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ENVISAT CYCLIC ALTIMETRIC REPORT

CYCLE 22

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 22.

This reports covers the period from the 24th of November 2003 to the 29th December 2003.

2 DISTRIBUTION LIST

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

3 ACRONYMS

AGC	Automatic Gain Control
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
DSR	Data Set Record
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-XXXX-CN, December 2003
[R – 2] ENVISAT Microwave Radiometer Assessment Report Cycle 022, CLS.DOS/04.004,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 December 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 # 79-82, ENVI-ESOC-OPS-RP-1011-TOS-OF
[R – 15] 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 APPLICABLE DOCUMENTS

[A – 1] Envisat RA-2 data analysis after on-board HSU1 fuses and OBT anomalies, Internal Technical Note

6 GENERAL QUALITY ASSESSMENT

6.1 Instruments status

The RA-2 instrument has been victim of three instrument anomalies during this cycle, as given in par. 7.1.

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].

6.2 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.
9073	9173.2	22964.79	477.308	24909.9	69261.21	96.20292	96.124	92.08422	84.75101
9173.2	9273.4	401125.3	5152.564	5148.919	11048.67	33.67629	32.82434	32.82495	31.84946
9273.4	9373.6	163764.5	388.607	412.861	7969.565	72.92246	72.85821	72.8542	71.60474
9373.6	9473.8	1047.386	550.021	559.368	43159.35	99.82682	99.73588	99.73433	92.69072
9473.8	9574	1089.389	549.767	557.578	13191.5	99.81988	99.72898	99.72768	97.63875

Table 1: RA-2 L0, L1b and L2 FGD Data products availability summary for cycle 22

6.3 Orbit quality

On the 15th December 2003, 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	2003/12/15-22:01:55	0.0213 m/sec	0.0212 m/sec	SFCM

On the 26th December 2003, a 1-burn SFCM orbit drift stop manoeuvre was executed. This orbit correction, the first of its kind since the beginning of the mission, was deemed necessary to avoid a violation of the ground track Western deadband. The following table summarises the SFCM observed performance:

	Burn Start Time	Nominal Delta-V	Calibrated Delta-V	Mode
First burn	2003/12/26-22:03:00	-0.0060 m/sec	-0.0067 m/sec	SFCM

6.4 Ground Segment Processing Chain Status

6.4.1 IPF PROCESSING CHAIN

Nov. 26, 2003: Installation at the different processing centers PDHS-K and PDHS-E of the Level 1 and Level 2 IPF processing chain **version 4.56**. The version includes:

1. Change in the AGC evaluation for Ku and S-band in the L1b processor.
2. Neural Network algorithm for evaluation of Wet Tropospheric Correction, Water Vapor and Liquid Water Content in the L2 processing.
3. Refinement in L2 Ice2 Retracker Algorithm.
4. ADF updates:
    a. Level 1 ADF: New IF mask ADF
    b. Level 2 ADF: Rain Flag, SSB, CLS00.1 MSS, Tides GOT2000 and FES2002, as recommended by the RA-2 and MWR CCVT.

6.4.2 F-PAC PROCESSING CHAIN

Aug. 04, 2003: Version installed CMA V6.1. Version mainly related to Envisat evolutions:

1. Neural Network algorithm for evaluation of Wet Tropospheric Correction, Water Vapor and Liquid Water Content in the L2 processing.
2. Refinement in L2 Ice2 Retracker Algorithm.
3. ADF updates: CLS00.1 MSS, GOT2000, FES2002, Rain Flag, SSB

Aug. 08, 2003: Patch 1: Envisat evolutions for ice1 parameterization.
Dec. 03, 2003: Version installed CMA V6.2.1. Version devoted to Jason-1 evolutions and SPR correction. No impacts on Envisat products.

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

6.4.3 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_AXVIEC20031208_145901_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_AXVIEC20030611_094400_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
```

Several auxiliary files have been changed during cycle 22 in correspondence to the operational activation of the IPF version 4.56. Those are: RA2_ICT_AX, RA2_IFF_AX, RA2_OT1_AX, RA2_OT2_AX, RA2_MSS_AX, RA2_SOI_AX, RA2_SSB_AX and RA2_TLD_AX.

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.

6.4.4 PLANNED UPGRADES

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

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

7 ENVISAT PAYLOAD STATUS

7.1 Altimeter Events

The Radar Altimeter 2, during cycle 22, was unavailable twice, in the following time periods:
Start: 26 Nov 2003 13:31:20 Orbit = 09096 RA-2 to Suspend mode (Reset/Wait/Init)

Stop: 26 Nov 2003 19:39:35 Orbit = 09100 due to a multiple reporting of a SEU-problem

Start: 3 Dec 2003 07:18:43 Orbit = 09193 PLSOL due to a known PMC software problem
Stop: 5 Dec 2003 16:35:05 Orbit = 09227

After the second anomaly it was decided to up-load a new version of the PMC S/W, to cure the known bug responsible for the payload anomaly. After that the recovery of the whole payload started during which out-of-limits were observed for parameters relate to the HSU1 fuse status associated to the S/W heater circuits for the RA2 TWT, EPC and ICU. At the same time the RA-2 EPC temperature constantly remained at around -11.9 deg C while this temperature used to rise largely above the minimum operational limit (-5 degC) after one orbit at the previous recoveries. The recovery of RA-2 was postponed in order to investigate further the problem, however, when then the recovery was executed the three temperatures associated to the RA-2 TWT, EPC and ICU got back soon the nominal behavior [A – 1].

Start: 6 Dec 2003 15:55:52 Orbit = 09241 RA-2 in Suspend mode due to an ICU Format
Stop: 10 Dec 2003 19:16:35 Orbit = 09300 Length Error and an ICU Format Header Error.

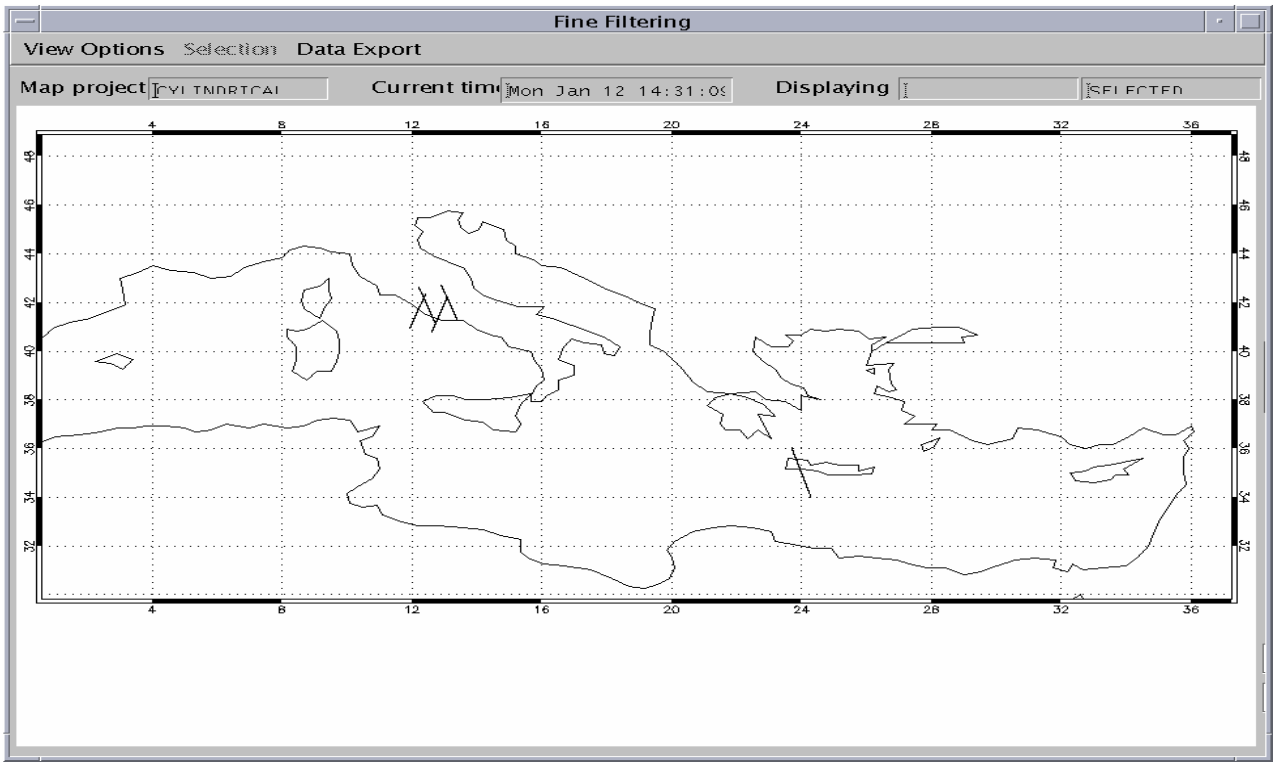
In this occasion RA-2 was switched to Suspend Mode due to an uncontrolled SW action having as a consequence the stop of the ICU OBT increase.

7.1.1 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, which should be located near Rome; both ascending and descending passes.
- Individual Echoes background planning: buffering of 20 Data block of individual Echoes and transmission of the in the following 160 Data Blocks. This repeated continuously.

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



7.2 MWR Events

The MWR, during cycle 22 was unavailable once:
Start: 3 Dec 2003 07:18:43 Orbit = 09193 PLSOL due to a known PMC software problem
Stop: 4 Dec 2003 18:45:41 Orbit = 09214

7.3 DORIS Events

The DORIS during cycle 22 was unavailable once:
Start: 3 Dec 2003 07:18:43 Orbit = 09193 PLSOL due to a known PMC software problem
Stop: 4 Dec 2003 17:18:28 Orbit = 09213

8 INSTRUMENT PERFORMANCES

8.1 RA-2 Calibration performances

8.1.1 IF FILTER SHAPE

In Figure 1 all valid IF masks retrieved by averaging the 100 seconds of data acquired daily during cycle 21 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 22 the number of valid IF masks has been of 6 representing the 25% 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 22 plotted together with the on-ground reference.

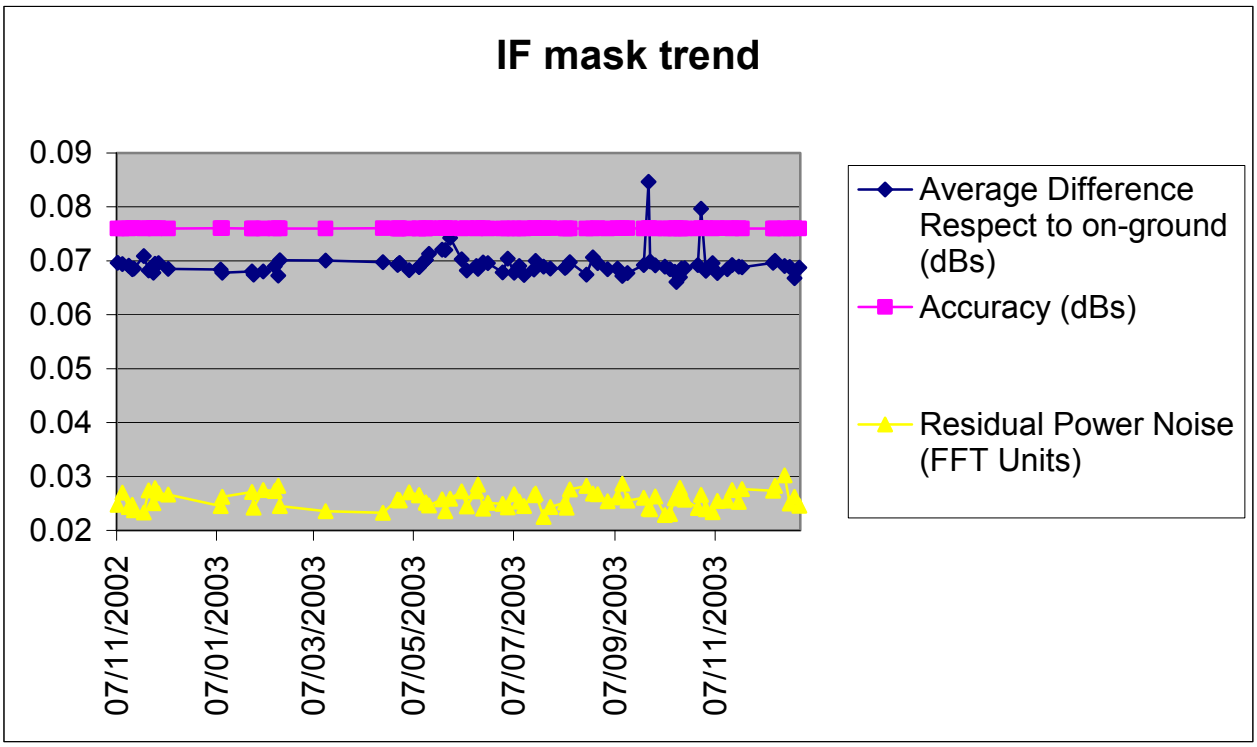


Figure 2: Evolution of the IF mask related parameters for valid IF masks retrieved until cycle 22.

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

8.1.2 USO

In Figure 3 the USO clock period trend retrieved until end of cycle 22 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 32.62 mm and –1.92 mm/year as calculated with data covering the period 4 September 2002 to 29 December 2003. The given bias and drift have to subtracted from the original altimetric range.

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

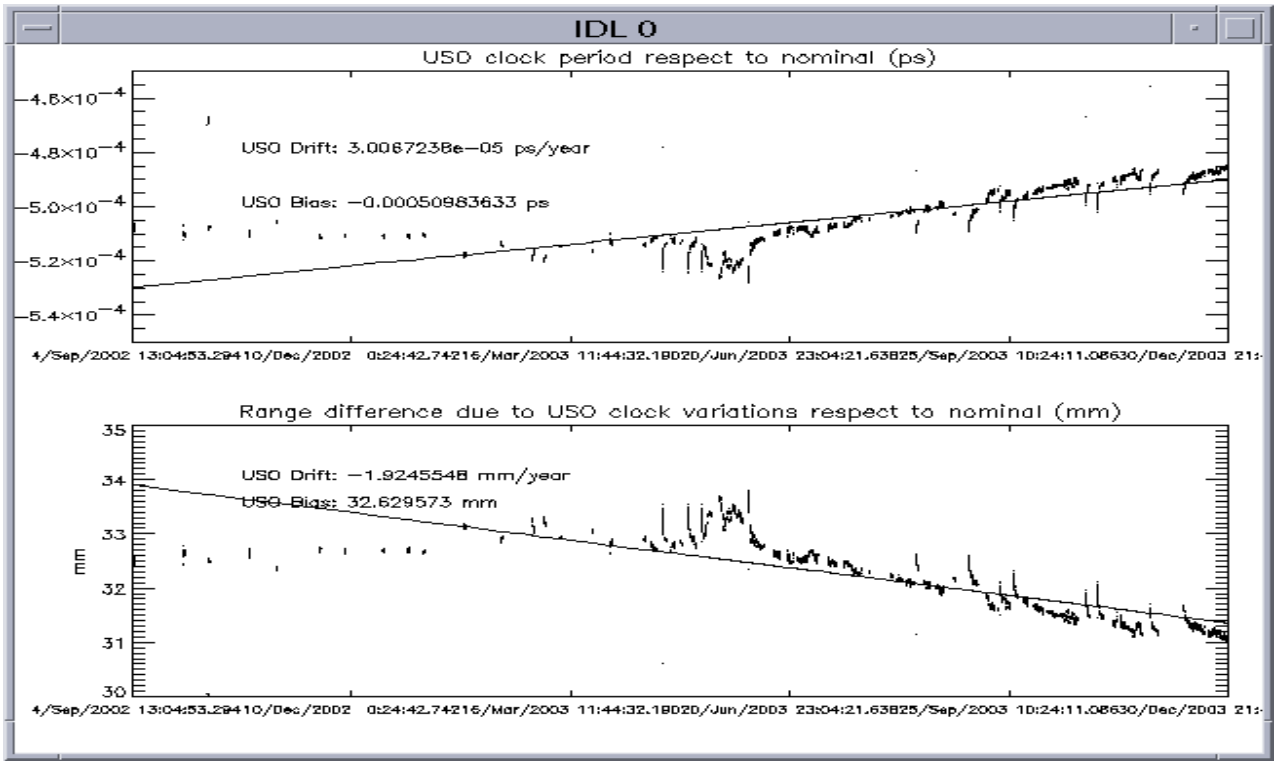


Figure 3: USO clock period trend until end of cycle 22

8.1.3 TRACKING CAPABILITY

In Figure 4 and Figure 5, the Chirp ID is plotted respectively for ascending and descending passes of cycle 21. 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).

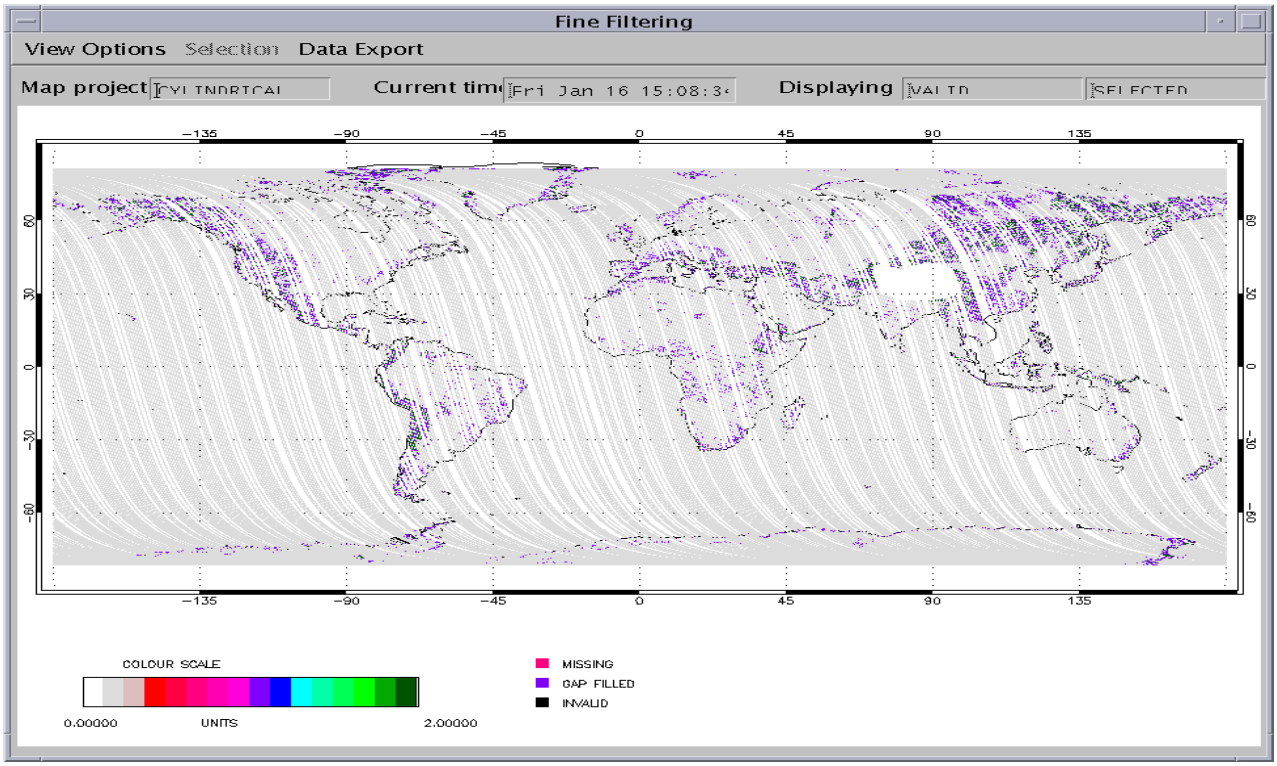


Figure 4: RA-2 Chirp ID for ascending passes during cycle 22

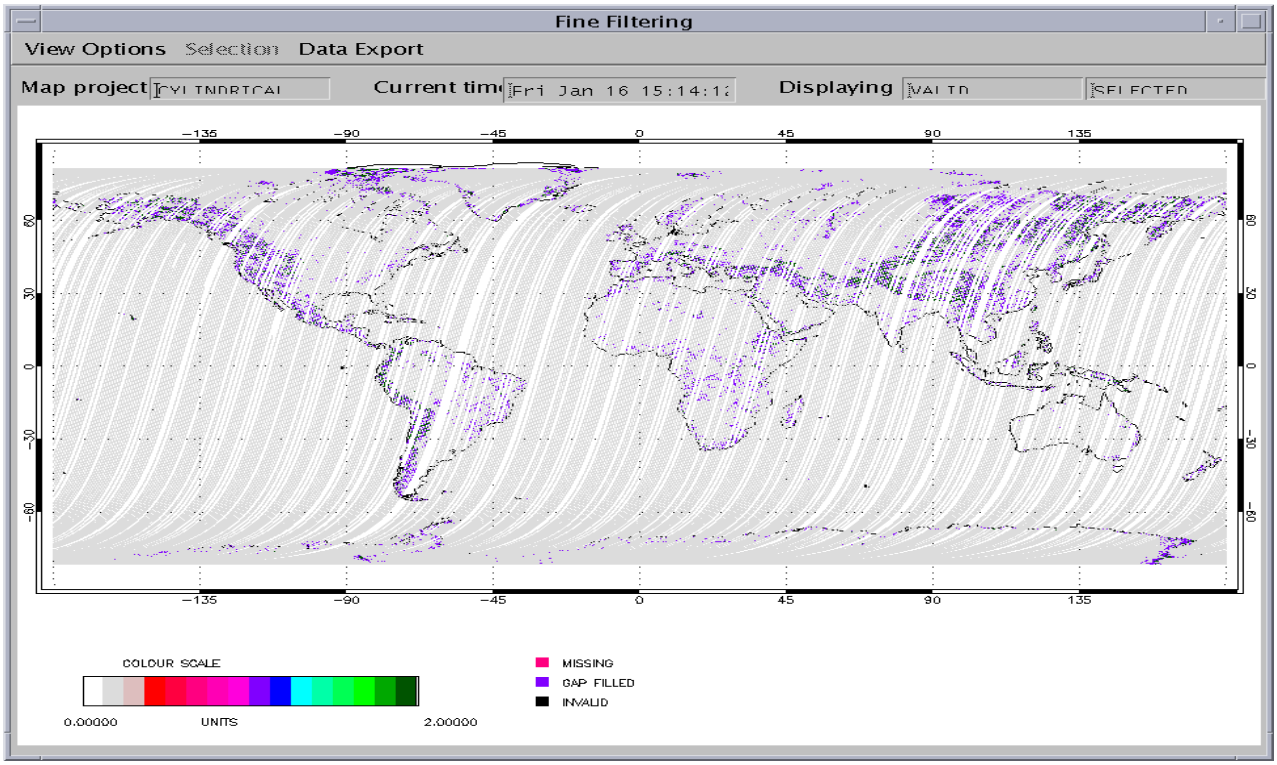


Figure 5: RA-2 Chirp ID for descending passes during cycle 22

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)	98.27%	1.52%	0.21%
Sea Ice	99.21%	0.70%	0.09%
Ice Sheet	96.27%	3.07%	0.66%
Land	81.58%	13.12%	5.30%
All world	95.06%	3.69%	1.25%

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 figure satisfy completely the objectives of the Commissioning Phase RSL and Tracking optimization hereafter reported:

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

8.1.4 SIGMA0 TRANSPONDER

No data relative to the Sigma_0 Transponder calibration is available for cycle 22. 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:

27-NOV-2003 20:36:27
16-DEC-2003 20:39:15
25-DEC-2003 09:39:04

However, for a PDS problem which has not yet been explained, L1b data corresponding to acquisitions of 27-NOV-2003 and 16-DEC-2003 have not been produced.

8.1.5 DATATION

No value is available for the datation bias relative to cycle 22 since the GDR data needed for this aim are not yet available.

8.1.6 MISPOINTING

In Figure 6 the trend and the histogram of the mispointing squared (smoothed over 120 s) is reported in deg^2*10e-4
The average value is of about 0.03 deg^2 which is not in agreement with the figures reported at platform level [R – 13].
However this is known to be due to a not perfect tuning of the algorithm used to retrieve the mispointing value from the RA-2 waveform data. A new algorithm to determine this parameter has been identified and it will be implemented in the next version of L2 processor to come mid-2004 (ref. 6.4.4).

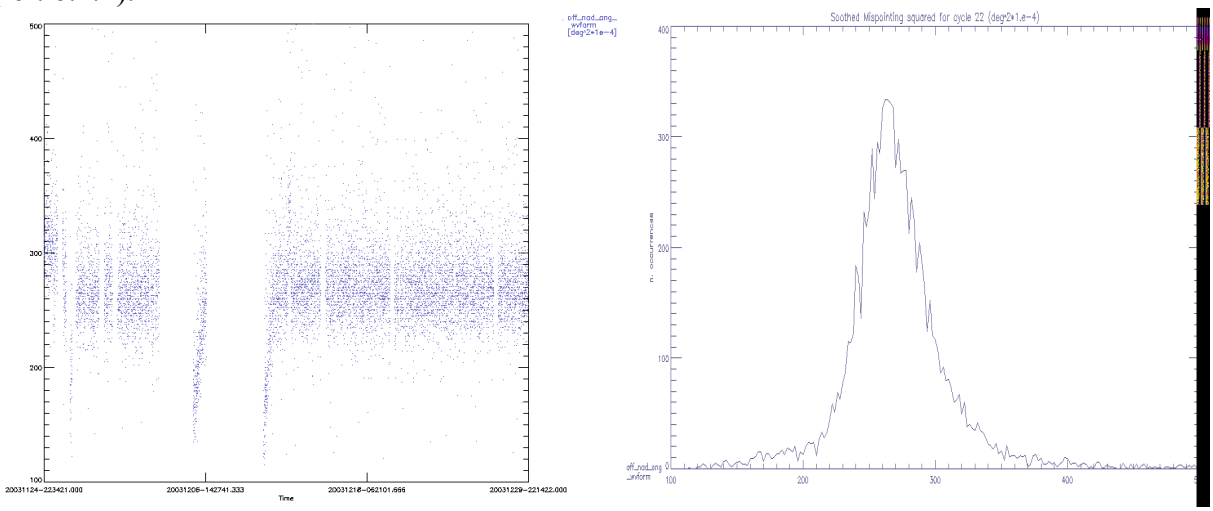


Figure 6: Smoothed mispointing squared trend and histogram for cycle 22 (deg^2*10^4)

Worthwhile to be noticed that the mispointing squared assumes lower values just after an instrument anomaly; afterwards an increasing trend of the parameter is visible until the it reaches stability at the usual value. Work is ongoing in order to understand the reason of this particular instrumental behavior.
On the other hand, the average mispointing squared value appears to decrease starting from November the 26th. This has been demonstrated to be due to the new IF mask auxiliary file (RA2_IFF_AX) uploaded together with the new IPF version 4.56. The impact of the new IF mask on the squared mispointing is of the order of 0.05 deg^2 while it has been demonstrated to be negligible on the other altimetric parameters.

8.1.7 S-BAND ANOMALY

The so-called “S-Band anomaly” still affects the performances of RA-2. Hereafter a list is reported of the products files that have been affected by this problem during cycle 22, which corresponds to a percentage of about 4% of the acquired data.
Being the method used a statistical one working on ocean data; files containing less than 1000 seconds of data over ocean have not been considered. This choice is supported by the fact that the “S-Band anomaly” is associated to a particular instrumental behavior that cannot appear and disappear within a short time frame.

File name	Start date	Start time	Stop date	Stop time
RA2_FGD_2PNPDK20031128_051328_000064142022_00048_09120_0309.N1	28-Nov-03	05:13:28.356508	28-Nov-03	07:00:22.712548
RA2_FGD_2PNPDK20031128_065858_000060582022_00049_09121_0310.N1	28-Nov-03	06:58:58.104256	28-Nov-03	08:39:55.980316
RA2_FGD_2PNPDK20031128_083824_000059832022_00050_09122_0311.N1	28-Nov-03	08:38:24.688024	28-Nov-03	10:18:07.926090
RA2_FGD_2PNPDK20031128_101703_000059902022_00051_09123_0312.N1	28-Nov-03	10:17:03.369795	28-Nov-03	11:56:53.291860
RA2_FGD_2PNPDK20031128_115557_000060972022_00052_09124_0313.N1	28-Nov-03	11:55:57.647562	28-Nov-03	13:37:34.513623
RA2_FGD_2PNPDK20031128_133639_000058762022_00053_09125_0314.N1	28-Nov-03	13:36:39.983327	28-Nov-03	15:14:36.277397
RA2_FGD_2PNPDK20031128_151402_000051732022_00054_09126_0315.N1	28-Nov-03	15:14:02.913098	28-Nov-03	16:40:16.273165
RA2_FGD_2PNPDK20031214_133225_000059702022_00282_09354_0432.N1	14-Dec-03	13:32:25.460996	14-Dec-03	15:11:55.331064
RA2_FGD_2PNPDK20031214_151123_000051542022_00283_09355_0433.N1	14-Dec-03	15:11:23.080764	14-Dec-03	16:37:17.502831
RA2_FGD_2PNPDE20031226_235603_000061582022_00460_09532_0259.N1	26-Dec-03	23:56:03.033647	27-Dec-03	01:38:41.169710
RA2_FGD_2PNPDE20031227_013807_000062742022_00461_09533_0260.N1	27-Dec-03	01:38:07.805410	27-Dec-03	03:22:41.797468
RA2_FGD_2PNPDE20031227_032143_000061452022_00462_09534_0261.N1	27-Dec-03	03:21:43.925170	27-Dec-03	05:04:08.693232
RA2_FGD_2PNPDE20031227_032239_000060242022_00462_09534_0262.N1	27-Dec-03	03:22:39.625167	27-Dec-03	05:03:04.081234
RA2_FGD_2PNPDK20031227_050257_000061512022_00463_09535_0584.N1	27-Dec-03	05:02:57.452935	27-Dec-03	06:45:28.904994
RA2_FGD_2PNPDK20031227_064338_000062492022_00464_09536_0585.N1	27-Dec-03	06:43:38.674700	27-Dec-03	08:27:48.158754
RA2_FGD_2PNPDK20031227_082638_000059132022_00465_09537_0586.N1	27-Dec-03	08:26:38.032454	27-Dec-03	10:05:11.088527

Table 3: List of L2 FGD Files affected by S-Band anomaly during cycle 22

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

8.2 RA-2 Altimeter Parameters

Hereafter a summary of the performance of the main Altimetric parameters are reported; these have been obtained with the editing criteria mentioned in par. 9.2

8.2.1 ALTIMETER RANGE

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

8.2.2 SIGNIFICANT WAVE HEIGHT

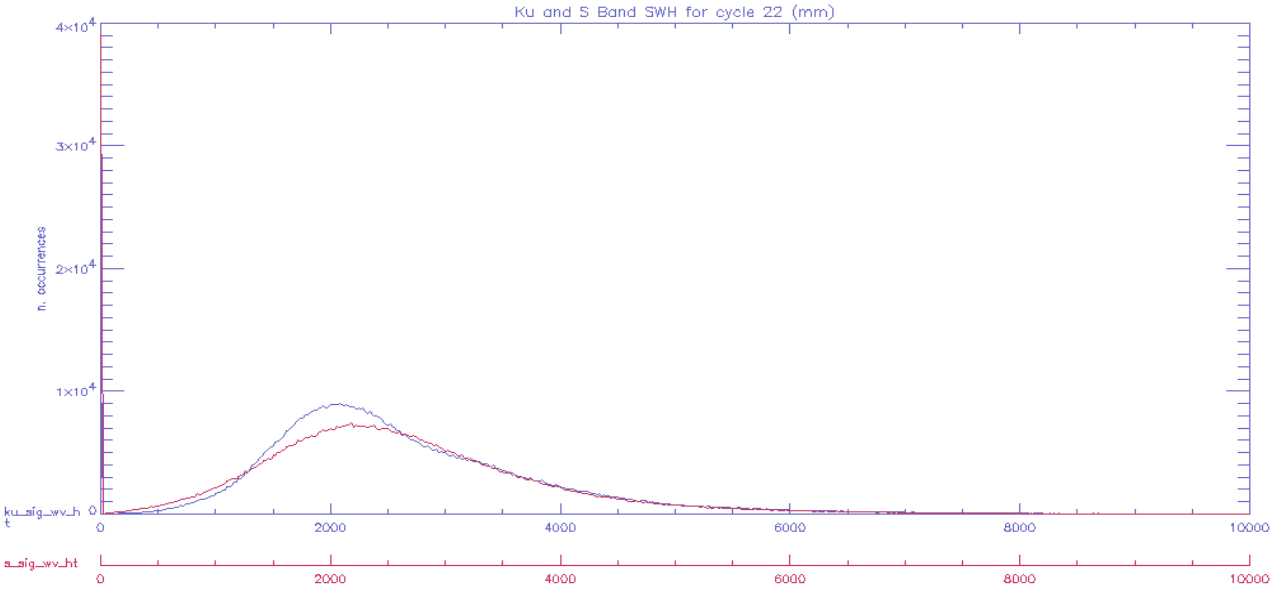


Figure 7: Histogram of Ku and S Band SWH for cycle 22 (mm)

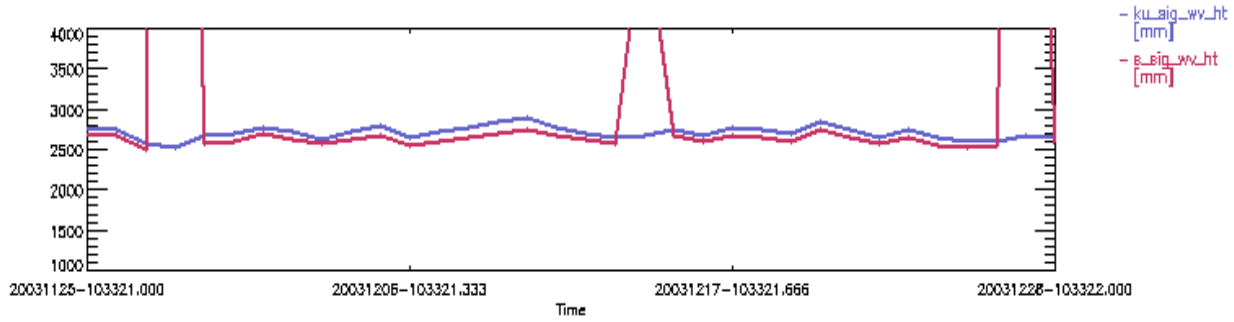


Figure 8: Ku and S SWH daily average for cycle 22 (mm)

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.8.1.7).

8.2.3 BACKSCATTER COEFFICIENT – WIND SPEED

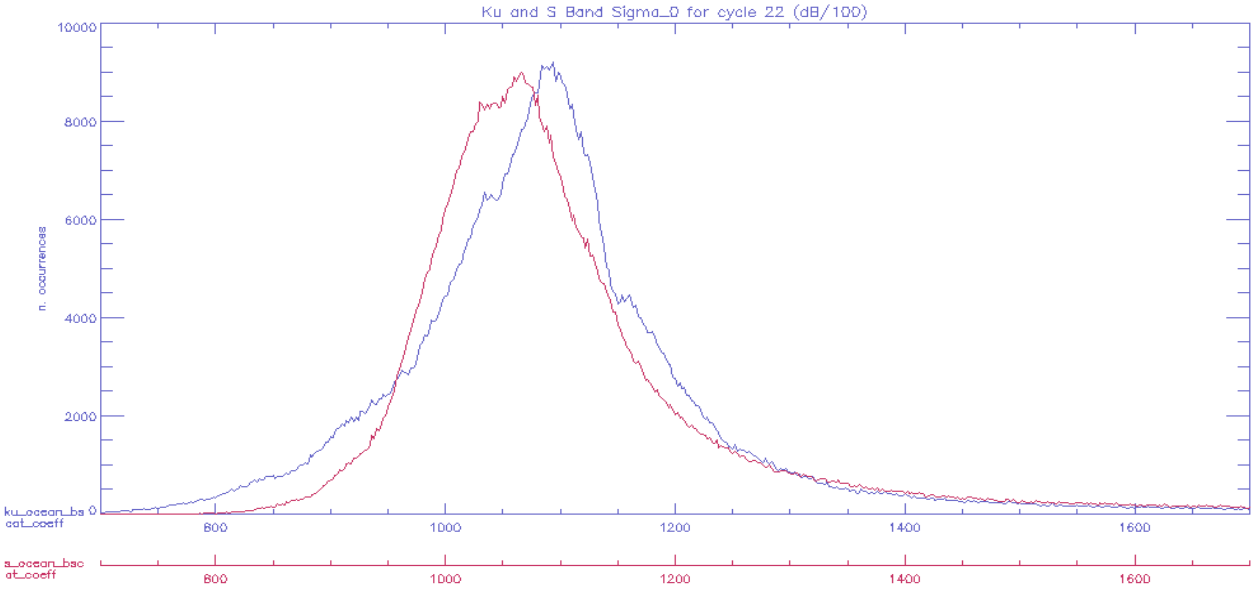


Figure 9: Histogram of Ku and S Band Backscattering Coefficient for cycle 22 (dB/100)

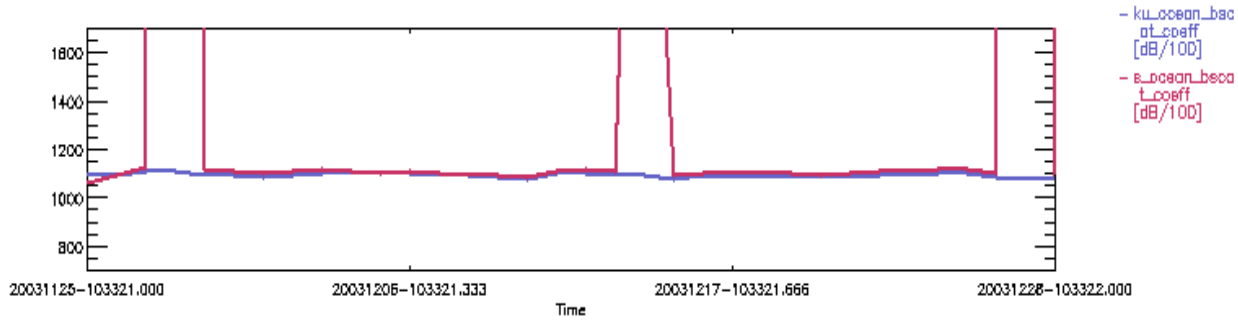


Figure 10: Ku and S Sigma_0 daily average for cycle 22 (dB/100)

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. 8.1.7). On the other hand, the average values of the S-Band backscattering for this cycle shows to be about 0.65 dBs higher than for the previous cycles. The explanation for this has been demonstrated to be the new algorithm used in IPF version 4.56 for the retrieval of the S-Band AGC from which the backscattering is then evaluated.

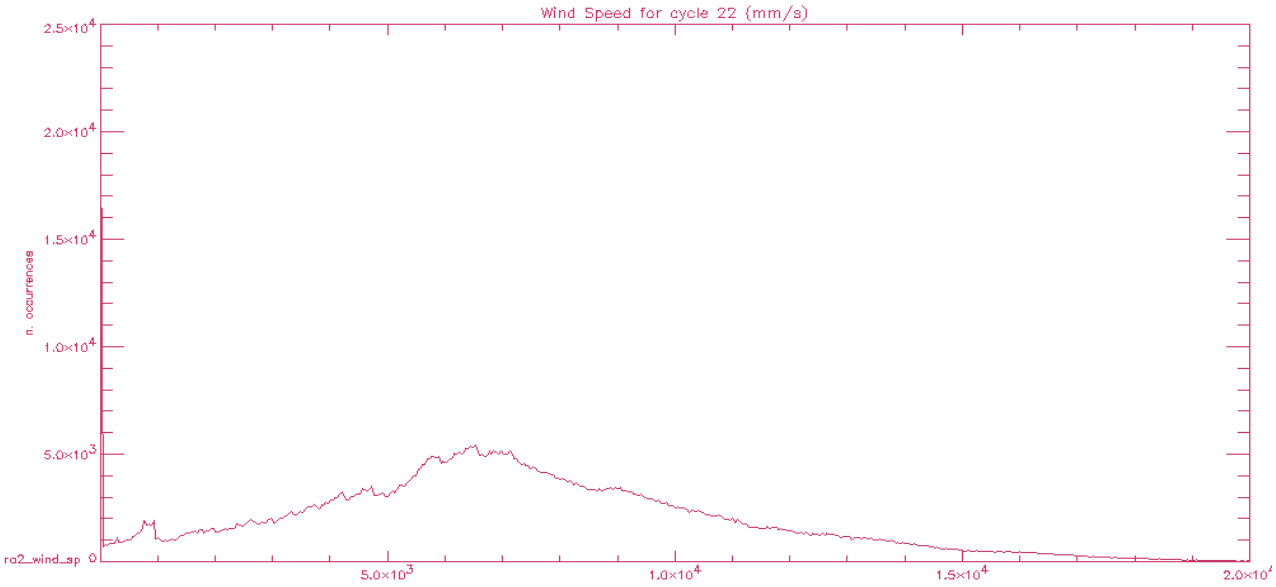


Figure 11: Histogram of Ku Wind Speed for cycle 22 (mm/s)

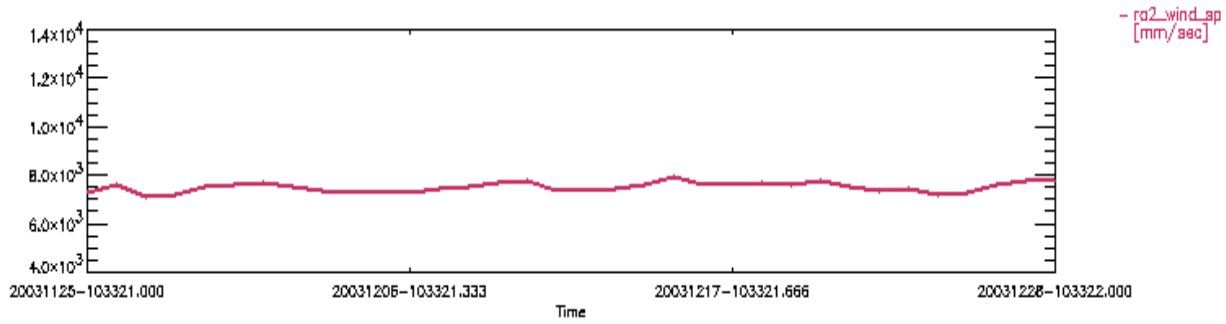


Figure 12: Wind Speed daily average for cycle 22 (mm/s)

8.3 MWR Performances

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

8.4 DORIS Performances

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

9 PRODUCT PERFORMANCES

9.1 Availability of data

In Figure 13 and Table 4 the summary of unavailable RA-2 L0 products is given. The unavailability of data caused by PLSOL (ref. 7.1) is not included in this list.

It is easy to notice that close to the Himalayan region a small gap is present daily, this is due to the daily instrument switch-off (Heater 2 mode) performed to prevent the S-Band anomaly to last more than one day.

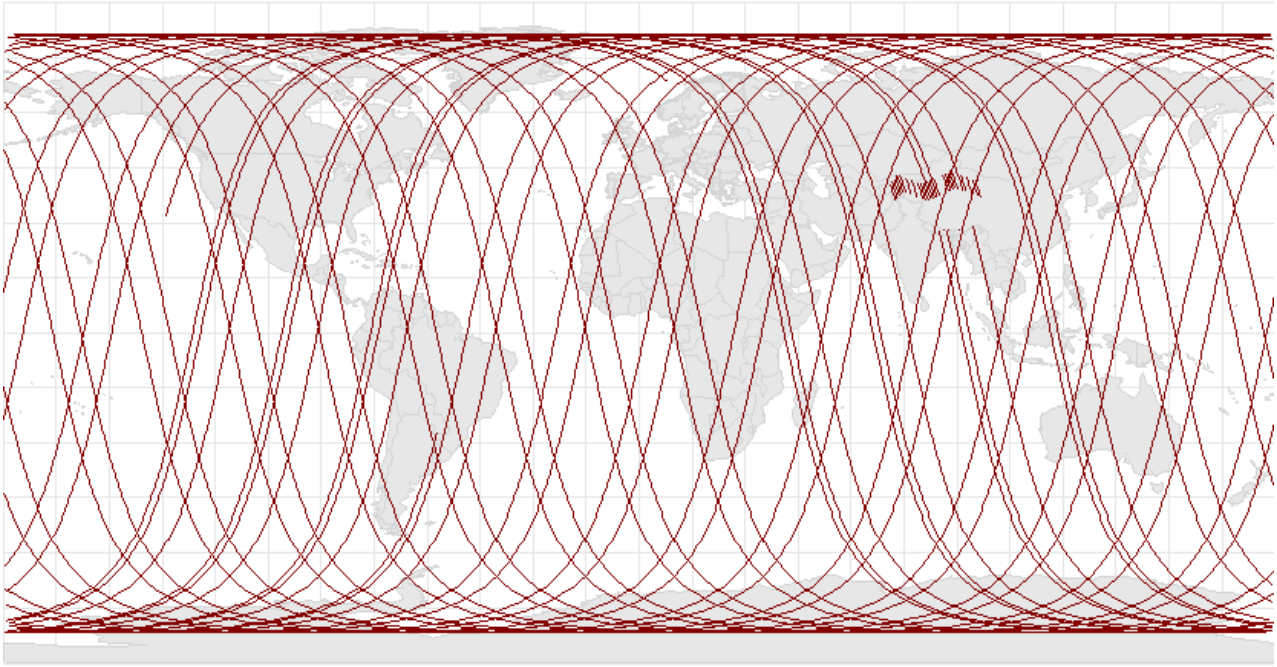


Figure 13: RA-2 L0 unavailable products for first part of cycle 22

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
25-Nov-03	16:36:43	25-Nov-03	16:38:01	78	9084	9084	PDS_UNKNOWN_FAILURE
26-Nov-03	13:31:10	26-Nov-03	13:31:20	10	9096	9096	PDS_UNKNOWN_FAILURE
26-Nov-03	13:31:20	26-Nov-03	16:02:18	9058	9096	9098	UNAV_RA2
26-Nov-03	16:04:40	26-Nov-03	19:39:35	12895	9098	9100	UNAV_RA2
27-Nov-03	15:33:55	27-Nov-03	15:35:13	78	9112	9112	PDS_UNKNOWN_FAILURE
28-Nov-03	16:42:08	28-Nov-03	16:43:25	77	9127	9127	PDS_UNKNOWN_FAILURE
29-Nov-03	16:10:23	29-Nov-03	16:11:41	78	9141	9141	PDS_UNKNOWN_FAILURE
30-Nov-03	15:39:31	30-Nov-03	15:40:49	78	9155	9155	PDS_UNKNOWN_FAILURE
01-Dec-03	15:07:22	01-Dec-03	15:08:40	78	9169	9169	PDS_UNKNOWN_FAILURE
08-Dec-03	19:58:09	09-Dec-03	09:41:53	49424	9272	9280	UNAV_RA2
09-Dec-03	09:41:53	09-Dec-03	09:42:13	20	9280	9280	UNAV_RA2
09-Dec-03	09:42:17	09-Dec-03	15:53:40	22283	9280	9284	UNAV_RA2
09-Dec-03	15:56:16	10-Dec-03	15:22:25	84369	9284	9298	UNAV_RA2
10-Dec-03	15:25:06	10-Dec-03	19:16:35	13889	9298	9300	UNAV_RA2
11-Dec-03	16:34:00	11-Dec-03	16:35:18	78	9313	9313	PDS_UNKNOWN_FAILURE
12-Dec-03	16:01:51	12-Dec-03	16:03:09	78	9327	9327	PDS_UNKNOWN_FAILURE

13-Dec-03	15:31:00	13-Dec-03	15:32:17	77	9341	9341	PDS_UNKNOWN_FAILURE
14-Dec-03	16:39:24	14-Dec-03	16:40:41	77	9356	9356	PDS_UNKNOWN_FAILURE
15-Dec-03	16:07:26	15-Dec-03	16:08:44	78	9370	9370	PDS_UNKNOWN_FAILURE
16-Dec-03	15:36:41	16-Dec-03	15:37:59	78	9384	9384	PDS_UNKNOWN_FAILURE
17-Dec-03	16:44:48	17-Dec-03	16:46:06	78	9399	9399	PDS_UNKNOWN_FAILURE
18-Dec-03	16:13:19	18-Dec-03	16:14:37	78	9413	9413	PDS_UNKNOWN_FAILURE
19-Dec-03	15:39:19	19-Dec-03	15:39:21	2	9427	9427	PDS_UNKNOWN_FAILURE
19-Dec-03	15:42:18	19-Dec-03	15:43:36	78	9427	9427	PDS_UNKNOWN_FAILURE
20-Dec-03	15:10:19	20-Dec-03	15:11:37	78	9441	9441	PDS_UNKNOWN_FAILURE
21-Dec-03	16:19:15	21-Dec-03	16:20:33	78	9456	9456	PDS_UNKNOWN_FAILURE
23-Dec-03	15:16:15	23-Dec-03	15:17:33	78	9484	9484	PDS_UNKNOWN_FAILURE
24-Dec-03	16:25:11	24-Dec-03	16:26:28	77	9499	9499	PDS_UNKNOWN_FAILURE
25-Dec-03	15:50:47	25-Dec-03	15:50:50	3	9513	9513	PDS_UNKNOWN_FAILURE
25-Dec-03	15:53:31	25-Dec-03	15:54:49	78	9513	9513	PDS_UNKNOWN_FAILURE
26-Dec-03	15:22:11	26-Dec-03	15:23:28	77	9527	9527	PDS_UNKNOWN_FAILURE
27-Dec-03	16:31:06	27-Dec-03	16:32:24	78	9542	9542	PDS_UNKNOWN_FAILURE
28-Dec-03	15:56:32	28-Dec-03	15:56:35	3	9556	9556	PDS_UNKNOWN_FAILURE
28-Dec-03	15:59:07	28-Dec-03	16:00:24	77	9556	9556	PDS_UNKNOWN_FAILURE

Table 4: List of gaps for RA-2 L0 products during cycle 22

In Figure 14 and Table 5 the summary of unavailable MWR L0 products is given. The unavailability of data caused by PLSOL (ref. 7.1) is not included in this list.

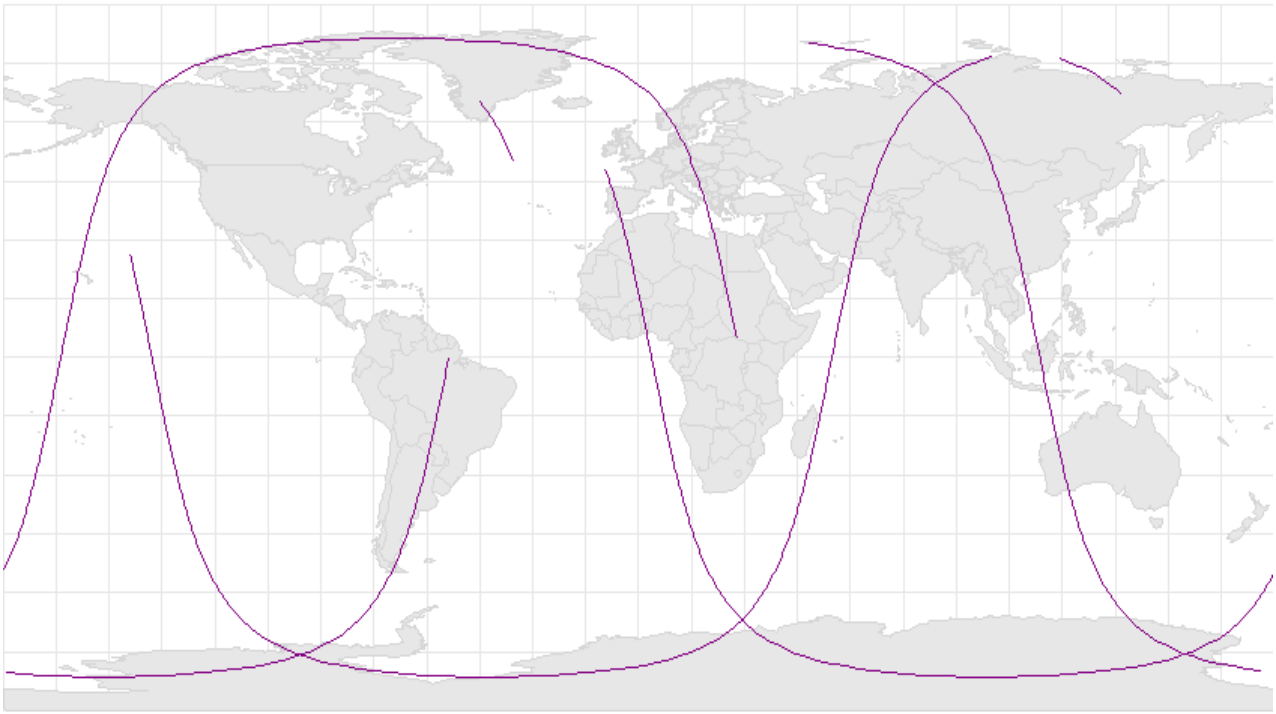


Figure 14: MWR L0 unavailable products for first part of cycle 22

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
02-Dec-03	13:34:57	02-Dec-03	14:48:57	4440	9182	9183	PDS_UNKNOWN_FAILURE
03-Dec-03	05:58:34	03-Dec-03	07:18:43	4809	9192	9193	PDS_UNKNOWN_FAILURE
04-Dec-03	20:05:47	04-Dec-03	21:58:41	6774	9215	9216	PDS_UNKNOWN_FAILURE
04-Dec-03	23:39:53	04-Dec-03	23:44:17	264	9217	9217	PDS_UNKNOWN_FAILURE
05-Dec-03	11:29:05	05-Dec-03	11:31:53	168	9224	9224	PDS_UNKNOWN_FAILURE

Table 5: List of gaps for MWR L0 products during cycle 22

In Figure 15 and Table 6 the summary of unavailable RA-2 L1b products is given. The unavailability of data caused by PLSOL (ref. 7.1) is not included in this list.

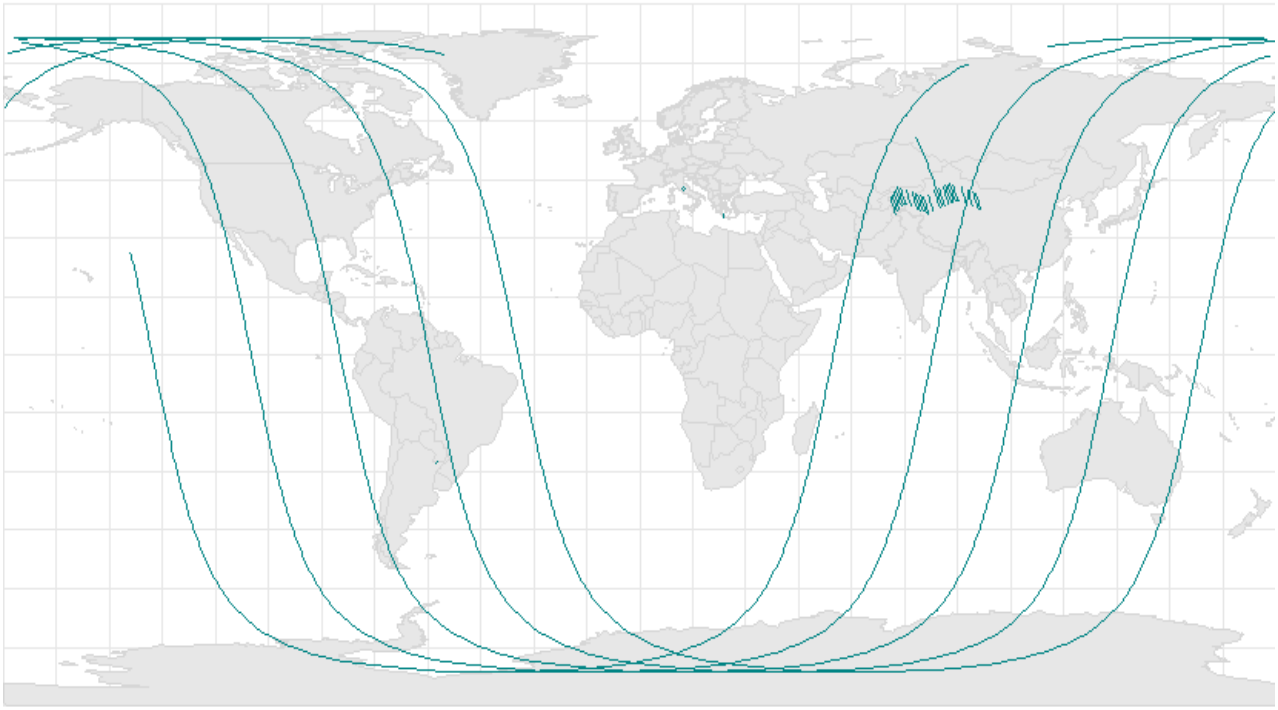


Figure 15: RA-2 L1b unavailable products for first part of cycle 22

Start date	Start time	Stop date	Stop time	Duration (s)	Start orbit	Stop orbit	Reason
25-Nov-03	16:36:43	25-Nov-03	16:38:01	78	9084	9084	PDS_UNKNOWN_FAILURE
26-Nov-03	13:31:11	26-Nov-03	13:31:20	9	9096	9096	PDS_UNKNOWN_FAILURE
26-Nov-03	22:59:06	27-Nov-03	05:46:05	24419	9102	9106	PDS_UNKNOWN_FAILURE
27-Nov-03	15:33:55	27-Nov-03	15:35:13	78	9112	9112	PDS_UNKNOWN_FAILURE
27-Nov-03	20:36:32	27-Nov-03	20:36:47	15	9115	9115	PDS_UNKNOWN_FAILURE
28-Nov-03	16:42:08	28-Nov-03	16:43:25	77	9127	9127	PDS_UNKNOWN_FAILURE
29-Nov-03	16:10:23	29-Nov-03	16:11:41	78	9141	9141	PDS_UNKNOWN_FAILURE
30-Nov-03	15:39:31	30-Nov-03	15:40:49	78	9155	9155	PDS_UNKNOWN_FAILURE
01-Dec-03	15:07:22	01-Dec-03	15:08:40	78	9169	9169	PDS_UNKNOWN_FAILURE

02-Dec-03	16:16:18	02-Dec-03	16:17:35	77	9184	9184	PDS_UNKNOWN_FAILURE
03-Dec-03	05:59:22	03-Dec-03	07:18:43	4761	9192	9193	PDS_UNKNOWN_FAILURE
06-Dec-03	15:50:41	06-Dec-03	15:55:52	311	9241	9241	PDS_UNKNOWN_FAILURE
11-Dec-03	16:34:00	11-Dec-03	16:35:18	78	9313	9313	PDS_UNKNOWN_FAILURE
12-Dec-03	16:01:51	12-Dec-03	16:03:09	78	9327	9327	PDS_UNKNOWN_FAILURE
13-Dec-03	15:31:00	13-Dec-03	15:32:17	77	9341	9341	PDS_UNKNOWN_FAILURE
14-Dec-03	16:39:24	14-Dec-03	16:40:41	77	9356	9356	PDS_UNKNOWN_FAILURE
14-Dec-03	19:59:57	14-Dec-03	20:00:21	24	9358	9358	PDS_UNKNOWN_FAILURE
15-Dec-03	16:07:26	15-Dec-03	16:08:44	78	9370	9370	PDS_UNKNOWN_FAILURE
16-Dec-03	15:36:41	16-Dec-03	15:37:59	78	9384	9384	PDS_UNKNOWN_FAILURE
16-Dec-03	20:39:21	16-Dec-03	20:39:35	14	9387	9387	PDS_UNKNOWN_FAILURE
17-Dec-03	16:44:48	17-Dec-03	16:46:06	78	9399	9399	PDS_UNKNOWN_FAILURE
18-Dec-03	16:13:19	18-Dec-03	16:14:37	78	9413	9413	PDS_UNKNOWN_FAILURE
19-Dec-03	15:42:18	19-Dec-03	15:43:36	78	9427	9427	PDS_UNKNOWN_FAILURE
20-Dec-03	15:10:19	20-Dec-03	15:11:37	78	9441	9441	PDS_UNKNOWN_FAILURE
21-Dec-03	16:19:15	21-Dec-03	16:20:33	78	9456	9456	PDS_UNKNOWN_FAILURE
22-Dec-03	15:47:54	22-Dec-03	15:49:12	78	9470	9470	PDS_UNKNOWN_FAILURE
23-Dec-03	15:16:15	23-Dec-03	15:17:33	78	9484	9484	PDS_UNKNOWN_FAILURE
24-Dec-03	16:25:11	24-Dec-03	16:26:28	77	9499	9499	PDS_UNKNOWN_FAILURE
25-Dec-03	15:53:31	25-Dec-03	15:54:49	78	9513	9513	PDS_UNKNOWN_FAILURE
26-Dec-03	15:22:11	26-Dec-03	15:23:28	77	9527	9527	PDS_UNKNOWN_FAILURE
27-Dec-03	16:31:06	27-Dec-03	16:32:24	78	9542	9542	PDS_UNKNOWN_FAILURE
28-Dec-03	15:59:07	28-Dec-03	16:00:24	77	9556	9556	PDS_UNKNOWN_FAILURE
29-Dec-03	15:28:05	29-Dec-03	15:29:23	78	9570	9570	PDS_UNKNOWN_FAILURE

Table 6: List of gaps for RA-2 L1b products during cycle 22

9.2 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 7: Editing criteria for RA-2 parameters statistics

9.3 Product disclaimer

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

9.4 Data handling recommendations

9.4.1 SEA-ICE FLAG

The following algorithm is proposed for the determination of a sea-ice flag. (See [R – 15]):

|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

9.4.2 OCEAN S-BAND ANOMALIES DETECTION

An algorithm useful to detect the Level 2 DSR affected by the RA-2 S-Band anomaly is proposed in [R- 12]. This is only valid for data acquired over open-ocean.

9.4.3 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.

9.4.4 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 which has been updated in IPF version 4.56 to be more coherent with the real functioning of the instrument.

For this reason the user is suggested to add an average value of 0.65 dBs to the old software versions S-Band Sigma0 in order to be in line with the new version.

9.5 Wind & Wave quality assessment

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

10 INSTRUMENT LONG TERM MONITORING

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

11 PARTICULAR INVESTIGATIONS

During cycle 22 particular attention has been taken in analyzing the data after the series of anomalies occurred at the end of November/beginning of December 2003, the results of this have been described in [A – 1].
On the other hand, also the analysis of the data just after the operational up-load of the IPF version 4.56 required a special care. Two peculiarities have been noticed for those data (ref. 8.1.6 and 8.2.3) and explained.