



Envisat GDR Quality Assessment Report

Cycle 025

08-03-2004 12-04-2004

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1 Introduction. Document overview

The purpose of this document is to report the major features of the data quality from the ocean Envisat mission. The document is associated with data dissemination on a cycle by cycle basis.

The objectives of this document are :

- To provide a data quality assessment
- To provide users with necessary information for data processing
- To report any change likely to impact data quality at any level, from instrument status to software configuration
- To present the major useful results for the current cycle

It is divided into the following topics:

General quality assessment and cycle overview
CALVAL main results

2 Cycle overview

2.1 Data and software version

This cycle has been produced with the IPF processing chain V4.56 and the CMA Reference Software V6.3 and V6.3_01.

2.2 Parameters

The parameters used to compute the sea surface height (SSH) for Envisat are:

- Ku range (ocean retracking)
- POE orbit
- Dual frequency ionospheric correction
- MWR derived wet troposphere correction
- ECMWF dry tropospheric correction
- Non parametric sea state bias
- Inverted barometer correction with time varying pressure
- Total geocentric GOT00 ocean tide height
- Geocentric pole tide height
- Solid earth tide height

2.3 Warnings and recommendations

9 passes are missing due to level1 B data unavailability (see [section 3.1](#)).

17 passes have no radiometer correction (see [section 3.3](#)).

As mentioned by J. Benveniste (internet communication, 9 nov 2002) an anomaly occasionally occurs on the S-Band. Consequently the Dual Frequency ionosphere correction is not available during these periods. 39 passes are impacted by the S-Band anomaly (see [section 3.3](#)).

2.4 Platform and instrument events

Orbit Maintenance Maneuver (2004/04/07 20:05:30 to 2004/04/07 22:05:34)

2.5 Cycle quality and performances

Good general results are obtained for this cycle of data.

The crossover standard deviation is 7.41 cm rms when using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes ($> |50|$ deg). The standard deviation of Sea Level Anomalies (SLA) relative to the CLS01V1 Mean Sea Surface is 10.6 cm. When using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes ($> |50|$ deg) it lowers to 9.5.

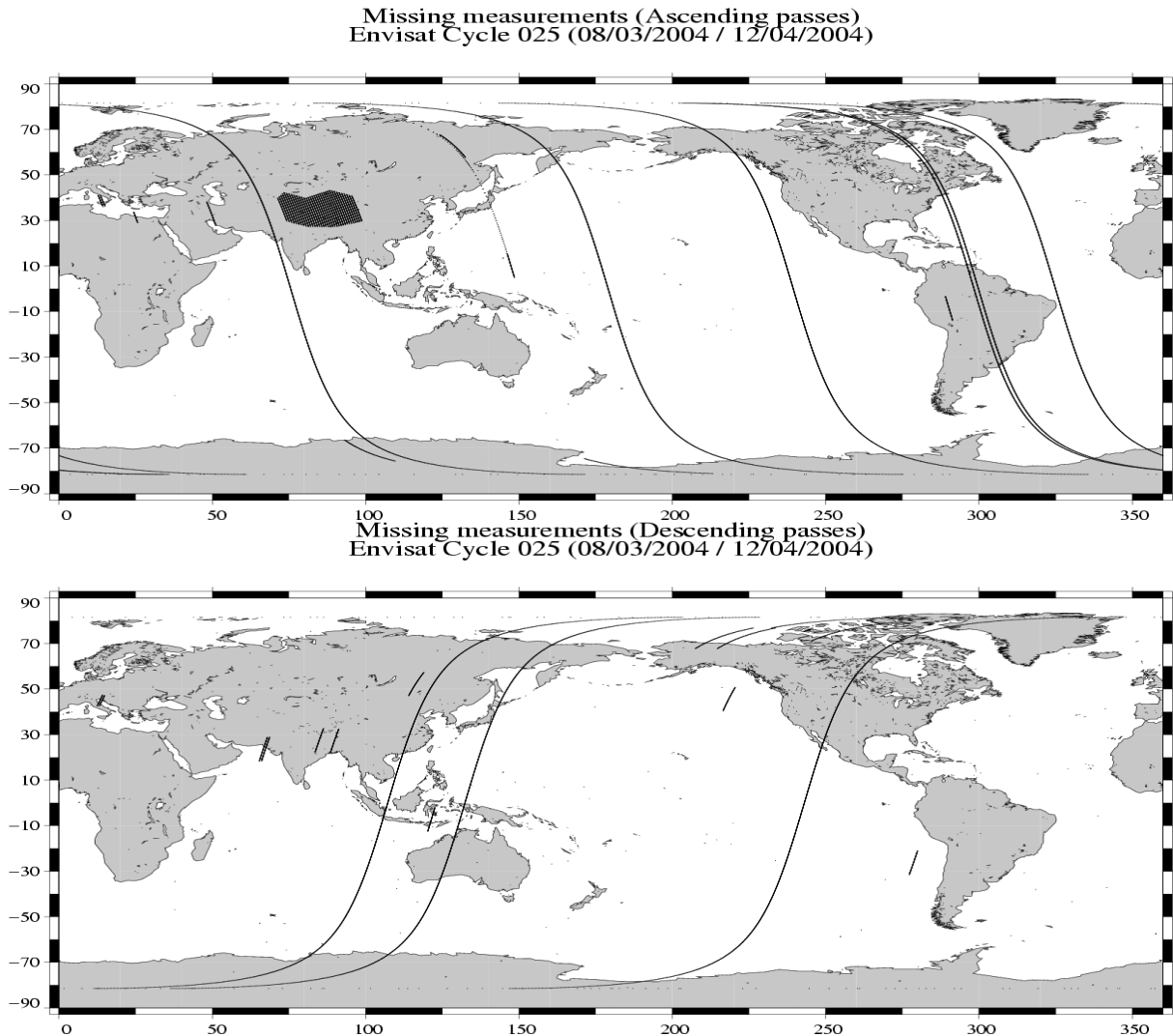
Detailed CALVAL results are presented in [section 3](#).

3 CALVAL main results

This section presents results that illustrate data quality during this cycle. These verification products are produced operationally so that they allow systematic monitoring of the main relevant parameters.

3.1 Missing measurements

2679520 are present, and 35374 (1.3%) are missing. The maps below illustrate missing 1Hz measurements in the GDRs, with respect to a 1 Hz sampling of a nominal repeat track.



9 passes are missing due to either to LRAC_PDHSs data generation to level1 problems or ingestion pbs on F-PAC side.

3.2 Orbit quality

3.2.1 Manoeuvres

On the 7th April 2004, a 1-burn in-plane orbit maintenance manoeuvre was executed as planned.

3.2.2 Doris and Laser performances

The next table gives statistics on Doris and Laser residuals:

7-day Period	Number of Doris measurements	Number of Laser measurements	RMS of Laser measurements (cm)
08/03/2004 to 15/03/2004	33816	1299	1.74740
08/03/2004 to 15/03/2004	35699	1646	1.73980
08/03/2004 to 15/03/2004	37554	1474	1.61620
08/03/2004 to 15/03/2004	37793	2070	1.69370
08/03/2004 to 15/03/2004	36388	893	1.60590

3.2.3 Impact on SLA

The orbit quality is good for this cycle of data. No Impact is noticed on SLA.

3.3 Edited measurements

3.3.1 Statistics

Data editing is necessary to remove altimeter measurements having lower accuracy.

First, there is an editing using flags. Compared to the GDR product, two additional flags are computed:

An ice flag to detect sea ice measurements. A measurement is set to ice if, at high latitudes ($> |50|$ deg), one of the following criteria is valid:

- Number of 20Hz measurement < 17
- $|MWR - ECMWF|$ wet tropospheric correction > 10 cm
- Peakiness > 2

A S-band anomaly flag: this flag is set if $|\text{Sigma0(Ku)} - \text{Sigma0(S)}| > 5$ dB

Notice that this flag is set over land and ice, even when no S-band anomaly occurs.

Parameter	Nb rejected	% rejected
Radiometer land flag	949829	40.58
Ice flag	754009	32.22
S-Band anomaly flag	437754	18.70

Then, measurements are edited using thresholds on several parameters. These thresholds are expected to remain constant throughout the Envisat mission, so that monitoring the number of edited measurements allows a survey of data quality.

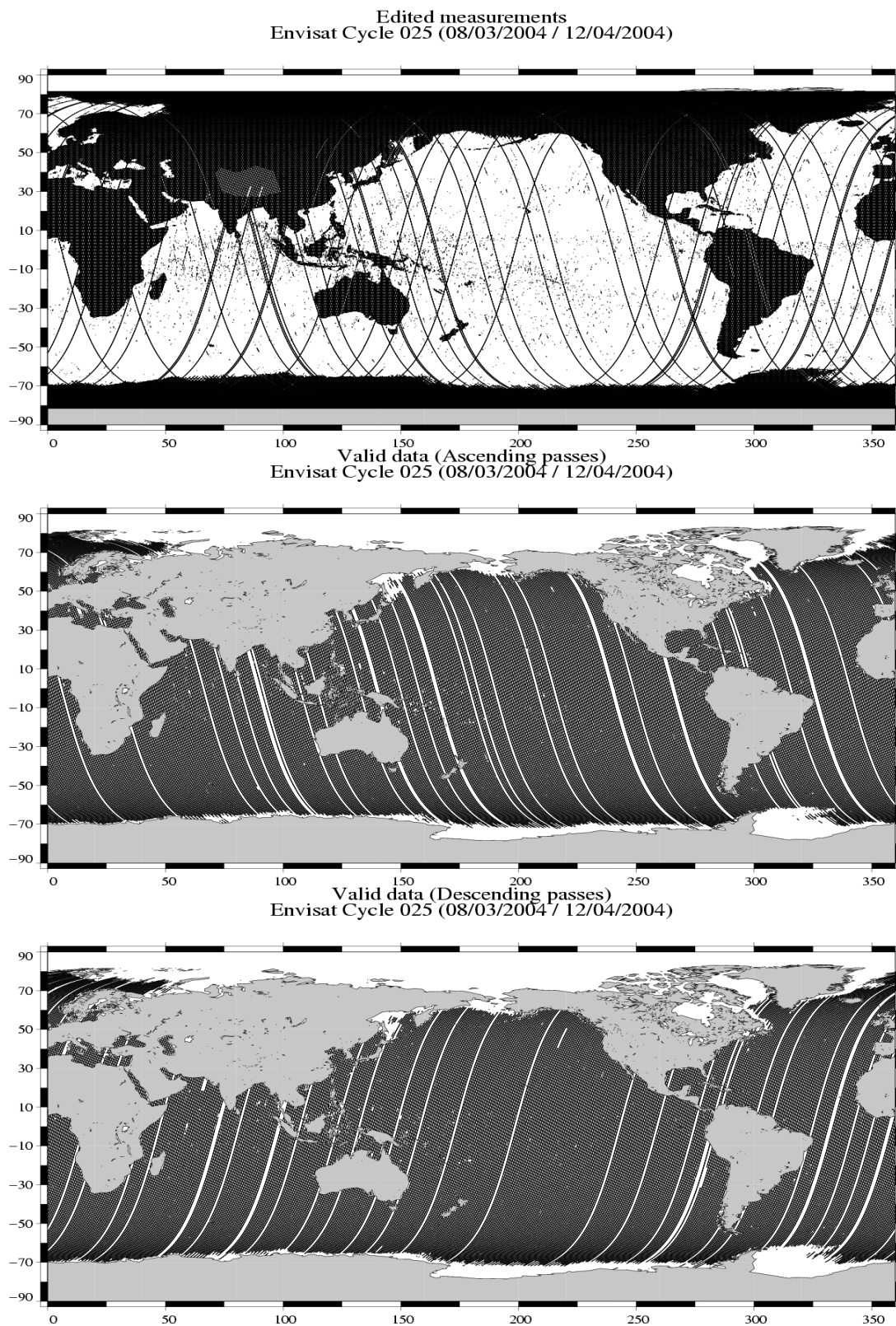
The next table gives for each tested parameter, minimum and maximum thresholds, the number and the percentage of points removed.

Parameters	Min Thres.	Max Thres.	Nb rejected	% rejected
Sea surface height (m)	-130.000	100.000	873	0.06
Variability relative to MSS (m)	-2.000	2.000	4517	0.33
Number of 18Hz valid points	10.000	-	105	0.01
Std. deviation of 18Hz range (m)	0.000	0.250	14148	1.03
Off nadir angle from waveform (deg ²)	-0.200	0.160	9964	0.73
Dry tropospheric correction (m)	-2.500	-1.900	0	0.00
Invert barometer correction (m)	-2.000	2.000	0	0.00
MWR wet tropospheric correction (m)	-0.500	-0.001	1619	0.12
Dual Ionospheric correction (m)	-0.400	0.040	3240	0.24
Significant wave height (m)	0.000	11.000	810	0.06
Sea state Bias (m)	-0.500	0.000	2121	0.15
Backscatter coefficient (dB)	7.000	30.000	1619	0.12
GOT00 ocean tide height (m)	-5.000	5.000	1060	0.08
Long period tide height (m)	-0.500	0.500	0	0.00
Earth tide (m)	-1.000	1.000	0	0.00
Pole tide (m)	-5.000	5.000	0	0.00
RA2 wind speed (m/s)	0.000	30.000	0	0.00

A final editing is then performed on corrected sea surface height, using a spline fitting procedure, leading to remove 431 (0.03 %) measurements.

3.3.2 Figures

The following maps are complementary: they show respectively the removed and selected measurements in the editing procedure.



3.3.3 Comments

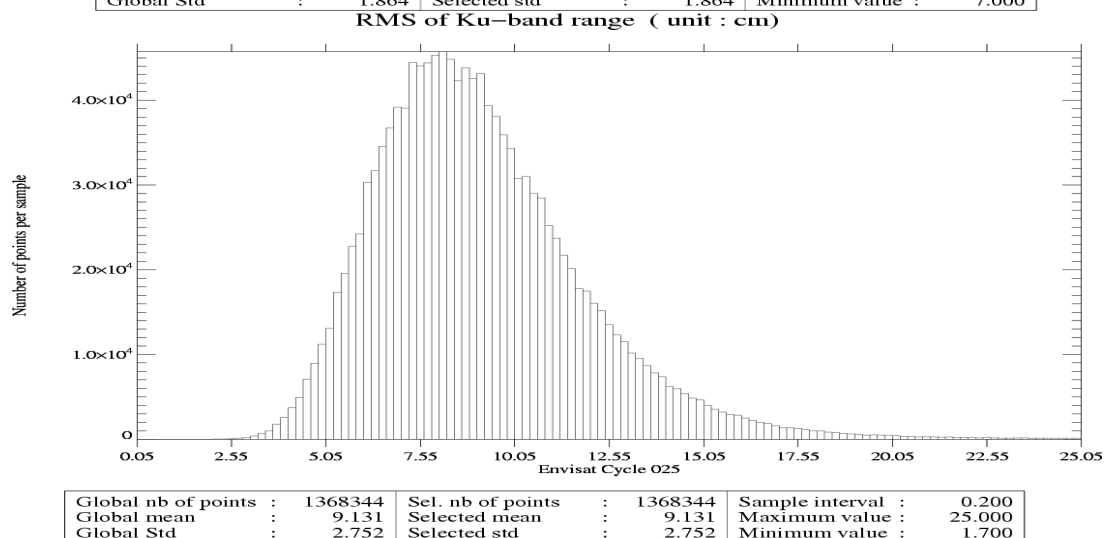
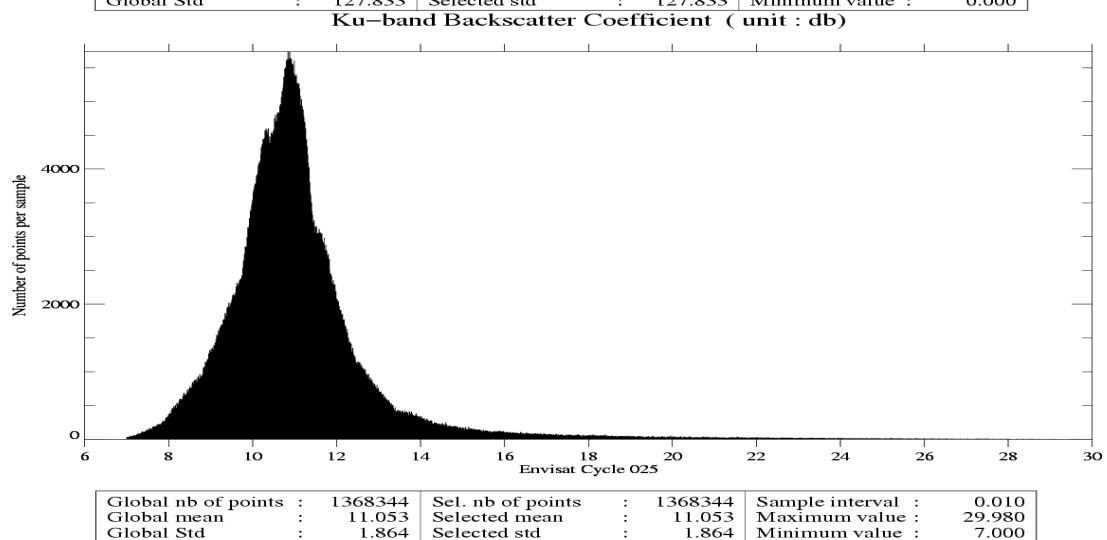
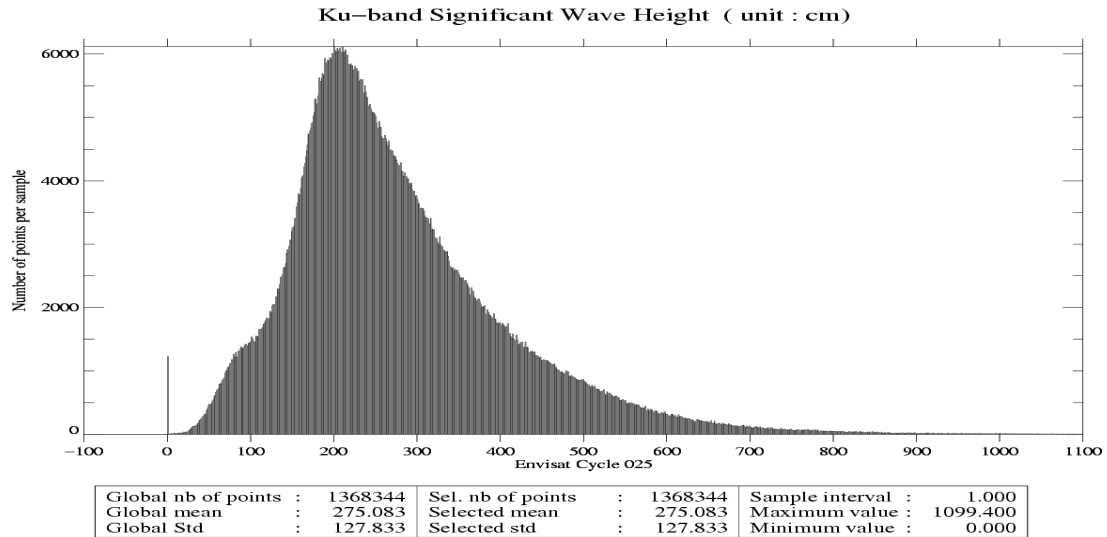
993 passes have been delivered. Among these passes:

- 17 passes are entirely edited on the radiometer land flag (no MWR correction)
- 39 passes (98 to 109, 136 to 137, 657 to 681) are edited because of S-Band anomalies. Users are advised not to use the S-Band parameters and the dual ionospheric correction on these passes.

Wet areas appear in the plot of removed data. Similar features are observed with other altimeters (T/P, Jason) mainly due to rain contamination.

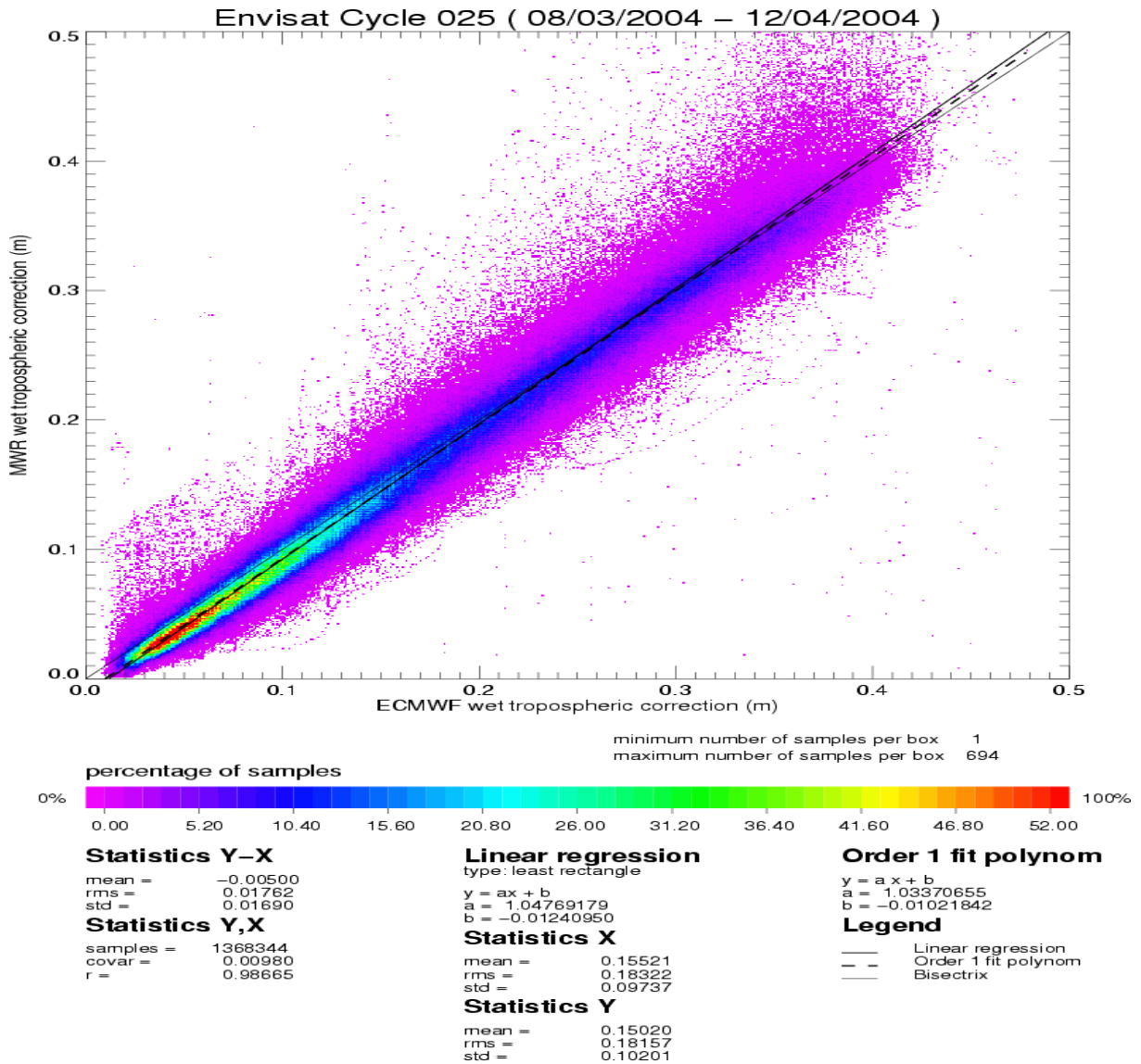
3.4 Altimeter parameters

In order to assess and to monitor altimeter parameter measurements, histograms of Envisat Ku-band Significant Wave Height (SWH), Backscatter coefficient (Sigma0) and RMS of altimeter range are computed.



3.5 Radiometer

In order to assess and to monitor radiometer measurements, a scatter plot between the radiometer wet troposphere correction and the ECMWF model is computed for the valid data set previously defined.

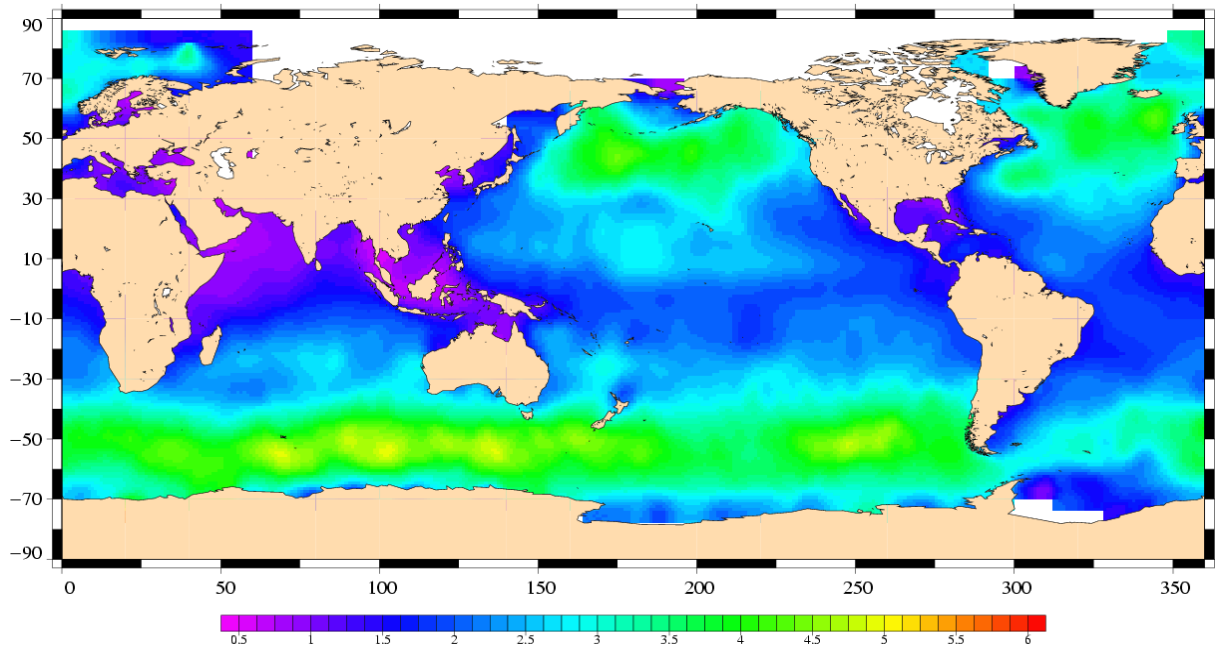


The radiometer-model mean difference is 0.5 cm. A drift on the Envisat 23.8GHz brightness temperature has been detected and has to be monitored on the long term. Note that the neural algorithm is now implemented on Envisat.

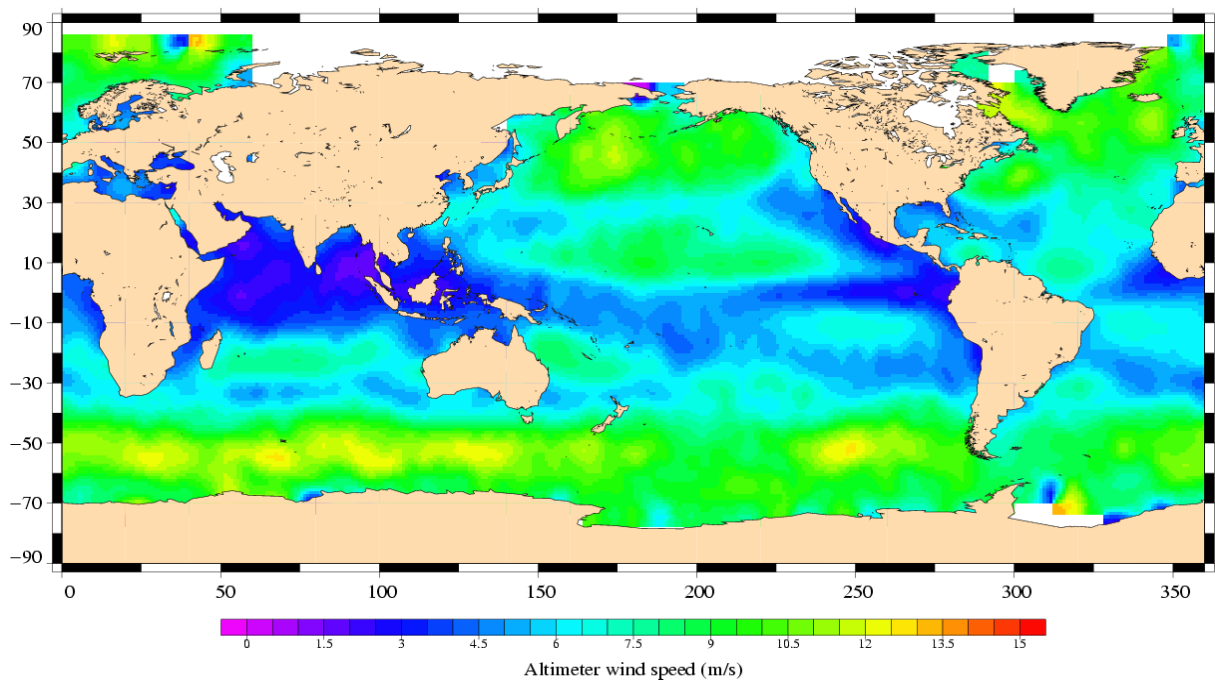
3.6 Wind and wave maps

These two figures show wind and wave estimations derived from 35 days of altimeter measurements.

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Significant Wave Height (m)
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3.7 Crossover statistics

3.7.1 General comment

SSH crossover statistics are computed from the valid data set. They are used to estimate the data quality and to monitor the system performances. After data editing and using the standard Envisat algorithms, the crossover standard deviation is about 8.62 cm rms, when using a selection to remove shallow waters (1000 m). When using an additional selection to remove areas of high ocean variability and high latitudes ($> |50|$ deg) it lowers to 7.41 cm rms. This statistic is a stable estimation of the system performance as it is not influenced by sea ice coverage.

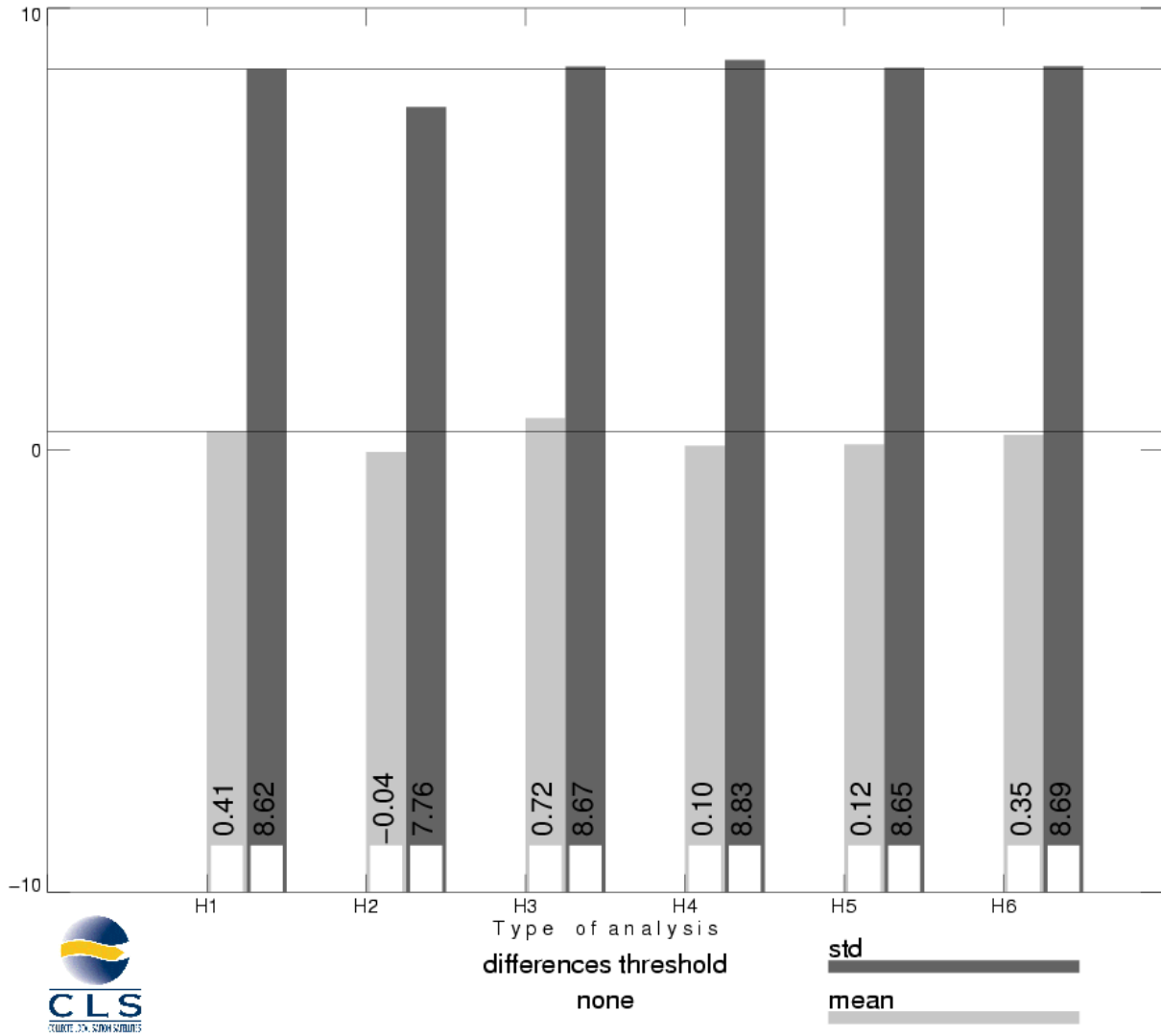
3.7.2 Impact of geophysical corrections

This figure shows the impact of geophysical corrections on crossover mean and rms. A selection is used to remove shallow waters (1000 m).

For this analysis two corrections have been computed: a long wave length and a model ionospheric correction. The long wave length estimation is performed by a global minimization of crossover differences using a (1 and 2 cycles/revolution) sinusoidal model. The model ionospheric correction is computed using the JPL's version of the GPS Ionosphere Maps (JPL GIM) thanks to the procedures provided by Remko Scharro (internet communication to the CCVT community, December 12, 2002).

ENEN – CROSSOVER STATISTICS

Impact of geophysical corrections

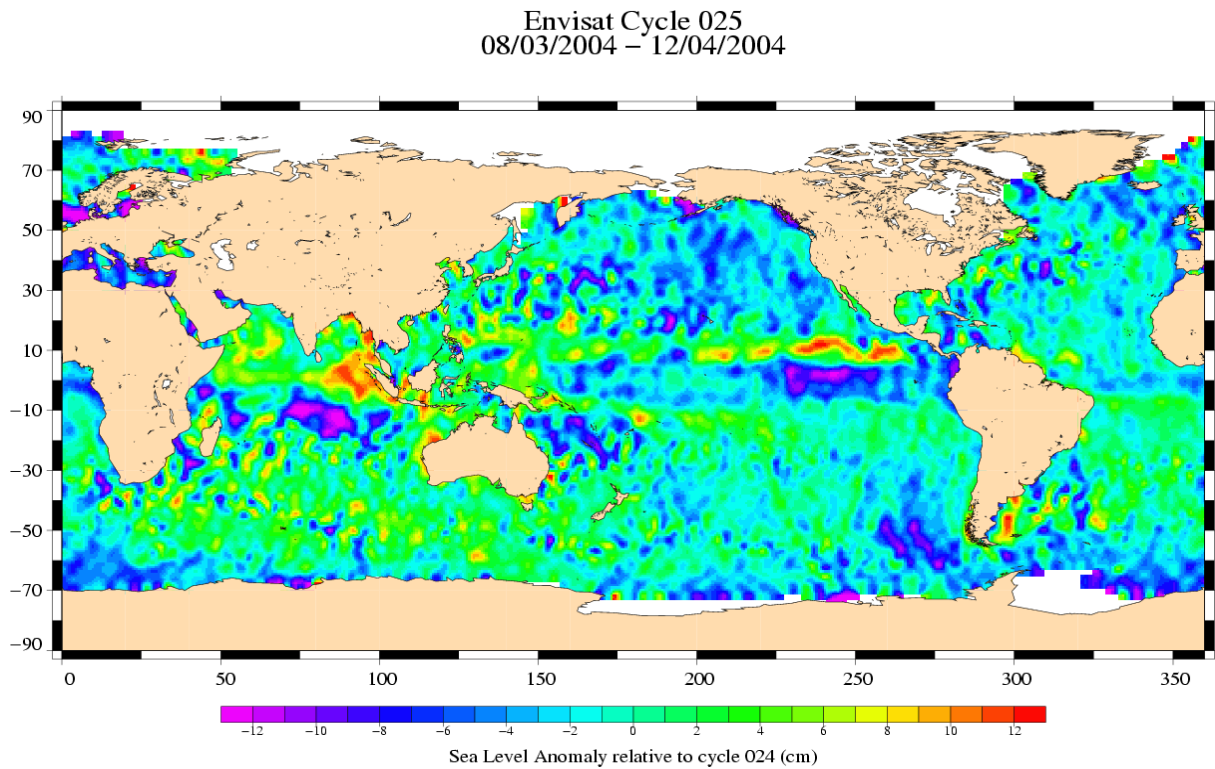


H1 = SSH	H4 = SSH with DORIS ionospheric correction (in product)
H2 = SSH applying a long wave length error (computed)	H5 = SSH with FES02 tide model (in product)
H3 = SSH with GIM ionospheric correction (computed)	H6 = SSH with ECMWF wet tropospheric correction (in product)

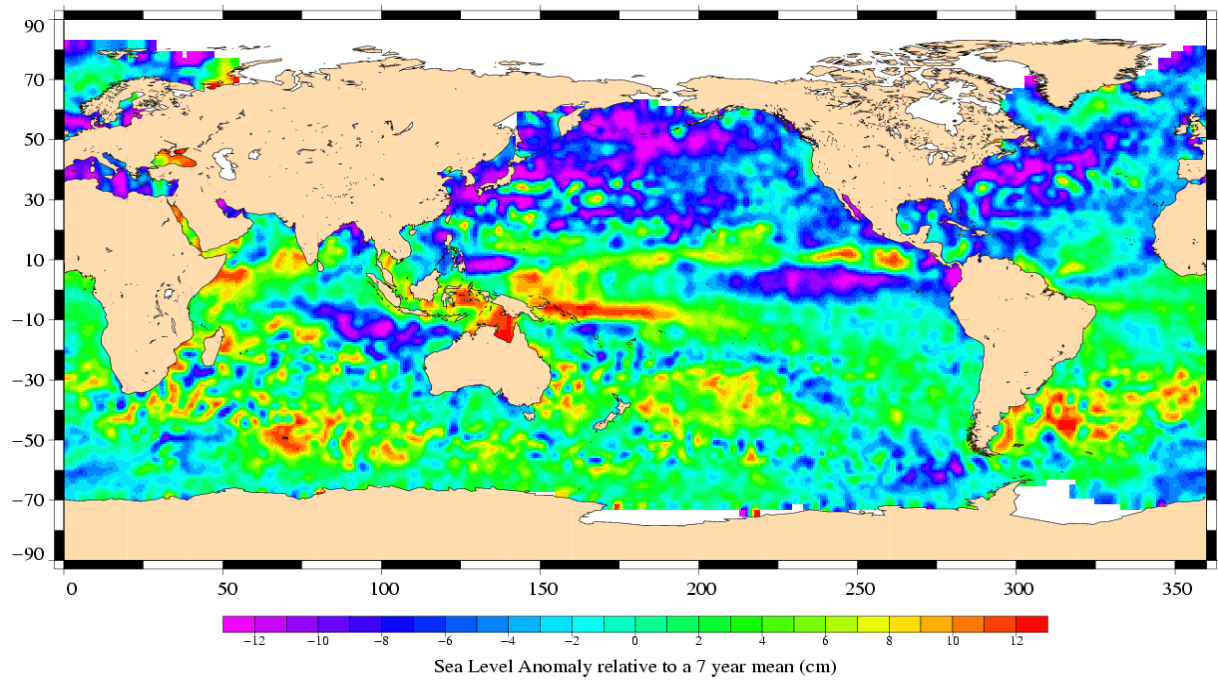
3.8 SSH variability

3.8.1 Sea Level Anomaly

Repeat-track analysis is routinely used to compute Sea Level Anomalies (SLA) relative to the previous cycle and relative to a mean profile. The mean profile has been computed using ERS-1 and ERS-2 data and has been adjusted on the 7 year TP mean profile. In order to see fine features SLA are centered about the mean value.



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3.8.2 Comparison to a precise Mean Sea Surface

The MSS from the product is used as a reference to compute SLA. Global statistics of Envisat SSH-MSS are (cm):

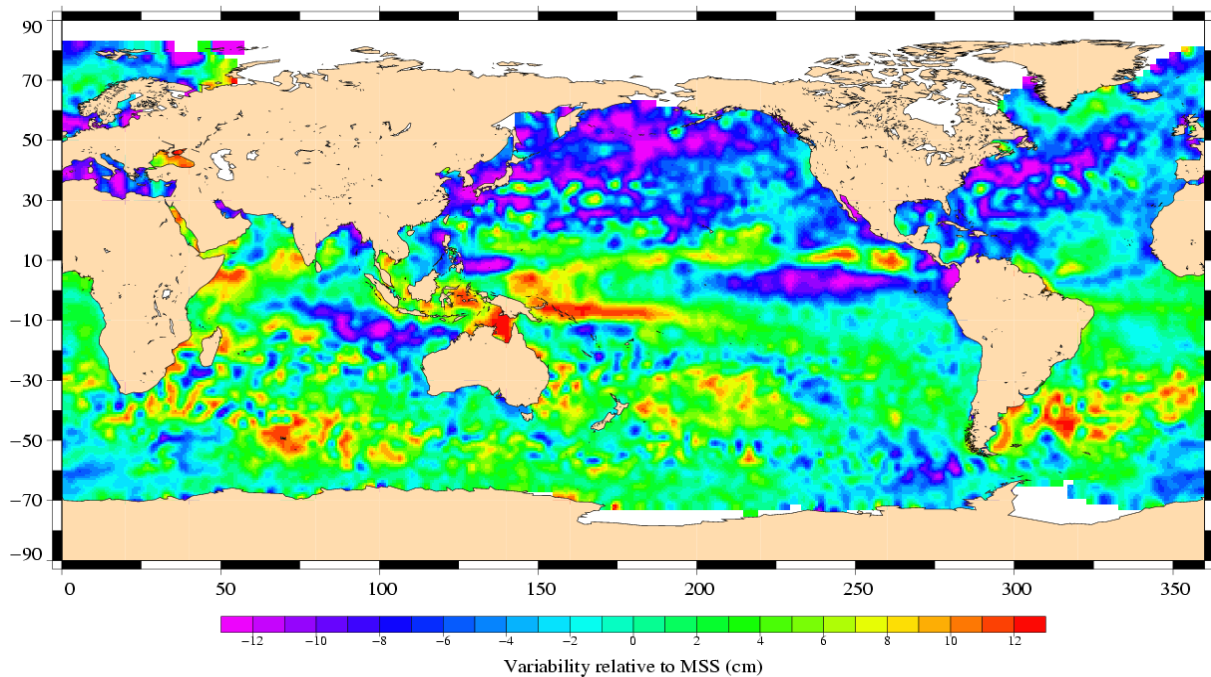
Number	Mean	Std. dev.
1534755	43.35	10.57

When using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes ($> |50|$ deg) statistics are:

Number	Mean	Std. dev.
922922	43.58	9.48

The two following maps respectively show the map of Envisat SLA relative to the MSS and differences higher than a 30 cm threshold. In order to see fine features SLA are centered about the mean value. The latter figure shows that apart from isolated measurements, higher differences are located in high ocean variability areas, as expected.

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(SSH - MSS) centered, differences greater than 30 cm
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