Jason-1 GDR
Quality Assessment Report

Cycle 039

27-01-2003 05-02-2003

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SALP-RP-P2-EX-21072-CLS039
Edition 01.0, October 2003

1 Introduction. Document overview

The purpose of this document is to report the major features of the data quality from the Jason-1 mission. The document is associated with data dissemination on a cycle by cycle basis.
This document reports results from Jason-1 GDRs.

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:

2 General quality assessment and cycle overview

2.1 Software version

This cycle has been produced with the CMA Reference Software V6.0_08. The content of this science software version is described in (Vincent et al., 2003 [1]).

2.2 Cycle quality and performances

Data quality for this cycle appears to be nominal. Analysis of crossovers and sea surface variability indicate that system performances are close to nominal values that are obtained from the TOPEX/POSEIDON data. For this cycle, the crossover standard deviation is 6.41 cm rms. When using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes (> |50| deg.) it lowers to 5.87 cm rms. The standard deviation of Sea Level Anomalies (SLA) relative to a 7-year mean (based on T/P data) is 10.40 cm.

- Performances from crossover differences are detailed in the dedicated **section Crossover statistics**.
- Detailed CALVAL results are presented in **section 4**.

2.3 Missing measurements

Pass 211 has 90% of missing measurements over ocean due to a Gyro calibration on this pass. Missing measurements relative to a nominal ground track are plotted on **section Missing measurements**.

3 Poseidon-2 altimeter and sensor

3.1 Sensor status

A detailed assessment of the Poseidon-2 sensor is made in a separate bulletin to be found on the AVISO website.

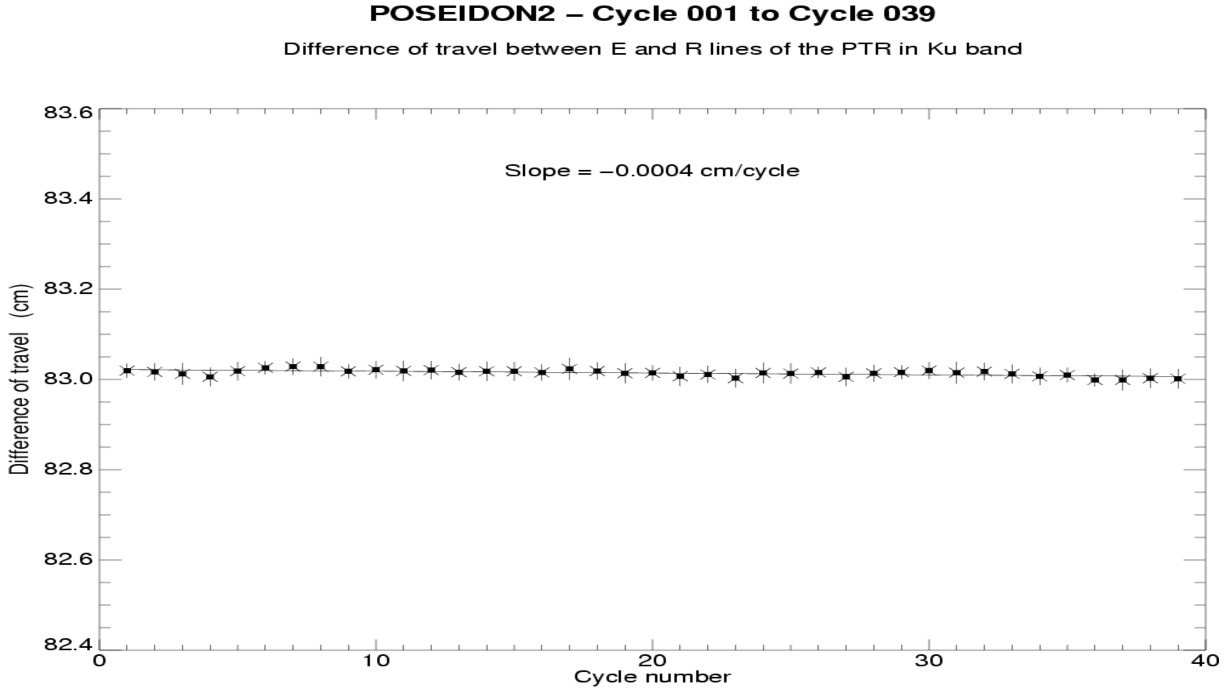
3.2 Poseidon-2 altimeter status

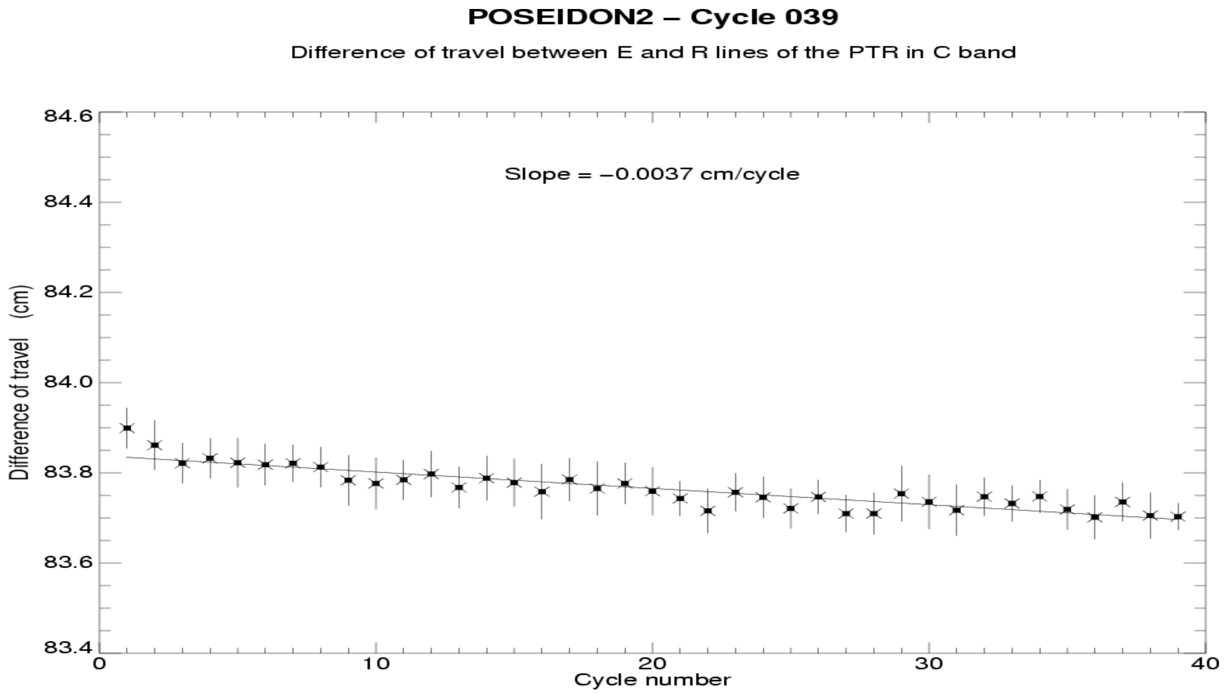
This section presents the general status of the altimeter for main instrumental variations through the Jason-1 mission. Two calibration modes are performed to monitor the altimeter internal drifts and to compute the altimetric parameters. They are programmed about three times per day, over land.
The CAL1 mode measures the Point Target Response (PTR) of the altimeter in Ku and C bands. Among the parameters extracted from the PTR are :

- the internal path delay
- the total power in the PTR

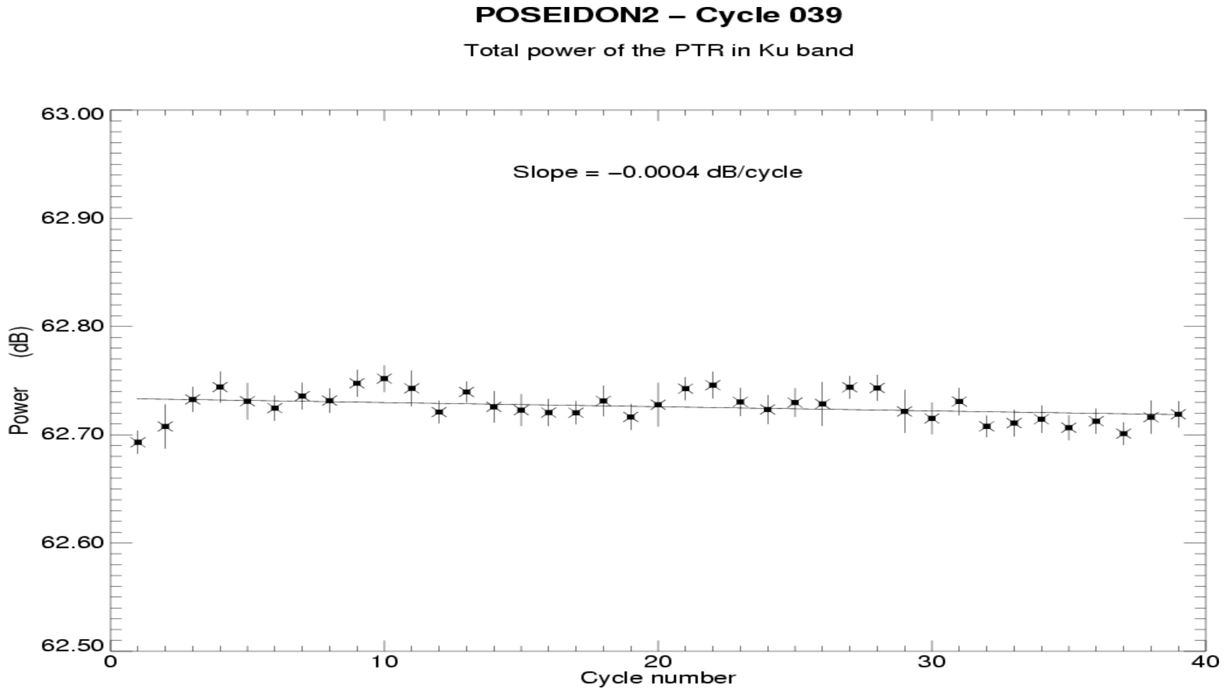
The evolutions of these parameters as a function of time are plotted to monitor the ageing of the altimeter.
Notice that in the Jason-1 products, the range is corrected for the internal path delay and the backscatter coefficient takes into account the total power of the measured PTR.

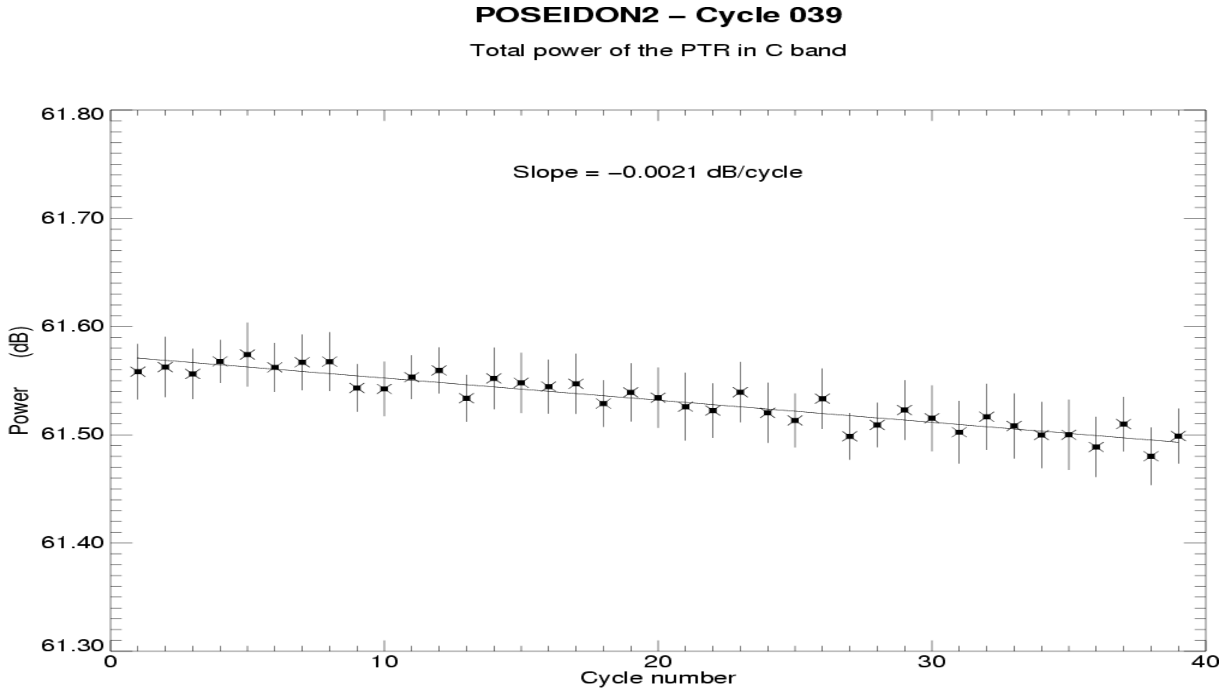
3.2.1 Monitoring of the internal path delay





3.2.2 Monitoring of the total power in the PTR



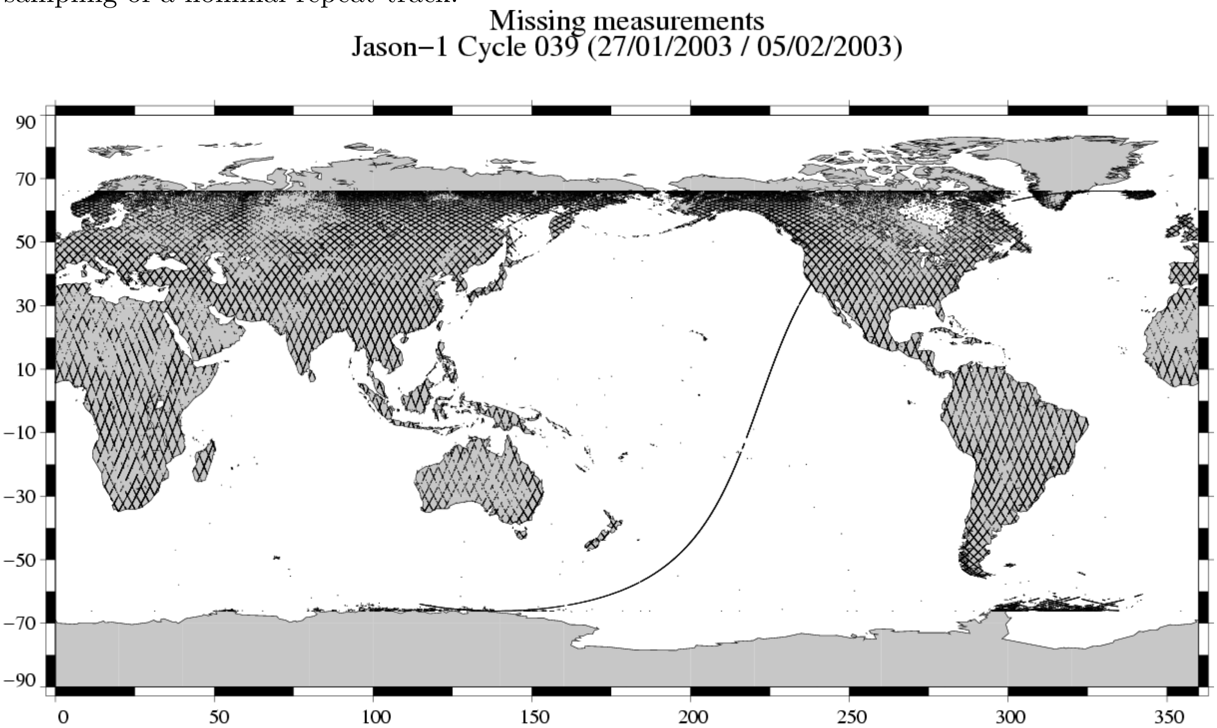


4 CALVAL main results

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.

4.1 Missing measurements

The map below illustrates missing 1Hz measurements in the GDRs, with respect to a 1 Hz sampling of a nominal repeat track.



4.2 Edited measurements

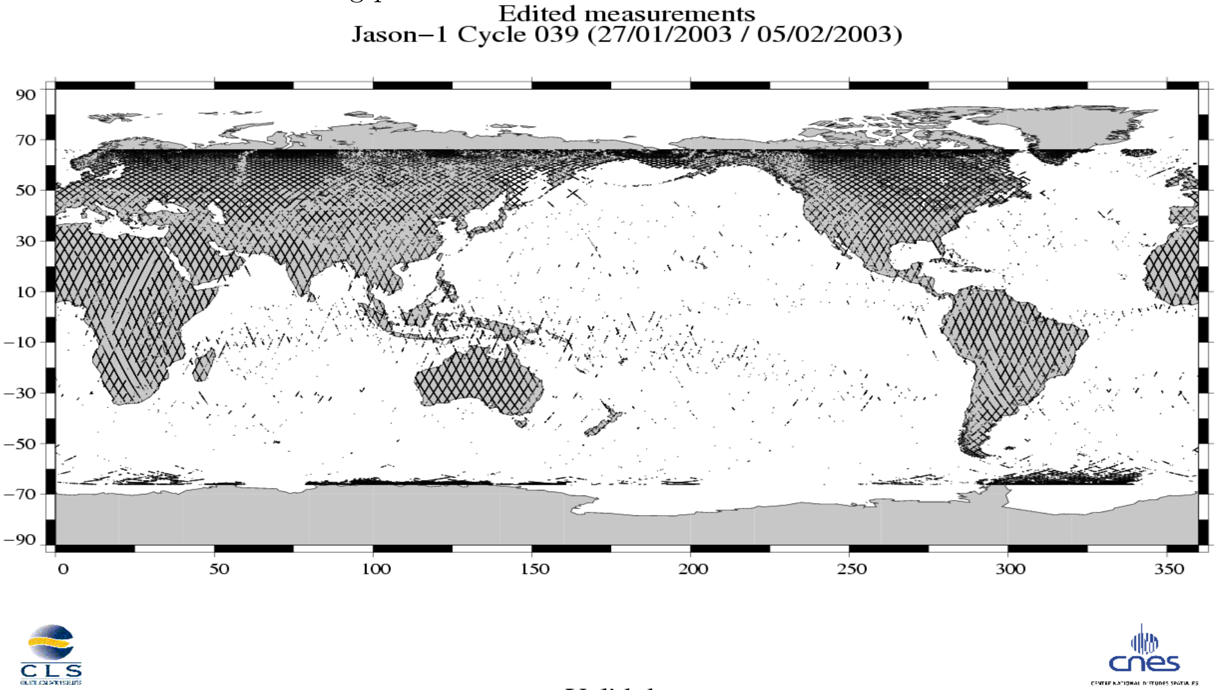
Editing criteria are defined for the GDR product in Aviso and PODAAC User Handbook [2]. The editing criteria are defined as minimum and maximum thresholds for various parameters. Measurements are edited if at least one parameter does not lie within those thresholds. These thresholds are expected to remain constant throughout the Jason-1 mission, so that monitoring the number of edited measurements allows a survey of data quality.
In the following, the altimeter state flag (alt_state_flag) is used instead of the radiometer state flag (rad_state_flag). Indeed, this allows to keep more data near the coasts and then to detect potential anomalies in these areas. Furthermore, there is no impact on global performance estimations since the more significant results are derived from analyses in open ocean areas.
The rain flag is not used for data selection since it is not yet tuned.

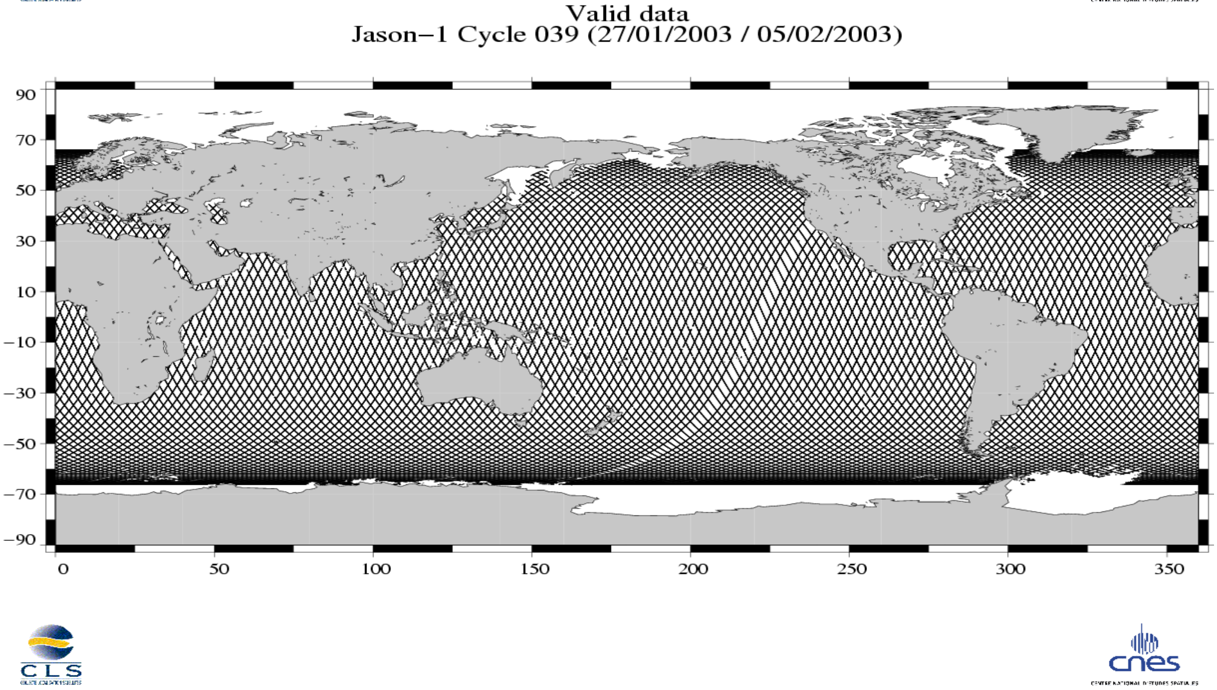
The number and percentage of points removed by each criterion is given on the following table. Note that these statistics are obtained with measurements already edited for altimeter land flag (17.34 % of points removed) and ice flag (6.44 % of points removed).

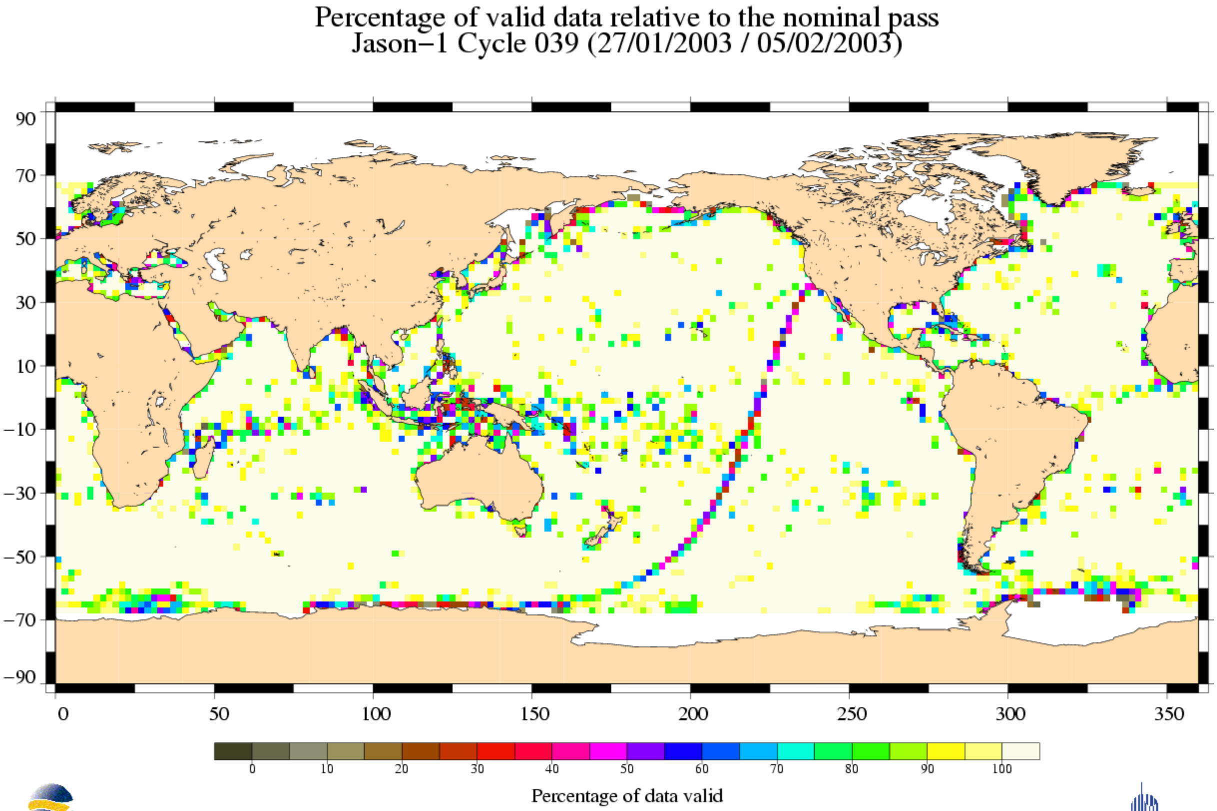
Parameters	Min threshold	Max threshold	Unit	Nb removed	% removed
Sea surface height	-130.000	100.000	m	8724	1.55
Sea level anomaly	-10.000	10.000	m	11635	2.07
Nb measurements of range	10.000	_	_	10537	1.88
Std. deviation of range	0.000	0.200	m	10884	1.94
Square off nadir angle	-0.200	0.160	deg^2	9211	1.64
Dry tropospheric correction	-2.500	-1.900	m	51	0.01
Inverted barometer correction	-2.000	2.000	m	33	0.01
JMR wet tropospheric correction	-0.500	-0.001	m	786	0.14
Ionospheric correction	-0.400	0.040	m	9716	1.73
Significant wave height	0.000	11.000	m	7188	1.28
Sea State Bias	-0.500	0.000	m	7179	1.28
Backscatter coefficient	7.000	30.000	dB	6264	1.12
Ocean tide	-5.000	5.000	m	4520	0.81
Equilibrium tide	-0.500	0.500	m	0	0.00
Earth tide	-1.000	1.000	m	0	0.00
Pole tide	-15.000	15.000	m	0	0.00
Altimeter wind speed	0.000	30.000	$m.s^{-1}$	7925	1.41
Global statistics of edited measurements by thresholds	_	_	_	17865	3.18

4.2.1 Figures

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






Percentage of valid data relative to the nominal pass
Jason−1 Cycle 039 (27/01/2003 / 05/02/2003)
90
70
50
30
10
−10
−30
−50
−70
−90
0
50
100
150
200
250
300
350
0
10
20
30
40
50
60
70
80
90
100
Percentage of data valid

4.2.2 Comments

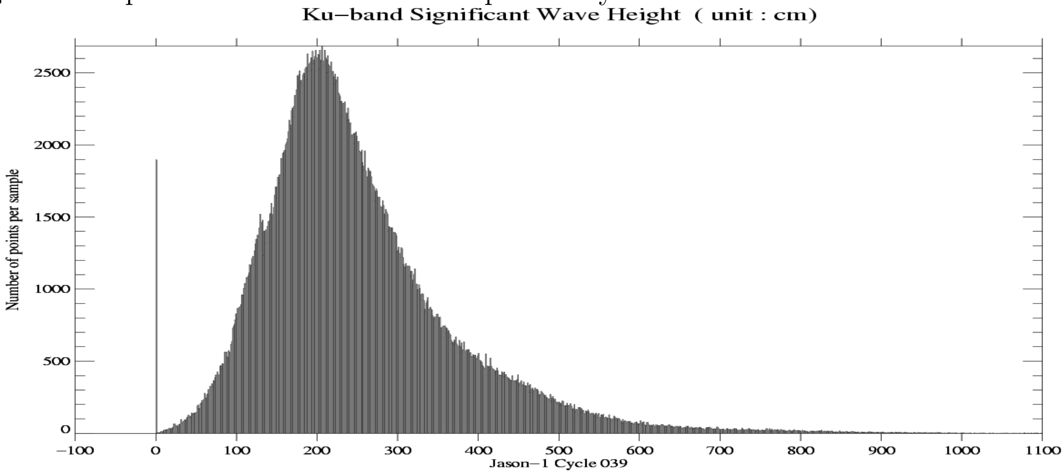
For the purpose of this quality assessment report, the GOT99.2 GDR field tide model has been replaced by GOT99.3 since the former is not available over the Black Sea, the Caspian and the Baltic sea.

Wet zones appear in the plot of removed data, as it was also the case for Topex and Poseidon altimeters: measurements may be corrupted by rain.

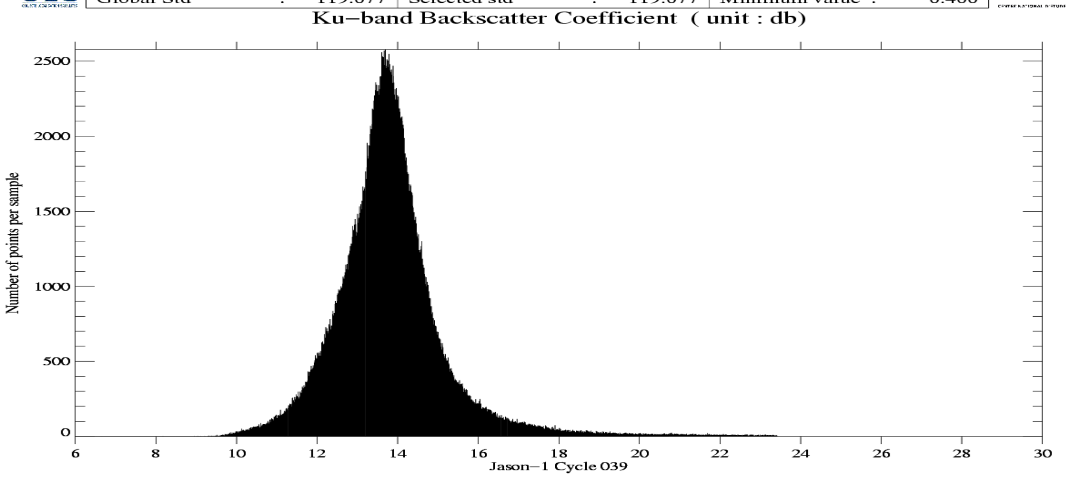
Compared with the usual maps obtained for Topex, there are less removed data in these zones and in the areas of strong sea states.

4.3 Altimeter parameters

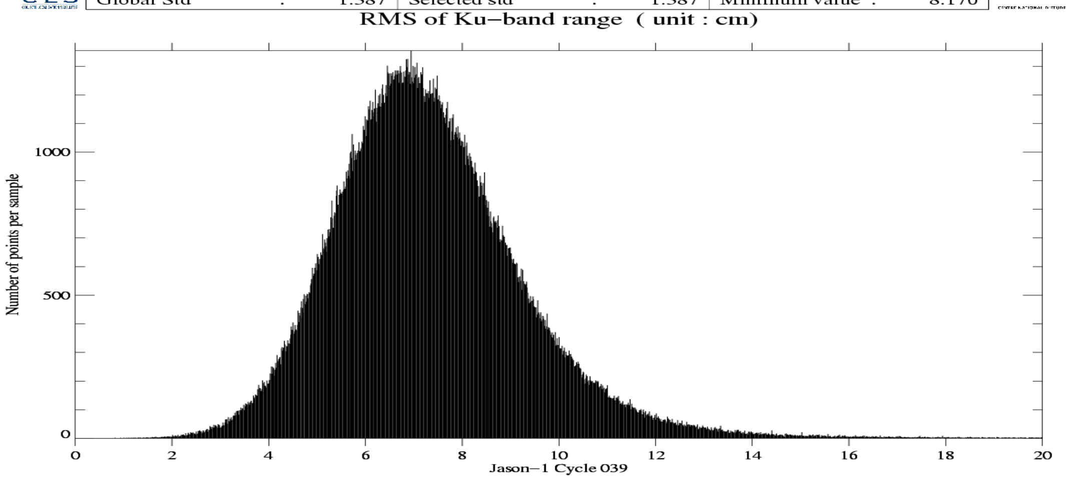
In order to assess and to monitor altimeter parameter measurements, histograms of Jason-1 Ku-band Significant Wave Height (SWH), Backscatter coefficient (Sigma0) and RMS of altimeter range are computed for the valid data set previously defined.



Global nb of points	:	543760	Sel. nb of points	:	543760	Sample interval	:	1.000
Global mean	:	250.291	Selected mean	:	250.291	Maximum value	:	1099.700
Global Std	:	119.077	Selected std	:	119.077	Minimum value	:	0.400



Global nb of points	:	543760	Sel. nb of points	:	543760	Sample interval	:	0.010
Global mean	:	13.798	Selected mean	:	13.798	Maximum value	:	23.430
Global Std	:	1.387	Selected std	:	1.387	Minimum value	:	8.170



Global nb of points	:	543760	Sel. nb of points	:	543760	Sample interval	:	0.010
Global mean	:	7.291	Selected mean	:	7.291	Maximum value	:	20.000
Global Std	:	1.921	Selected std	:	1.921	Minimum value	:	0.820

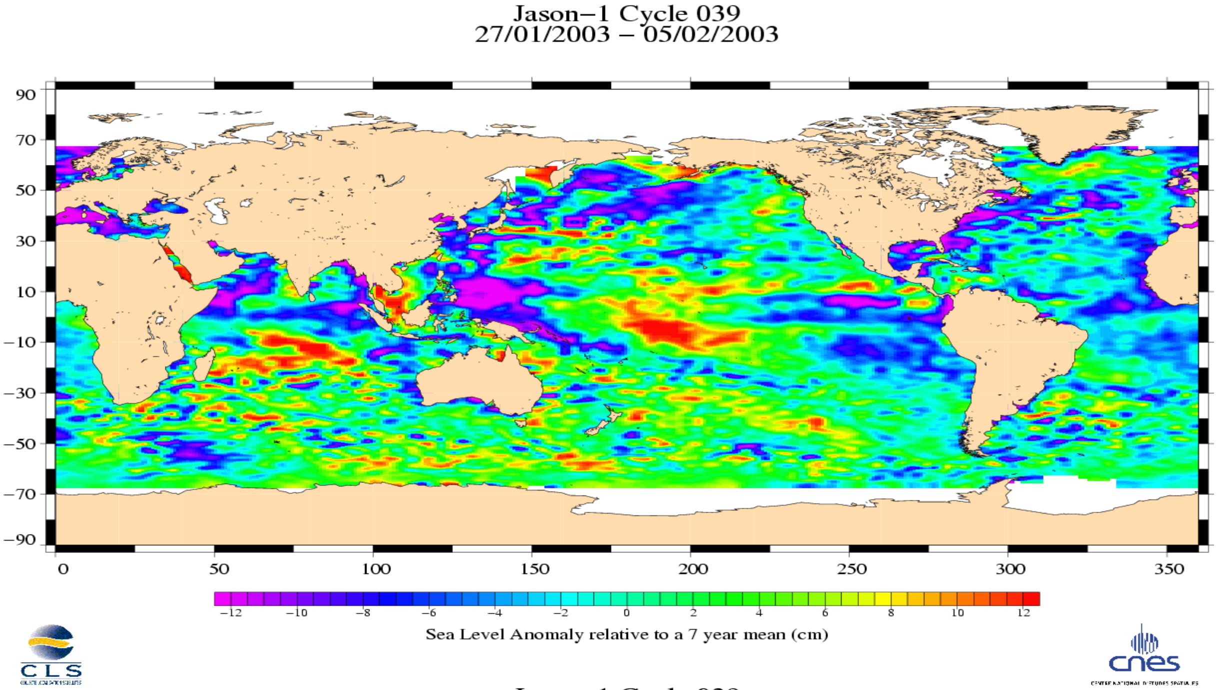
4.4 Crossover statistics

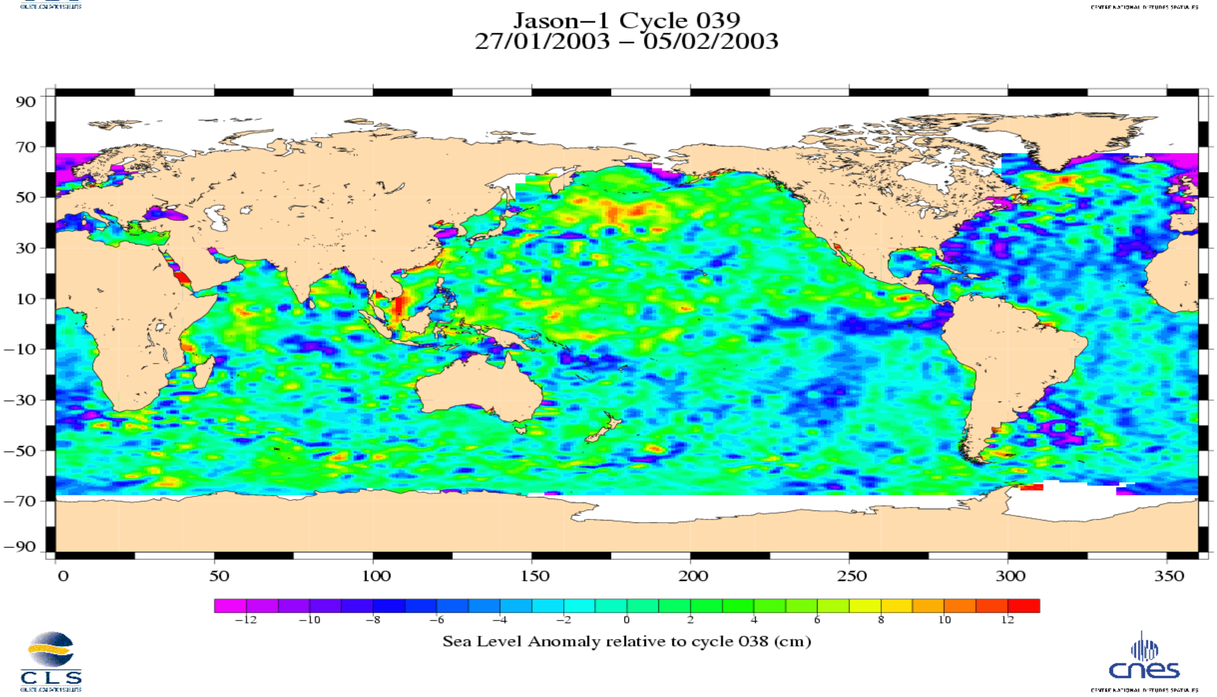
SSH crossover statistics are computed from the valid data set. They are used to estimate the data quality and to monitor the system performances.
After data editing and using the standard Jason-1 algorithms, the crossover standard deviation is about 5.87 cm rms, when using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes ($> |50|$ deg.).

4.5 SSH variability

4.5.1 Jason-1 Sea Level Anomalies

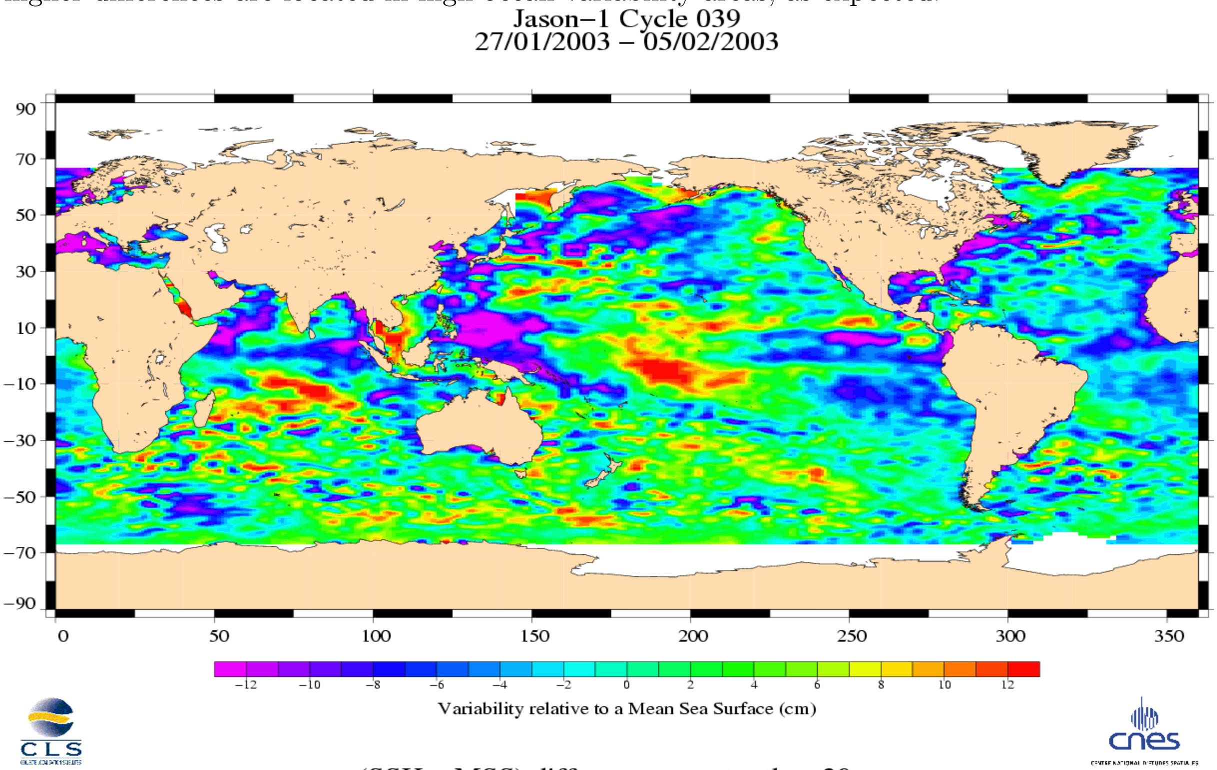
Repeat-track analysis is routinely used to compute Sea Level Anomalies (SLA) relative to the previous cycle and relative to a mean profile. SLA relative to a 7-year mean (based on TOPEX/Poseidon data) shows general oceanic features in good agreement with what is observed with TOPEX/Poseidon.
The SSH differences relative to the previous cycle 038 are plotted on the bottom figure. The differences seem homogeneous and do not exhibit any particular trackiness pattern, showing the good quality of the orbit calculation in the Jason-1 GDRs.

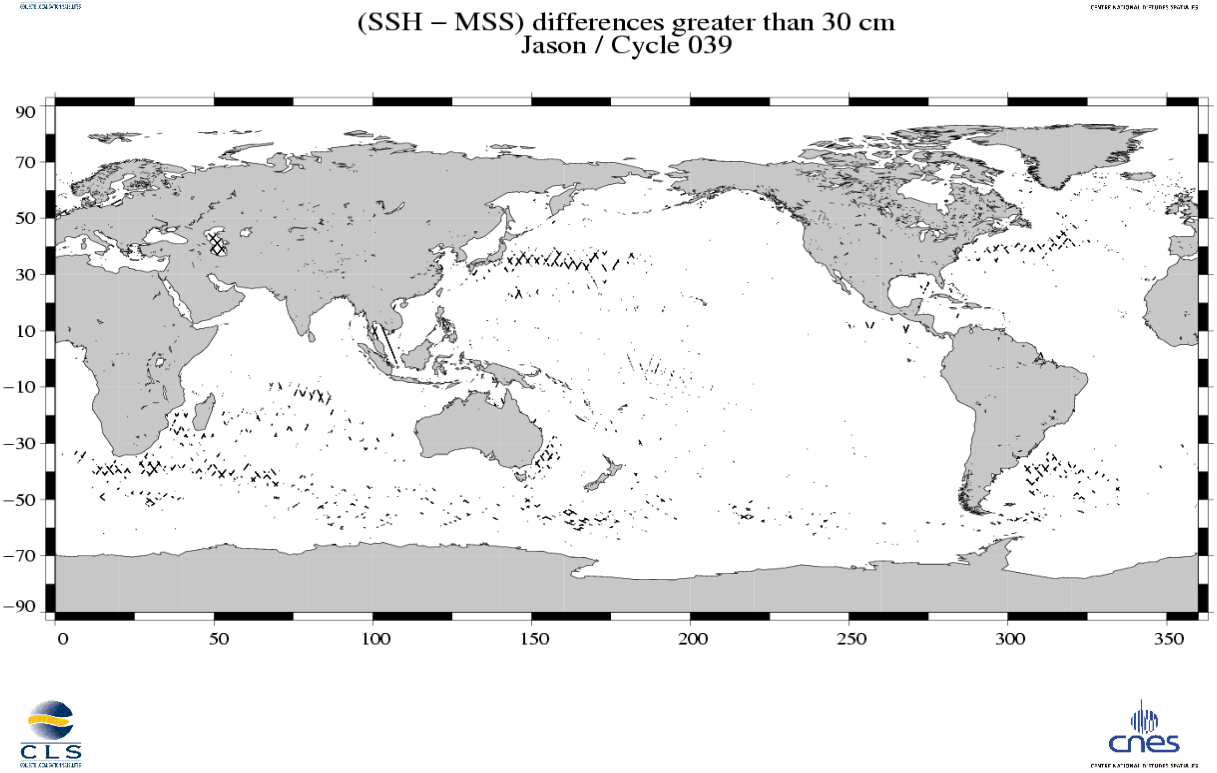




4.5.2 Comparison to a Mean Sea Surface

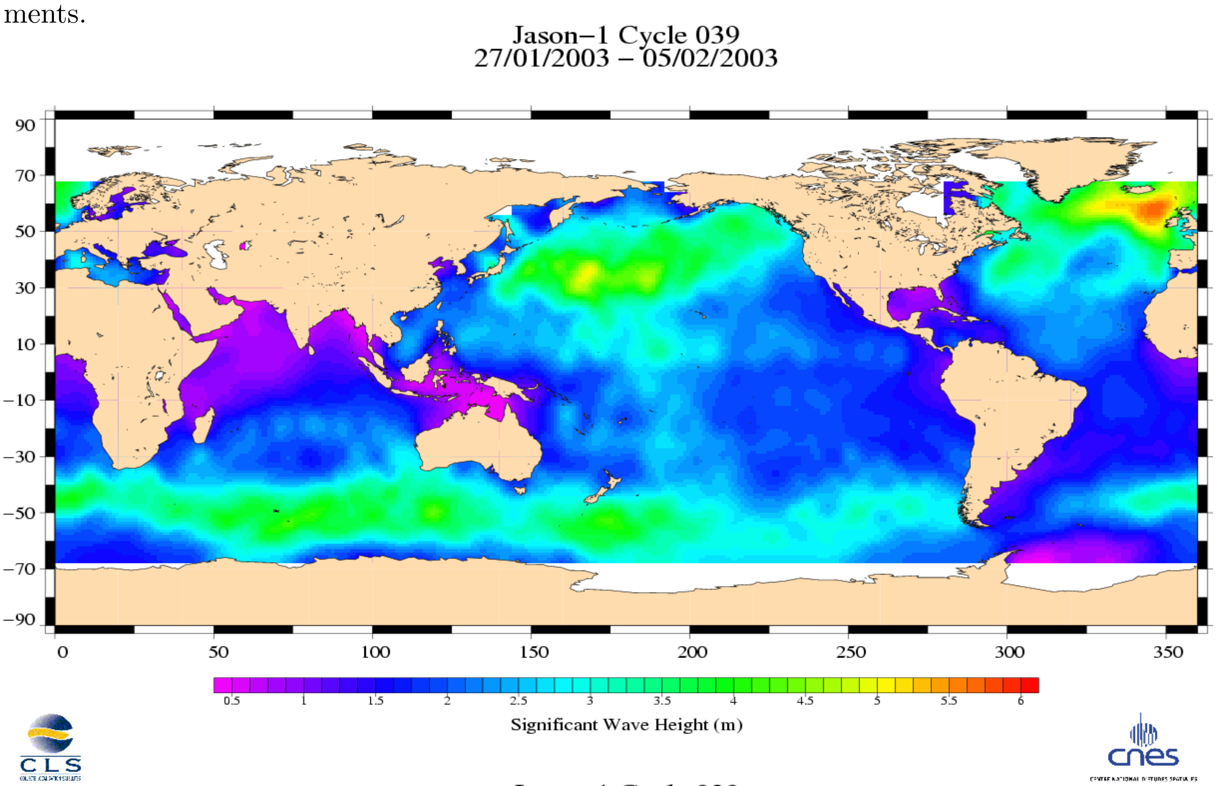
The two following maps respectively show the map of Jason-1 SLA relative to the MSS and differences higher than a 30 cm threshold (after centering the data). The latter figure shows that apart from isolated measurements that should be removed after refining the editing thresholds, higher differences are located in high ocean variability areas, as expected.

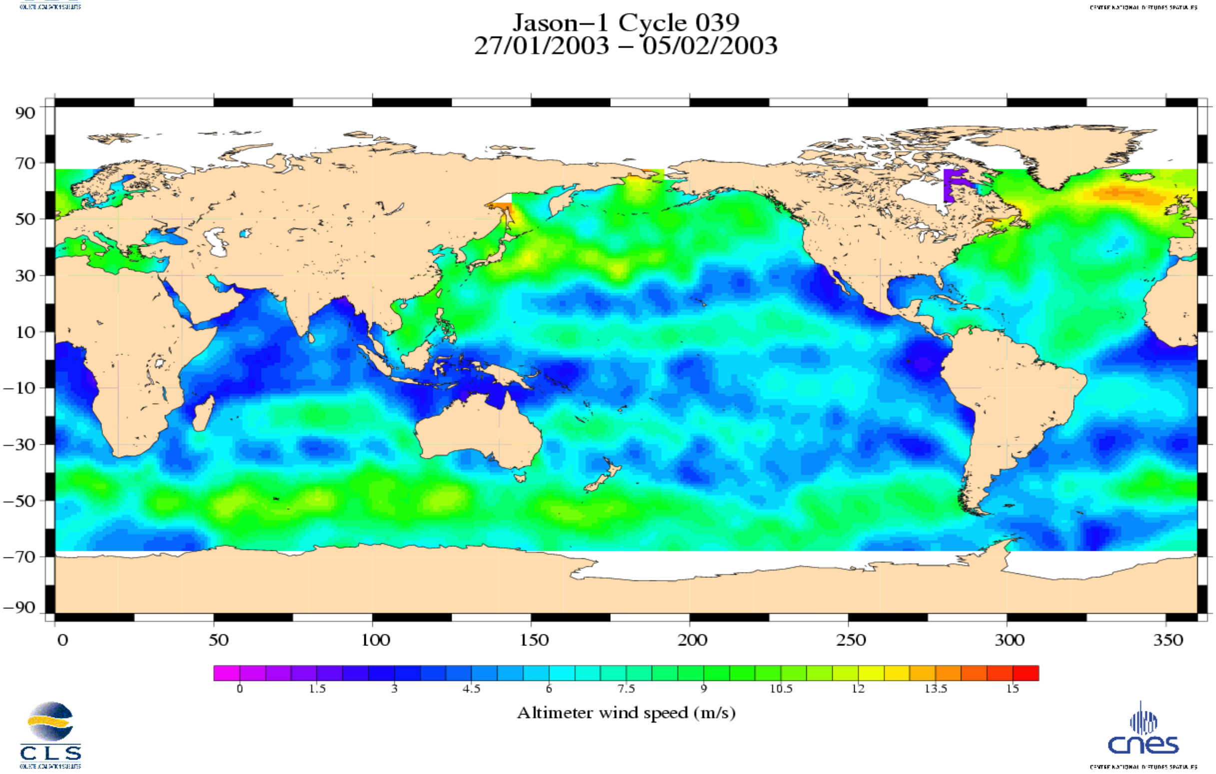




4.6 Wind and wave maps

These two figures show wind and wave estimations derived from 10 days of altimeter measurements.



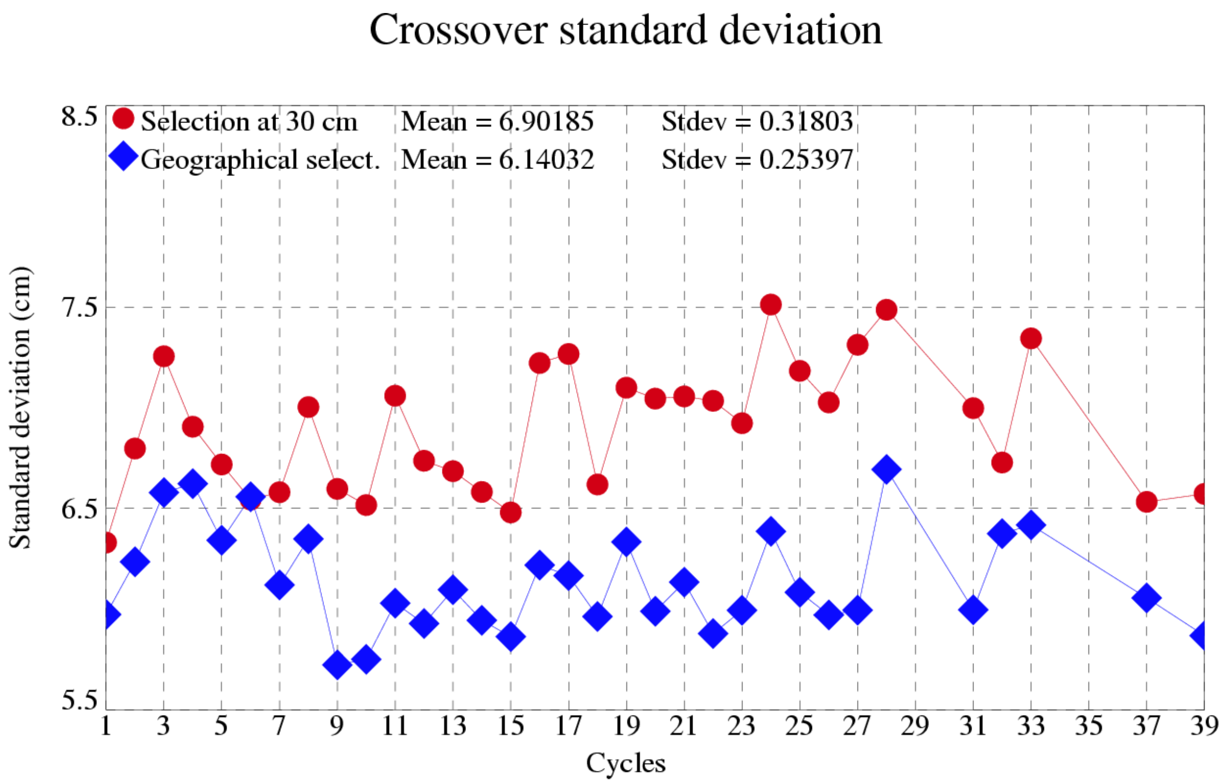


5 Jason-1 long term performance monitoring

Statistics of SSH variability are computed after crossover and repeat-track analyses. This allows to estimate how Jason-1 data fulfill the mission objectives in terms of performances.

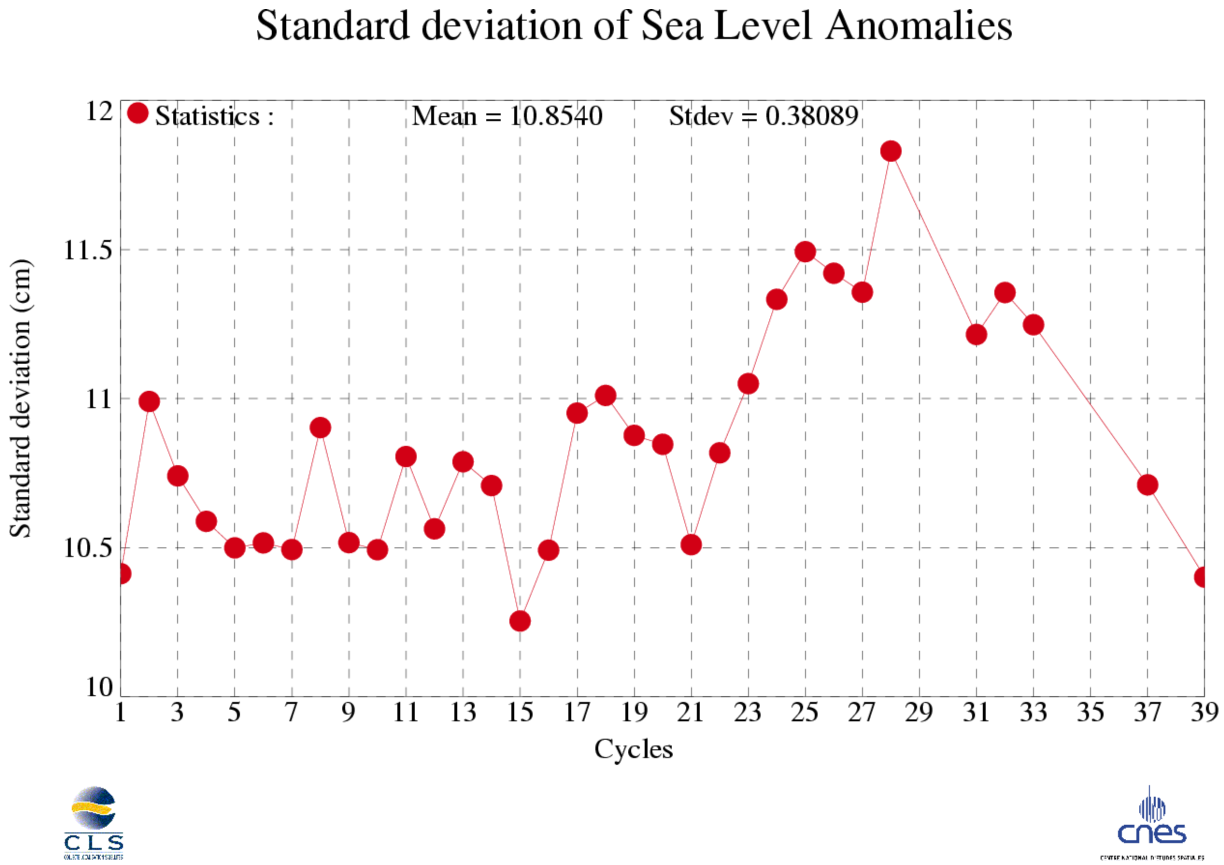
5.1 Crossover standard deviation

This parameter is plotted as a function of time in a one cycle per cycle basis in the figure below. It is computed after data editing with two different selections:
- selecting crossover differences lower than 30 cm to avoid contamination by remaining spurious data.
- Removing shallow waters (1000 m), areas of high ocean variability and high latitudes (> |50| deg.) to avoid ice coverage effects.



5.2 RMS of Sea Level Anomaly

Sea Level Anomalies relative to a mean profile are computed using repeat-track analysis for each Jason-1 cycle. To monitor Jason-1 performances and ocean signals, the cycle per cycle standard deviation of the SLA is plotted as a function of time.



6 Particular investigations

6.1 Square of the mispointing angle

A boresight calibration (pass 234) and a swap from Star Tracker 1 to Star Tracker 2 through passes 60-90 are performed. This leads to slightly higher than usual off nadir angles values on this pass (0.1 degree).
Pass 221 is partly edited due to a Gyro calibration and the remaining measurements on this pass have off nadir angles values higher than usual (0.2 degree).

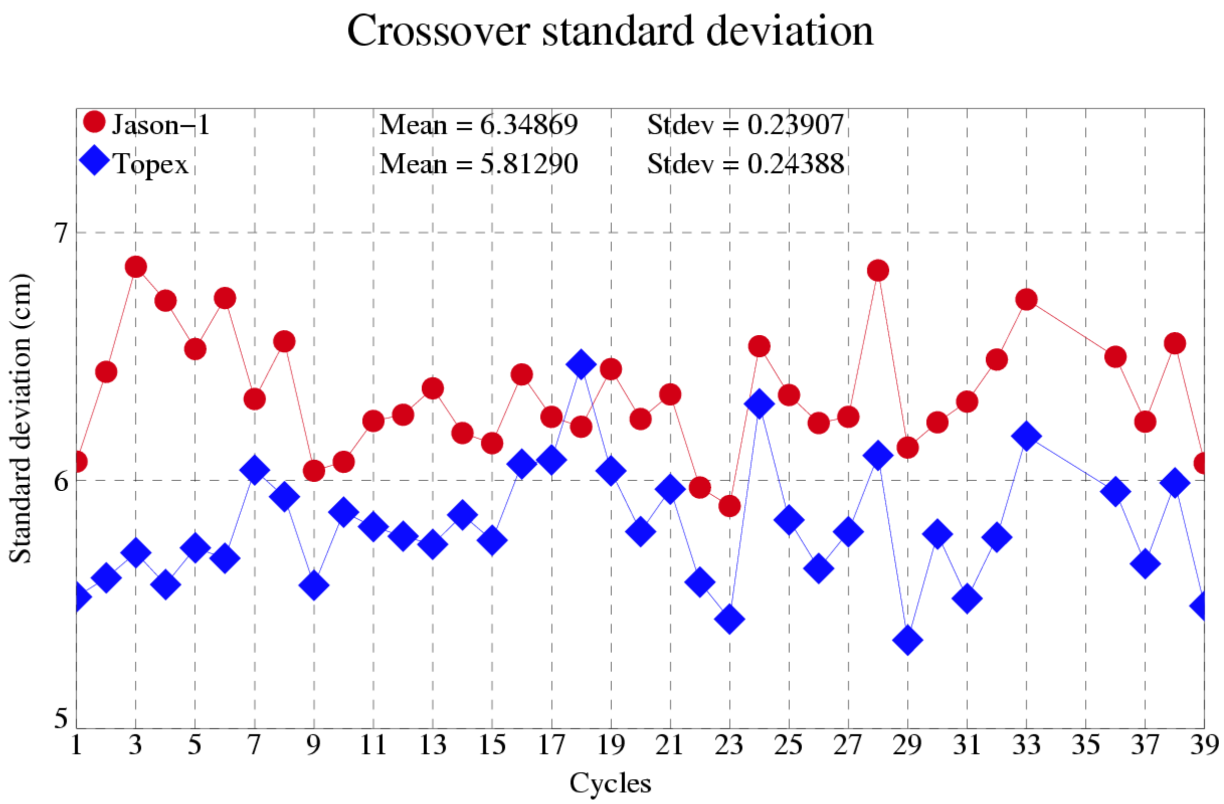
6.2 TP and Jason-1 comparisons

In order to compare TOPEX and Jason-1 SSH estimations, TOPEX data from M-GDRs have been updated so that all the geophysical corrections are the same as Jason-1. The TOPEX-B non-parametric sea state bias has been applied. This bias has been computed with the same method as TOPEX-A non-parametric sea state bias (Gaspar et al., 2002 [3]).
Note that cycle 1 for Jason-1 corresponds with cycle 344 for TOPEX.

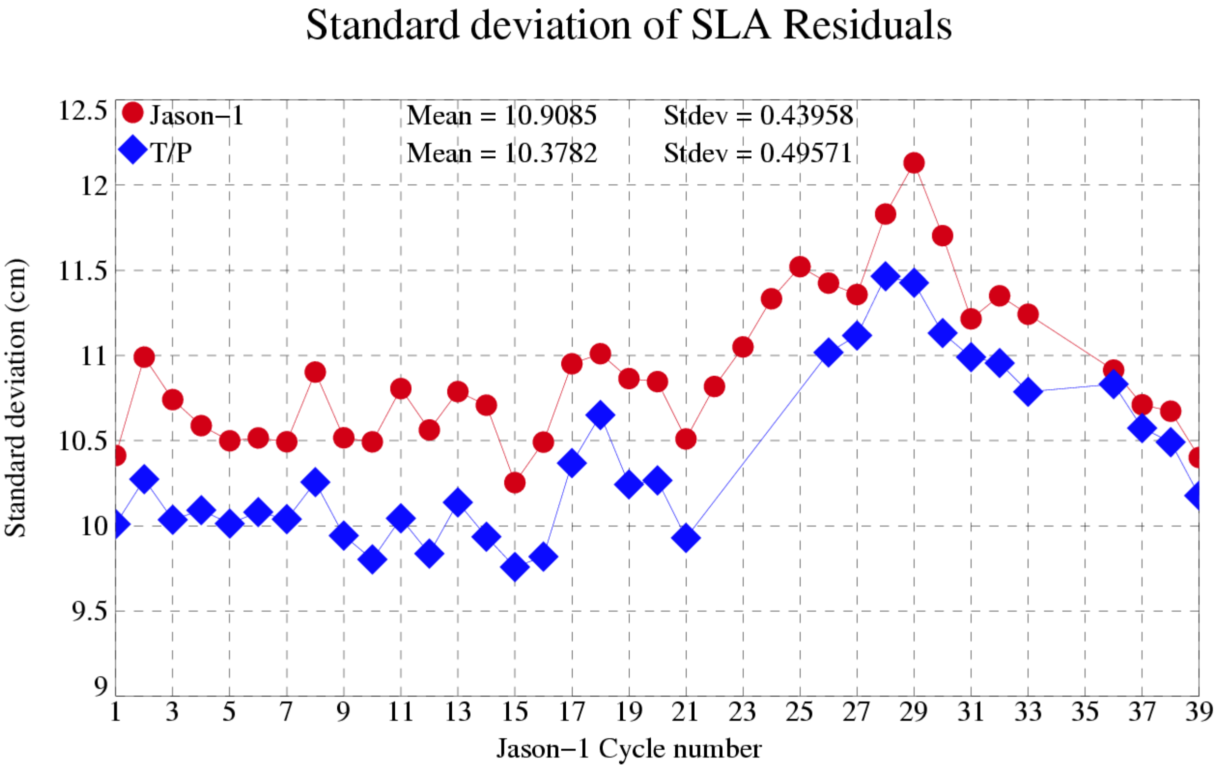
6.2.1 Performance comparisons

10-day crossovers are computed on a 1 cycle basis for both TOPEX and Jason-1. In order to estimate the system performances, crossovers are selected according to several criteria: shallow waters (1000m), areas of high ocean variability (> 20 cm), and high latitudes ($> |50|$ deg.) are excluded.

Futhermore, because of tape recorder problems, TOPEX measurements are missing over large geographical areas. These areas are then excluded from the selection for the two satellites.
The long term statistics are reported below. The slightly higher standard deviation for Jason-1 might be explained by residual orbit errors and larger high frequency content due to different altimeter processing.

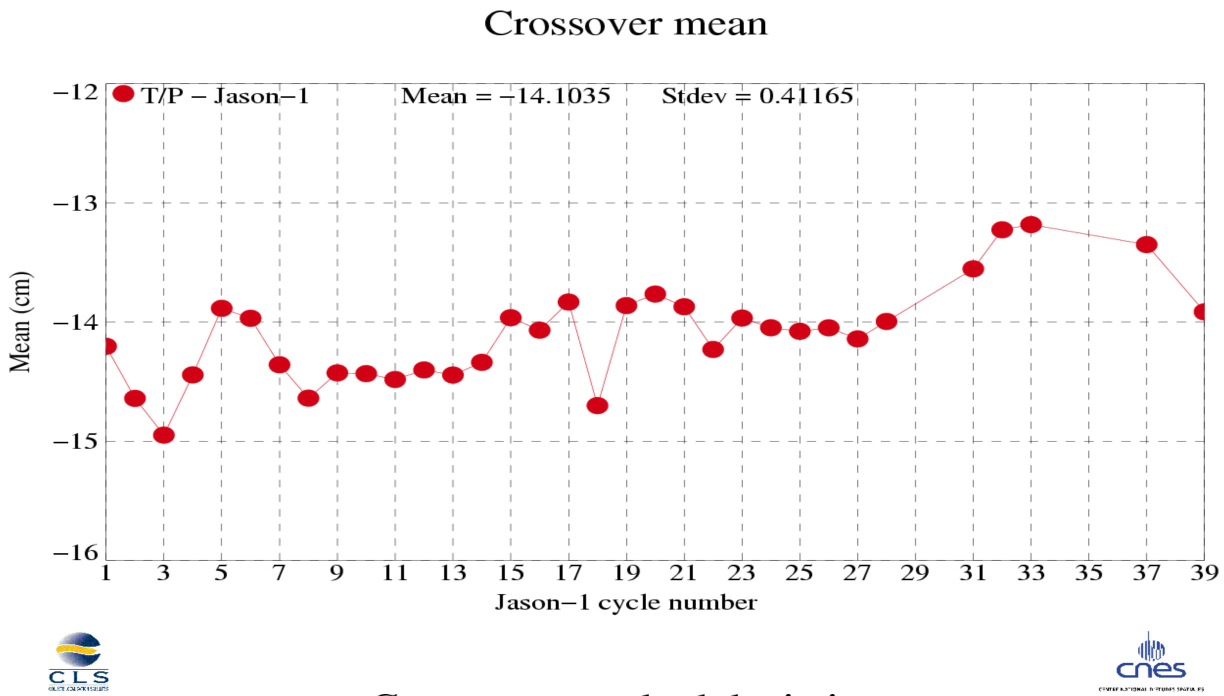

Crossover standard deviation
Jason−1
Topex
Mean = 6.34869
Mean = 5.81290
Stdev = 0.23907
Stdev = 0.24388
Standard deviation (cm)
7
6
5
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
Cycles

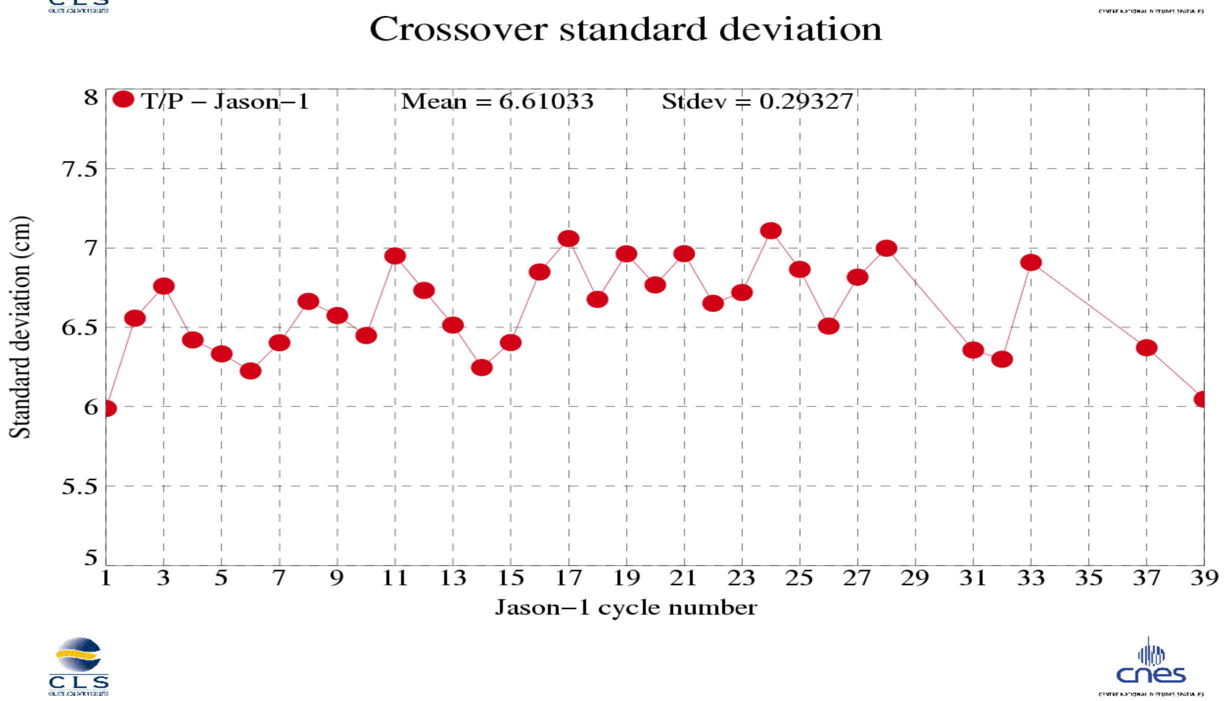
Sea Level Anomaly (SLA) statistics are computed from repeat-track analysis. The plot below gives the SLA standard deviation for each cycle over the whole data set (shallow waters are excluded).
It is not possible to compute the TOPEX SLA through Jason-1 cycles 22-25 (corresponding with TOPEX cycles 365-368) because T/P is not on a repeat cycle orbit. During this period the satellite is moved to the Tandem Mission orbit on the new ground track spacing to the West of Jason-1.



6.2.2 TP − Jason-1 crossovers

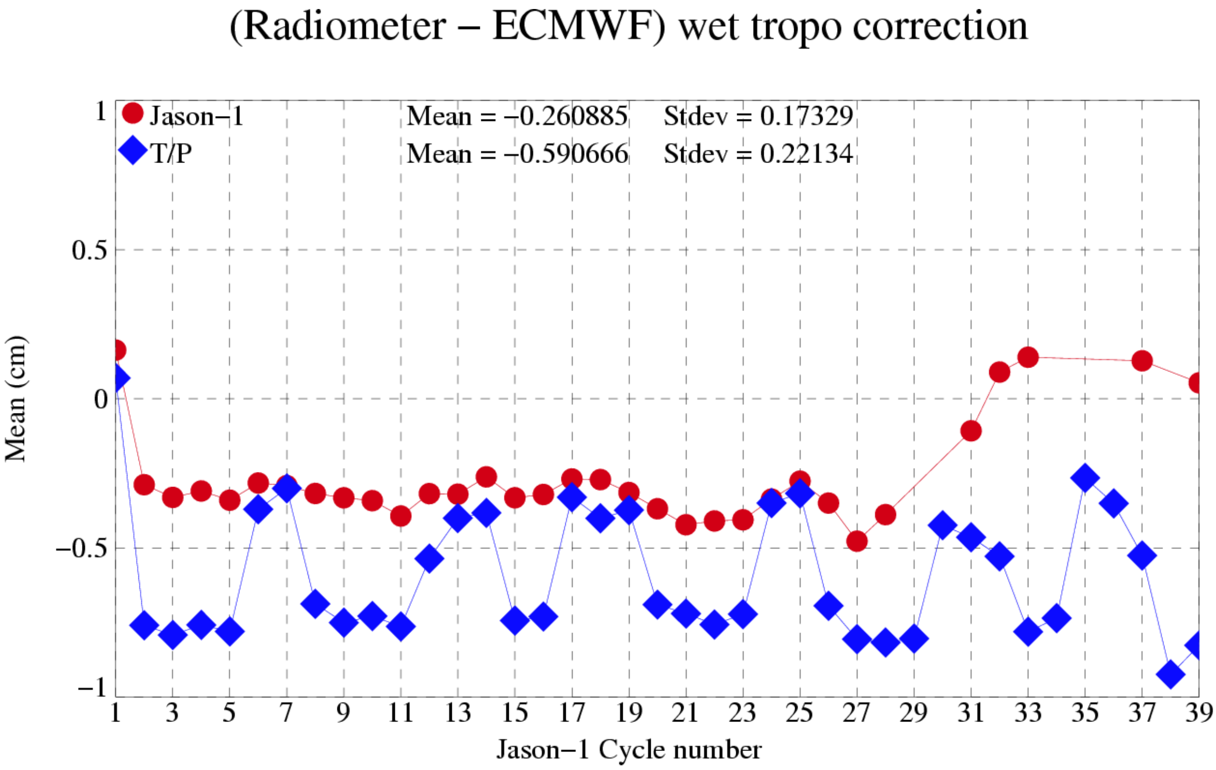
The two following figures show the mean and the standard deviation of (TP − Jason-1) 10-day SSH crossovers. The statistics are computed removing shallow waters (1000 m).





6.2.3 TP and Jason-1 Radiometer wet troposphere correction comparisons

The mean of (Radiometer - ECMWF) wet troposphere corrections are computed cycle by cycle for T/P and Jason-1. The long term monitoring is plotted below. The particular values obtained for Jason-1 cycle 1 and TP cycle 344 are explained by the change in the ECMWF model in January 2002.
Note that the TMR wet tropospheric correction has been corrected for the drift (Ruf C.S., 2002 [4]).



7 General warnings

7.1 Altimeter wind speed default values : minor warning

The altimeter wind speed algorithm was adjusted on TOPEX data before the Jason-1 launch. It gives very few negative values which are set to default values in the GDR. The user may note that a valid SSB value is present in the product when altimeter wind speed values are set to default : this is because negative wind values enter the SSB algorithm; such a feature remain to be corrected to clean up the wind algorithm. It is also clear that the wind algorithm should be better tuned to Jason-1 data in the near future.

References

[1] Vincent,P., Desai S.D., Picot N. & Case K., April 8, 2003 : The first generation of IGDRs and GDRs products to be made available after completion of the Jason-1 verification phase. *Memo to Jason-1 PIs and CoIs.*

[2] Aviso and PODAAC User Handbook, April 2003 : IGDR and GDR Jason User Products, *SMM-MU-M5-OP-13184-CN.*

[3] Gaspar, P., S. Labroue & F. Ogor, October 2002: Improving nonparametric estimates of the sea state bias in radar altimeter measurements of sea level *J. Atmos. Oceanic Technol.,* **19,** 1690-1707.

[4] Ruf C.S., June 2002 : TMR Drift - Correction to 18 GHz Brightness Temperatures, Revisited. *Report to TOPEX Project.*