20040124_102350_000062092023_00366_09939_0949.N1	24-Jan-04	10:23:50.829038	24-Jan-04	12:07:20.209095
RA2_FGD_2PNPDK20040124_120621_000058702023_00367_09940_0950.N1	24-Jan-04	12:06:21.222799	24-Jan-04	13:44:10.832874
RA2_FGD_2PNPDK20040124_134315_000051012023_00368_09941_0951.N1	24-Jan-04	13:43:15.188577	24-Jan-04	15:08:16.138615

Table 3: List of L2 FGD Files affected by S-Band anomaly during cycle 23

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.

7.2 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. 8.2

7.2.1 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.

7.2.2 SIGNIFICANT WAVE HEIGHT

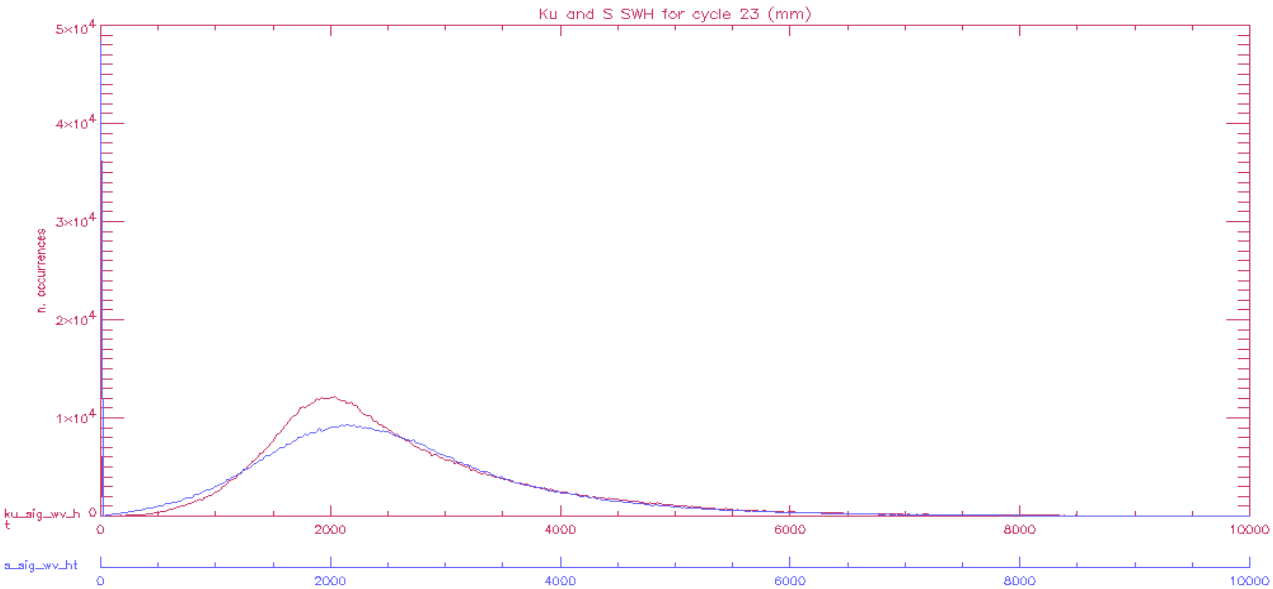


Figure 7: Histogram of Ku and S Band SWH for cycle 23 (mm)

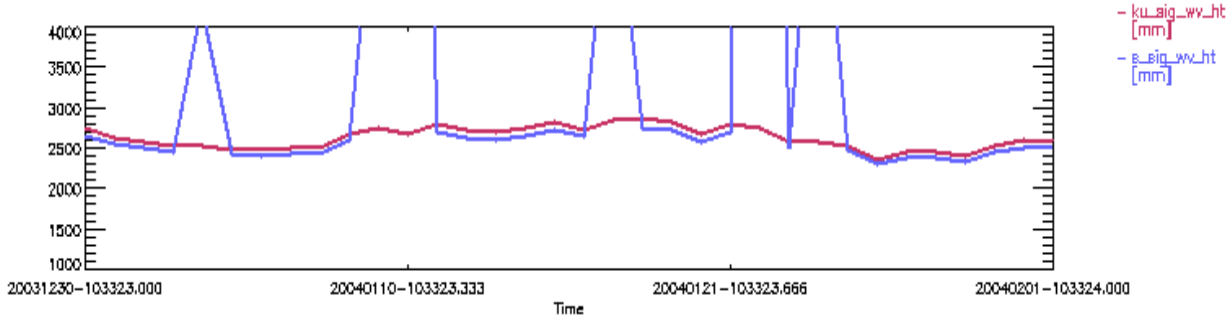


Figure 8: Ku and S SWH daily average for cycle 23 (mm)

The trend and the histogram of the SWH show a nominal behavior for this cycle; the high daily means reported for the S-Band values are due to the so-called S-Band anomaly (ref. par.7.1.6).

7.2.3 BACKSCATTER COEFFICIENT – WIND SPEED

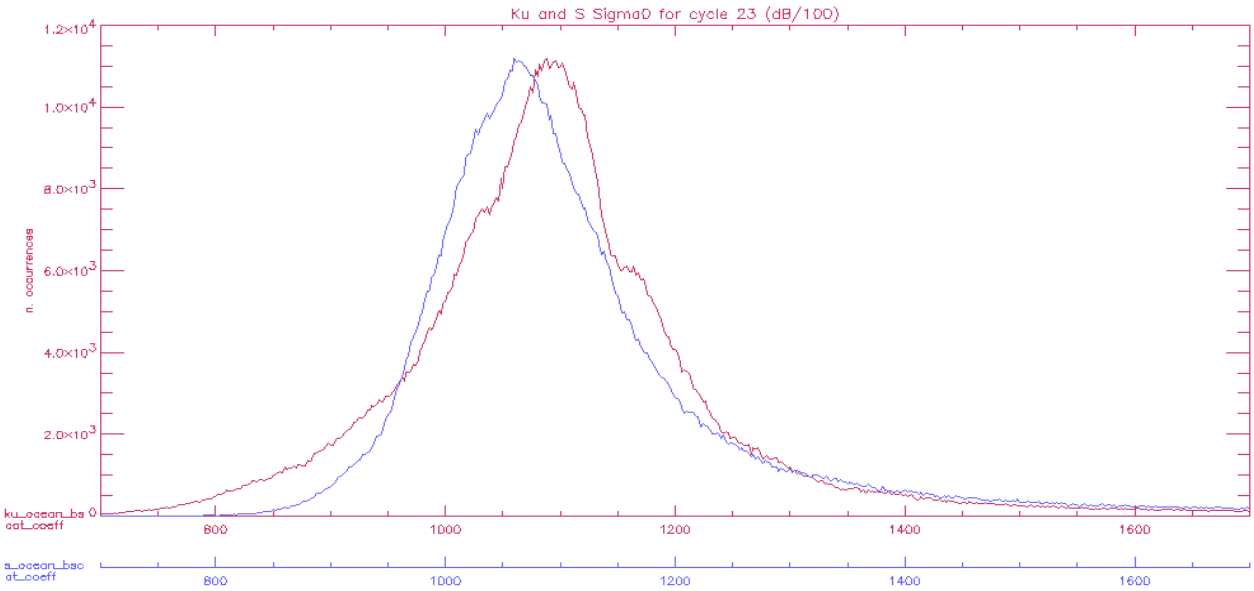


Figure 9: Histogram of Ku and S Band Backscattering Coefficient for cycle 23 (dB/100)

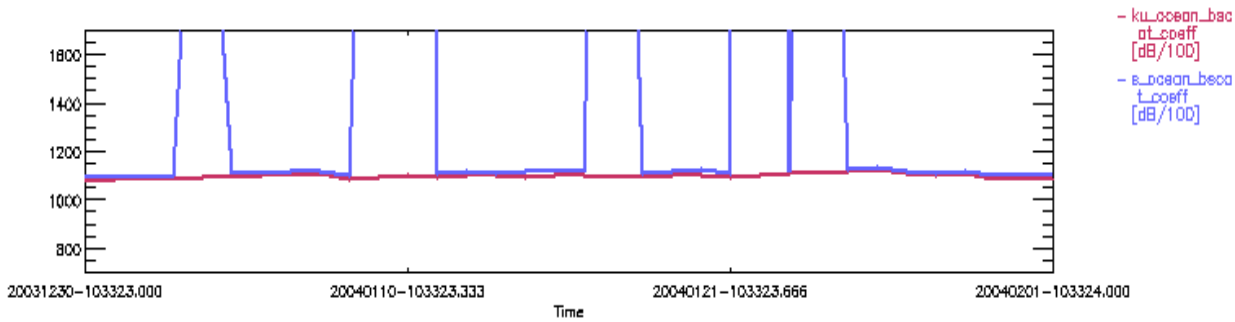


Figure 10: Ku and S Sigma_0 daily average for cycle 23 (dB/100)

The trend and the histogram of the Sigma_0 show a nominal behavior for this cycle; the high daily means reported for the S-Band values are due to the so-called S-Band anomaly (ref. par. 7.1.6).

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 higherwith respect to the previous versions. See chapter 9.4.4.

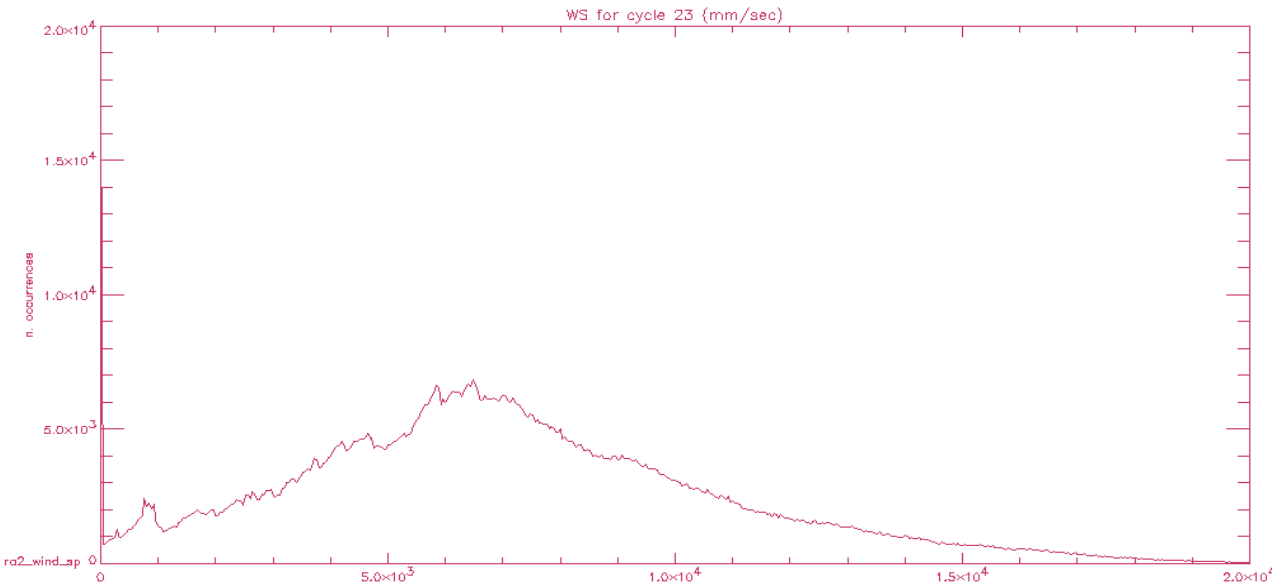


Figure 11: Histogram of Ku Wind Speed for cycle 23 (mm/s)

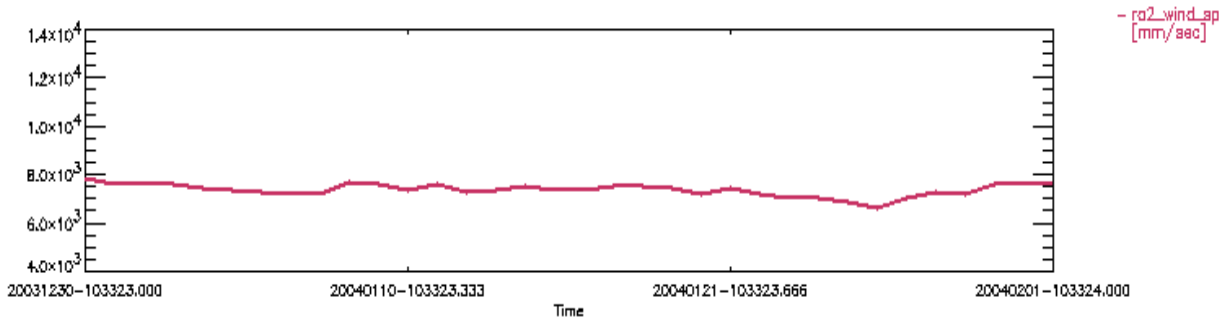


Figure 12: Wind Speed daily average for cycle 23 (mm/s)

7.3 MWR Performances

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

7.4 DORIS Performances

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

8 PRODUCT PERFORMANCES

8.1 Availability of data

In Figure 13 and Table 4 the summary of unavailable RA-2 L0 products is given.
It is easy to notice that close to the Himalayan region a small gap in the data is present. This is due to the daily instrument switch-off (Heater 2 mode) performed to prevent the S-Band anomaly to last more than one day when it occurs

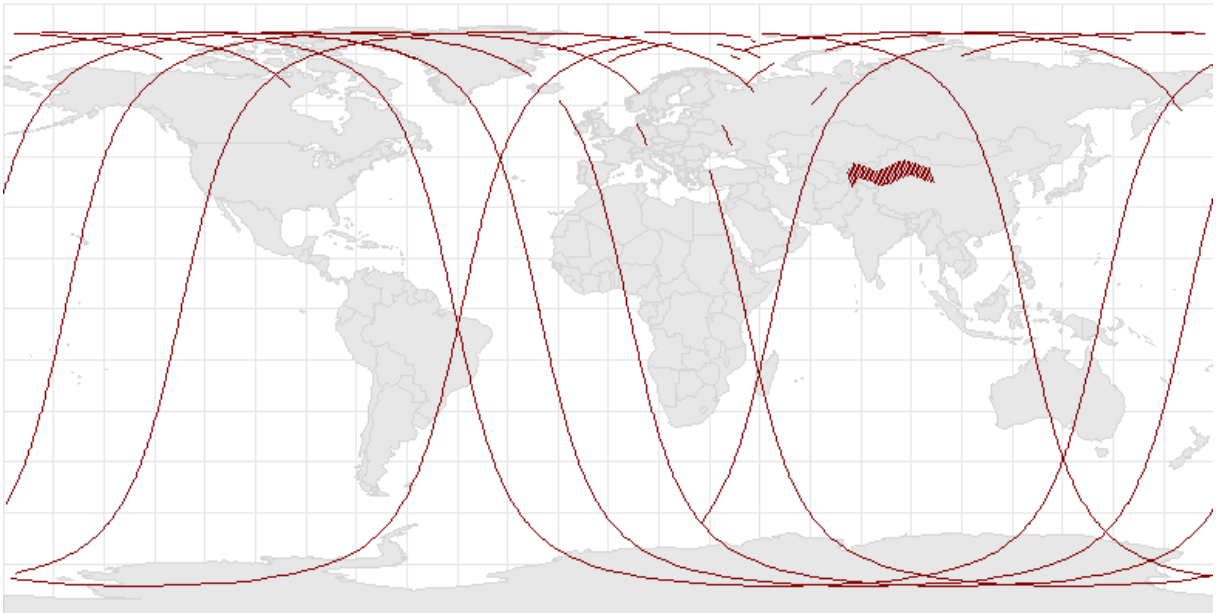


Figure 13: RA-2 L0 unavailable products for first part of cycle 23

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
30-Dec-03	16:36:45	30-Dec-03	16:38:02	77	9585	9585	PDS_UNKNOWN_FAILURE
31-Dec-03	16:04:42	31-Dec-03	16:05:59	77	9599	9599	PDS_UNKNOWN_FAILURE
01-Jan-04	15:33:56	01-Jan-04	15:35:14	78	9613	9613	PDS_UNKNOWN_FAILURE
02-Jan-04	16:42:09	02-Jan-04	16:43:26	77	9628	9628	PDS_UNKNOWN_FAILURE
03-Jan-04	16:10:24	03-Jan-04	16:11:41	77	9642	9642	PDS_UNKNOWN_FAILURE
04-Jan-04	15:36:30	04-Jan-04	15:36:33	3	9656	9656	PDS_UNKNOWN_FAILURE
04-Jan-04	15:39:32	04-Jan-04	15:40:49	77	9656	9656	PDS_UNKNOWN_FAILURE
05-Jan-04	15:07:23	05-Jan-04	15:08:41	78	9670	9670	PDS_UNKNOWN_FAILURE

06-Jan-04	16:16:18	06-Jan-04	16:17:36	78	9685	9685	PDS_UNKNOWN_FAILURE
07-Jan-04	15:45:06	07-Jan-04	15:46:24	78	9699	9699	PDS_UNKNOWN_FAILURE
08-Jan-04	15:13:17	08-Jan-04	15:14:35	78	9713	9713	PDS_UNKNOWN_FAILURE
08-Jan-04	23:46:48	08-Jan-04	23:49:47	179	9718	9718	PDS_UNKNOWN_FAILURE
09-Jan-04	16:22:12	09-Jan-04	16:23:30	78	9728	9728	PDS_UNKNOWN_FAILURE
10-Jan-04	15:47:53	10-Jan-04	15:47:55	2	9742	9742	PDS_UNKNOWN_FAILURE
10-Jan-04	15:50:41	10-Jan-04	15:51:59	78	9742	9742	PDS_UNKNOWN_FAILURE
11-Jan-04	15:19:11	11-Jan-04	15:20:29	78	9756	9756	PDS_UNKNOWN_FAILURE
12-Jan-04	16:28:06	12-Jan-04	16:29:24	78	9771	9771	PDS_UNKNOWN_FAILURE
13-Jan-04	15:56:16	13-Jan-04	15:57:34	78	9785	9785	PDS_UNKNOWN_FAILURE
14-Jan-04	15:22:22	14-Jan-04	15:22:24	2	9799	9799	PDS_UNKNOWN_FAILURE
14-Jan-04	15:25:05	14-Jan-04	15:26:23	78	9799	9799	PDS_UNKNOWN_FAILURE
15-Jan-04	16:33:59	15-Jan-04	16:35:17	78	9814	9814	PDS_UNKNOWN_FAILURE
16-Jan-04	16:01:50	16-Jan-04	16:03:08	78	9828	9828	PDS_UNKNOWN_FAILURE
17-Jan-04	15:28:00	17-Jan-04	15:28:02	2	9842	9842	PDS_UNKNOWN_FAILURE
17-Jan-04	15:30:59	17-Jan-04	15:32:16	77	9842	9842	PDS_UNKNOWN_FAILURE
17-Jan-04	15:43:00	17-Jan-04	15:43:06	6	9842	9842	PDS_UNKNOWN_FAILURE
17-Jan-04	17:21:36	17-Jan-04	17:21:58	22	9843	9843	PDS_UNKNOWN_FAILURE
17-Jan-04	18:54:43	17-Jan-04	18:56:25	102	9844	9844	PDS_UNKNOWN_FAILURE
17-Jan-04	20:35:20	17-Jan-04	20:37:14	114	9845	9845	PDS_UNKNOWN_FAILURE
18-Jan-04	05:11:27	18-Jan-04	05:13:20	113	9850	9850	PDS_UNKNOWN_FAILURE
18-Jan-04	06:56:54	18-Jan-04	06:58:22	88	9851	9851	PDS_UNKNOWN_FAILURE
18-Jan-04	08:35:17	18-Jan-04	08:37:13	116	9852	9852	PDS_UNKNOWN_FAILURE
18-Jan-04	11:54:19	18-Jan-04	11:56:20	121	9854	9854	PDS_UNKNOWN_FAILURE
18-Jan-04	13:34:00	18-Jan-04	13:35:40	100	9855	9855	PDS_UNKNOWN_FAILURE
18-Jan-04	15:11:56	18-Jan-04	15:13:21	85	9856	9856	PDS_UNKNOWN_FAILURE
18-Jan-04	16:39:23	18-Jan-04	16:40:40	77	9857	9857	PDS_UNKNOWN_FAILURE
18-Jan-04	16:50:15	18-Jan-04	16:51:33	78	9857	9857	PDS_UNKNOWN_FAILURE
19-Jan-04	06:21:06	19-Jan-04	07:01:52	2446	9865	9865	PDS_UNKNOWN_FAILURE
19-Jan-04	16:07:25	19-Jan-04	16:08:43	78	9871	9871	PDS_UNKNOWN_FAILURE
19-Jan-04	17:55:59	19-Jan-04	19:30:02	5643	9872	9873	PDS_UNKNOWN_FAILURE
20-Jan-04	05:46:19	20-Jan-04	05:46:30	11	9879	9879	PDS_UNKNOWN_FAILURE
20-Jan-04	12:31:38	20-Jan-04	14:09:19	5861	9883	9884	PDS_UNKNOWN_FAILURE
20-Jan-04	15:33:37	20-Jan-04	15:33:40	3	9885	9885	PDS_UNKNOWN_FAILURE
20-Jan-04	15:36:39	20-Jan-04	15:37:57	78	9885	9885	PDS_UNKNOWN_FAILURE
21-Jan-04	16:44:46	21-Jan-04	16:46:03	77	9900	9900	PDS_UNKNOWN_FAILURE
21-Jan-04	20:13:52	21-Jan-04	21:53:55	6003	9902	9903	PDS_UNKNOWN_FAILURE
22-Jan-04	16:13:16	22-Jan-04	16:14:34	78	9914	9914	PDS_UNKNOWN_FAILURE
23-Jan-04	15:42:15	23-Jan-04	15:43:33	78	9928	9928	PDS_UNKNOWN_FAILURE
24-Jan-04	15:10:16	24-Jan-04	15:11:34	78	9942	9942	PDS_UNKNOWN_FAILURE
24-Jan-04	22:01:43	25-Jan-04	01:27:04	12321	9946	9948	PDS_UNKNOWN_FAILURE
25-Jan-04	03:02:30	25-Jan-04	03:09:04	394	9949	9949	PDS_UNKNOWN_FAILURE
25-Jan-04	04:45:47	25-Jan-04	04:51:37	350	9950	9950	PDS_UNKNOWN_FAILURE

25-Jan-04	08:08:58	25-Jan-04	08:13:51	293	9952	9952	PDS_UNKNOWN_FAILURE
25-Jan-04	09:42:51	25-Jan-04	09:54:19	688	9953	9953	PDS_UNKNOWN_FAILURE
25-Jan-04	16:19:12	25-Jan-04	16:20:30	78	9957	9957	PDS_UNKNOWN_FAILURE
26-Jan-04	15:44:58	26-Jan-04	15:45:01	3	9971	9971	PDS_UNKNOWN_FAILURE
26-Jan-04	15:47:51	26-Jan-04	15:49:09	78	9971	9971	PDS_UNKNOWN_FAILURE
27-Jan-04	15:16:12	27-Jan-04	15:17:30	78	9985	9985	PDS_UNKNOWN_FAILURE
28-Jan-04	16:25:07	28-Jan-04	16:26:25	78	10000	10000	PDS_UNKNOWN_FAILURE
29-Jan-04	15:50:43	29-Jan-04	15:50:46	3	10014	10014	PDS_UNKNOWN_FAILURE
29-Jan-04	15:53:27	29-Jan-04	15:54:45	78	10014	10014	PDS_UNKNOWN_FAILURE
30-Jan-04	15:19:31	30-Jan-04	15:19:34	3	10028	10028	PDS_UNKNOWN_FAILURE
30-Jan-04	15:22:06	30-Jan-04	15:23:24	78	10028	10028	PDS_UNKNOWN_FAILURE
31-Jan-04	16:31:01	31-Jan-04	16:32:19	78	10043	10043	PDS_UNKNOWN_FAILURE
01-Feb-04	15:56:28	01-Feb-04	15:56:30	2	10057	10057	PDS_UNKNOWN_FAILURE
01-Feb-04	15:59:02	01-Feb-04	16:00:20	78	10057	10057	PDS_UNKNOWN_FAILURE
02-Feb-04	15:28:01	02-Feb-04	15:29:19	78	10071	10071	PDS_UNKNOWN_FAILURE

Table 4: List of gaps for RA-2 L0 products during cycle 23

In Figure 14 and Table 5 the summary of unavailable MWR L0 products is given.

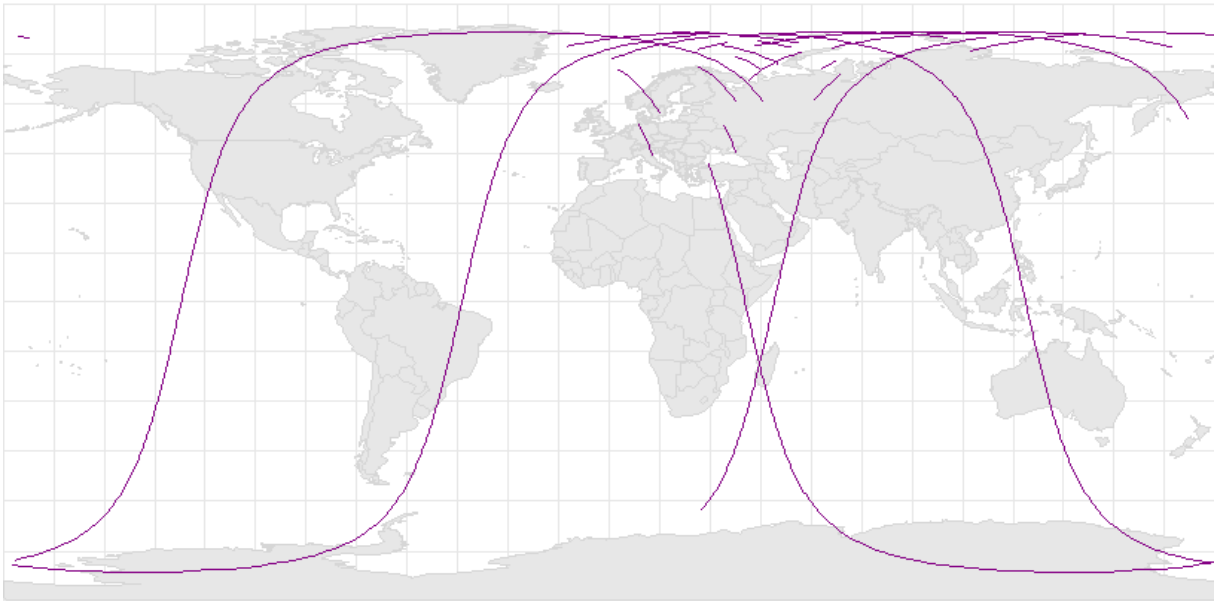


Figure 14: MWR L0 unavailable products for cycle 23

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
17-Jan-04	07:26:11	17-Jan-04	07:26:59	48	9837	9837	PDS_UNKNOWN_FAILURE
17-Jan-04	10:45:23	17-Jan-04	10:46:11	48	9839	9839	PDS_UNKNOWN_FAILURE

17-Jan-04	15:42:11	17-Jan-04	15:42:59	48	9842	9842	PDS_UNKNOWN_FAILURE
17-Jan-04	17:20:36	17-Jan-04	17:21:48	72	9843	9843	PDS_UNKNOWN_FAILURE
17-Jan-04	18:53:48	17-Jan-04	18:56:12	144	9844	9844	PDS_UNKNOWN_FAILURE
17-Jan-04	20:34:12	17-Jan-04	20:37:00	168	9845	9845	PDS_UNKNOWN_FAILURE
18-Jan-04	05:10:37	18-Jan-04	05:13:01	144	9850	9850	PDS_UNKNOWN_FAILURE
18-Jan-04	06:55:49	18-Jan-04	06:58:13	144	9851	9851	PDS_UNKNOWN_FAILURE
18-Jan-04	08:34:13	18-Jan-04	08:37:01	168	9852	9852	PDS_UNKNOWN_FAILURE
18-Jan-04	11:53:25	18-Jan-04	11:56:13	168	9854	9854	PDS_UNKNOWN_FAILURE
18-Jan-04	13:33:01	18-Jan-04	13:35:25	144	9855	9855	PDS_UNKNOWN_FAILURE
18-Jan-04	15:11:01	18-Jan-04	15:13:01	120	9856	9856	PDS_UNKNOWN_FAILURE
18-Jan-04	16:49:26	18-Jan-04	16:51:26	120	9857	9857	PDS_UNKNOWN_FAILURE
18-Jan-04	18:26:38	18-Jan-04	18:29:50	192	9858	9858	PDS_UNKNOWN_FAILURE
18-Jan-04	20:06:14	18-Jan-04	20:10:14	240	9859	9859	PDS_UNKNOWN_FAILURE
19-Jan-04	06:20:15	19-Jan-04	07:01:51	2496	9865	9865	PDS_UNKNOWN_FAILURE
19-Jan-04	17:55:04	19-Jan-04	19:30:16	5712	9872	9873	PDS_UNKNOWN_FAILURE
20-Jan-04	05:45:29	20-Jan-04	05:47:05	96	9879	9879	PDS_UNKNOWN_FAILURE
20-Jan-04	12:30:41	20-Jan-04	14:09:05	5904	9883	9884	PDS_UNKNOWN_FAILURE
25-Jan-04	08:08:03	25-Jan-04	08:13:39	336	9952	9952	PDS_UNKNOWN_FAILURE
25-Jan-04	09:42:03	25-Jan-04	09:54:03	720	9953	9953	PDS_UNKNOWN_FAILURE
25-Jan-04	11:30:27	25-Jan-04	11:33:15	168	9954	9954	PDS_UNKNOWN_FAILURE

Table 5: List of gaps for MWR L0 products during cycle 23

In Figure 15 and Table 6 the summary of unavailable RA-2 L1b products is given.

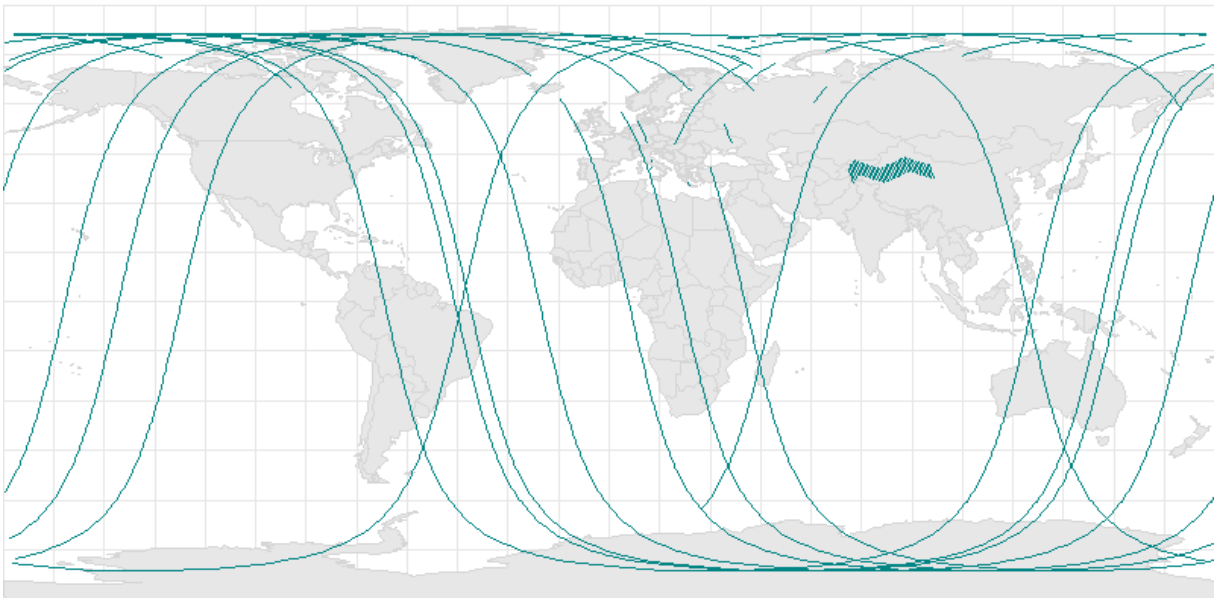


Figure 15: RA-2 L1b unavailable products for cycle 23

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
30-Dec-03	16:36:45	30-Dec-03	16:38:02	77	9585	9585	PDS_UNKNOWN_FAILURE
31-Dec-03	16:04:42	31-Dec-03	16:05:59	77	9599	9599	PDS_UNKNOWN_FAILURE
01-Jan-04	15:33:56	01-Jan-04	15:35:14	78	9613	9613	PDS_UNKNOWN_FAILURE
01-Jan-04	20:36:34	01-Jan-04	20:36:48	14	9616	9616	PDS_UNKNOWN_FAILURE
02-Jan-04	16:42:09	02-Jan-04	16:43:26	77	9628	9628	PDS_UNKNOWN_FAILURE
03-Jan-04	16:10:24	03-Jan-04	16:11:41	77	9642	9642	PDS_UNKNOWN_FAILURE
03-Jan-04	16:11:41	03-Jan-04	16:11:42	1	9642	9642	PDS_UNKNOWN_FAILURE
04-Jan-04	15:36:31	04-Jan-04	15:36:33	2	9656	9656	PDS_UNKNOWN_FAILURE
04-Jan-04	15:39:32	04-Jan-04	15:40:49	77	9656	9656	PDS_UNKNOWN_FAILURE
05-Jan-04	15:07:23	05-Jan-04	15:08:41	78	9670	9670	PDS_UNKNOWN_FAILURE
06-Jan-04	16:16:18	06-Jan-04	16:17:36	78	9685	9685	PDS_UNKNOWN_FAILURE
07-Jan-04	15:45:06	07-Jan-04	15:46:24	78	9699	9699	PDS_UNKNOWN_FAILURE
08-Jan-04	15:13:17	08-Jan-04	15:14:35	78	9713	9713	PDS_UNKNOWN_FAILURE
08-Jan-04	23:46:49	08-Jan-04	23:49:47	178	9718	9718	PDS_UNKNOWN_FAILURE
09-Jan-04	16:22:12	09-Jan-04	16:23:30	78	9728	9728	PDS_UNKNOWN_FAILURE
10-Jan-04	15:50:41	10-Jan-04	15:51:59	78	9742	9742	PDS_UNKNOWN_FAILURE
11-Jan-04	15:19:11	11-Jan-04	15:20:29	78	9756	9756	PDS_UNKNOWN_FAILURE
12-Jan-04	16:28:06	12-Jan-04	16:29:24	78	9771	9771	PDS_UNKNOWN_FAILURE
13-Jan-04	15:56:16	13-Jan-04	15:57:34	78	9785	9785	PDS_UNKNOWN_FAILURE
14-Jan-04	15:25:05	14-Jan-04	15:26:23	78	9799	9799	PDS_UNKNOWN_FAILURE
15-Jan-04	16:33:59	15-Jan-04	16:35:17	78	9814	9814	PDS_UNKNOWN_FAILURE
15-Jan-04	23:28:46	16-Jan-04	02:52:42	12236	9818	9820	PDS_UNKNOWN_FAILURE
16-Jan-04	16:01:50	16-Jan-04	16:03:08	78	9828	9828	PDS_UNKNOWN_FAILURE
17-Jan-04	15:30:59	17-Jan-04	15:32:16	77	9842	9842	PDS_UNKNOWN_FAILURE
17-Jan-04	15:43:01	17-Jan-04	15:43:06	5	9842	9842	PDS_UNKNOWN_FAILURE
17-Jan-04	17:21:37	17-Jan-04	17:21:58	21	9843	9843	PDS_UNKNOWN_FAILURE
17-Jan-04	18:54:45	17-Jan-04	18:56:25	100	9844	9844	PDS_UNKNOWN_FAILURE
17-Jan-04	20:35:21	17-Jan-04	20:37:14	113	9845	9845	PDS_UNKNOWN_FAILURE
18-Jan-04	05:11:28	18-Jan-04	05:13:20	112	9850	9850	PDS_UNKNOWN_FAILURE
18-Jan-04	06:56:55	18-Jan-04	06:58:22	87	9851	9851	PDS_UNKNOWN_FAILURE
18-Jan-04	08:35:18	18-Jan-04	08:37:13	115	9852	9852	PDS_UNKNOWN_FAILURE
18-Jan-04	11:54:20	18-Jan-04	11:56:20	120	9854	9854	PDS_UNKNOWN_FAILURE
18-Jan-04	13:34:01	18-Jan-04	13:35:40	99	9855	9855	PDS_UNKNOWN_FAILURE
18-Jan-04	15:11:57	18-Jan-04	15:13:21	84	9856	9856	PDS_UNKNOWN_FAILURE
18-Jan-04	16:39:23	18-Jan-04	16:40:40	77	9857	9857	PDS_UNKNOWN_FAILURE
18-Jan-04	16:50:16	18-Jan-04	16:51:33	77	9857	9857	PDS_UNKNOWN_FAILURE
18-Jan-04	19:59:56	18-Jan-04	20:00:20	24	9859	9859	PDS_UNKNOWN_FAILURE
19-Jan-04	06:21:07	19-Jan-04	07:01:52	2445	9865	9865	PDS_UNKNOWN_FAILURE
19-Jan-04	16:07:25	19-Jan-04	16:08:43	78	9871	9871	PDS_UNKNOWN_FAILURE
19-Jan-04	17:56:00	19-Jan-04	19:30:02	5642	9872	9873	PDS_UNKNOWN_FAILURE
20-Jan-04	05:46:20	20-Jan-04	05:46:30	10	9879	9879	PDS_UNKNOWN_FAILURE

20-Jan-04	09:12:36	20-Jan-04	09:19:54	438	9881	9881	PDS_UNKNOWN_FAILURE
20-Jan-04	12:31:40	20-Jan-04	14:09:19	5859	9883	9884	PDS_UNKNOWN_FAILURE
20-Jan-04	15:36:39	20-Jan-04	15:37:57	78	9885	9885	PDS_UNKNOWN_FAILURE
20-Jan-04	17:26:30	20-Jan-04	17:30:56	266	9886	9886	PDS_UNKNOWN_FAILURE
21-Jan-04	16:44:46	21-Jan-04	16:46:03	77	9900	9900	PDS_UNKNOWN_FAILURE
21-Jan-04	20:13:53	21-Jan-04	21:53:55	6002	9902	9903	PDS_UNKNOWN_FAILURE
22-Jan-04	16:13:16	22-Jan-04	16:14:34	78	9914	9914	PDS_UNKNOWN_FAILURE
23-Jan-04	15:42:15	23-Jan-04	15:43:33	78	9928	9928	PDS_UNKNOWN_FAILURE
23-Jan-04	19:10:47	23-Jan-04	20:49:33	5926	9930	9931	PDS_UNKNOWN_FAILURE
24-Jan-04	15:10:16	24-Jan-04	15:11:34	78	9942	9942	PDS_UNKNOWN_FAILURE
24-Jan-04	22:01:45	25-Jan-04	01:27:04	12319	9946	9948	PDS_UNKNOWN_FAILURE
25-Jan-04	03:02:31	25-Jan-04	03:09:04	393	9949	9949	PDS_UNKNOWN_FAILURE
25-Jan-04	04:45:49	25-Jan-04	04:51:37	348	9950	9950	PDS_UNKNOWN_FAILURE
25-Jan-04	08:08:59	25-Jan-04	08:13:51	292	9952	9952	PDS_UNKNOWN_FAILURE
25-Jan-04	09:42:53	25-Jan-04	09:54:19	686	9953	9953	PDS_UNKNOWN_FAILURE
25-Jan-04	11:31:04	25-Jan-04	11:33:28	144	9954	9954	PDS_UNKNOWN_FAILURE
25-Jan-04	16:19:12	25-Jan-04	16:20:30	78	9957	9957	PDS_UNKNOWN_FAILURE
26-Jan-04	15:47:51	26-Jan-04	15:49:09	78	9971	9971	PDS_UNKNOWN_FAILURE
27-Jan-04	15:16:12	27-Jan-04	15:17:30	78	9985	9985	PDS_UNKNOWN_FAILURE
28-Jan-04	16:25:07	28-Jan-04	16:26:25	78	10000	10000	PDS_UNKNOWN_FAILURE
29-Jan-04	09:39:07	29-Jan-04	09:39:20	13	10010	10010	PDS_UNKNOWN_FAILURE
29-Jan-04	15:53:27	29-Jan-04	15:54:45	78	10014	10014	PDS_UNKNOWN_FAILURE
30-Jan-04	15:22:06	30-Jan-04	15:23:24	78	10028	10028	PDS_UNKNOWN_FAILURE
31-Jan-04	16:31:01	31-Jan-04	16:32:19	78	10043	10043	PDS_UNKNOWN_FAILURE
01-Feb-04	15:59:02	01-Feb-04	16:00:20	78	10057	10057	PDS_UNKNOWN_FAILURE
02-Feb-04	15:28:01	02-Feb-04	15:29:19	78	10071	10071	PDS_UNKNOWN_FAILURE

Table 6: List of gaps for RA-2 L1b products during cycle 23

8.2 Edited measurements

In order to produce the statistics reported in 7.2 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 7: Editing criteria for RA-2 parameters statistics

8.3 Product disclaimer

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

8.4 Data handling recommendations

8.4.1 CORRECTION FOR USO DRIFT

Considering that the correction for the USO clock variation won't be included in the L1b processing until the next upgrade (ref. Par. 5.4.4); the user should apply a correction to the range to take into account this. As reported in chapter 7.1.2, a bias of 32.54 mm should be added to the range and a drift of -2.11 mm/year should be considered; being those figures valid for data acquired until the end of cycle 23.

8.4.2 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

8.4.3 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.

8.4.4 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.

8.4.5 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 Wind & Wave quality assessment

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

9 PARTICULAR INVESTIGATIONS

No particular investigation has been performed on this cycle.