



# TOPEX/Poseidon MGRD Quality Assessment Report

**Cycle 404**

**02-09-2003 12-09-2003**

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**SALP-RP-P2-EX-21120-CLS404**

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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 Topex/Poseidon 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:

[Cycle overview](#)

[CALVAL main results](#)

## 2 Cycle overview

### 2.1 Cycle quality and performances

Data quality for this cycle appears to be nominal. For this cycle, the crossover standard deviation is 6.30 cm rms, and the standard deviation of Sea Level Anomalies (SLA) relative to a Mean Sea Surface is 9.34 cm.

### 2.2 Warnings and recommendations

- Missing measurements :
  - There is a lot of data gaps due to tape recorder anomalies, especially in the Indian Ocean, in the South Pacific Ocean close to the South and Central America coasts and below the Groenland coasts.
  - Pass 179 is missing from current data set. No information allows to explain this anomaly.
- Doris ionospheric correction :

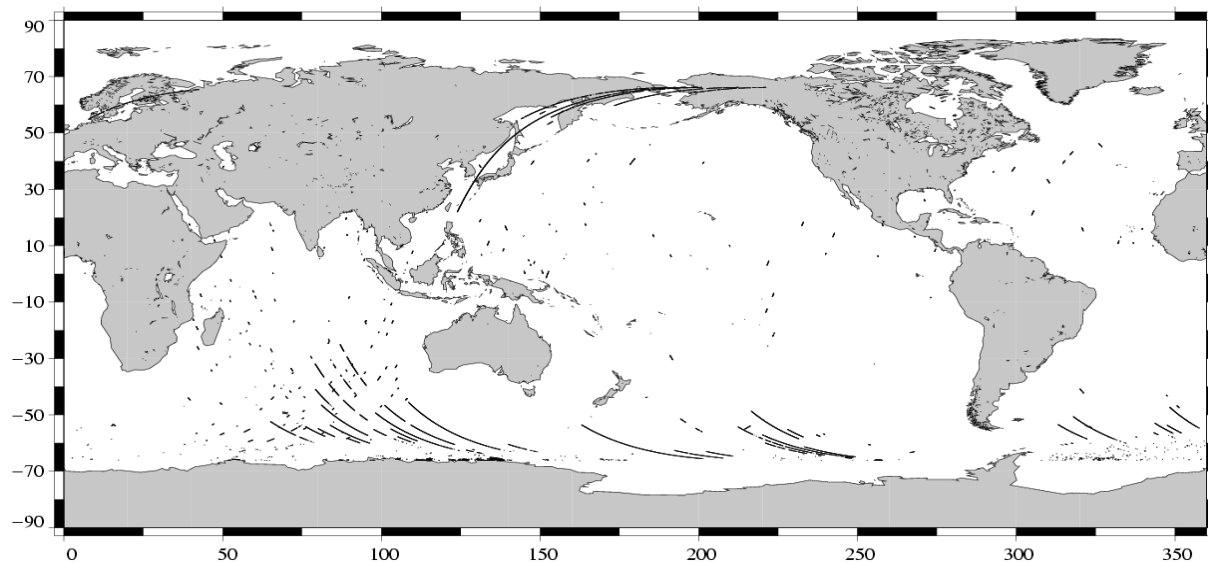
The DORIS instrument experienced an incident on 06,September 2003. Therefore there is no DORIS data available from 05/09/2003(pass 74) to 10/09/2003(pass 227). Only bent ionospheric correction is available during this period.
- Measurements edited by the TMR parameters :

The following anomalies are explained by the problems in the interpolation of the TMR parameters due to tape recorder failures :

  - 2.27% of the measurements are removed by the TMR correction criterion (see the following figure).
  - Some measurements have radiometer land flag set to valid over land. A new criterion has been added to the editing procedure to remove all these measurements (see [Editing](#)) .

The pass 142 is partly rejected (in the southern Indian Ocean) by the radiometer land flag criterium. This flag is set to defalut value. This anomaly seems not linked with the problems in the interpolation of the TMR parameters and is under investigation.

Edited parameter : Radiometer wet tropospheric correction  
T/P Cycle 404 (02/09/2003 / 12/09/2003)



### 3 CALVAL main results

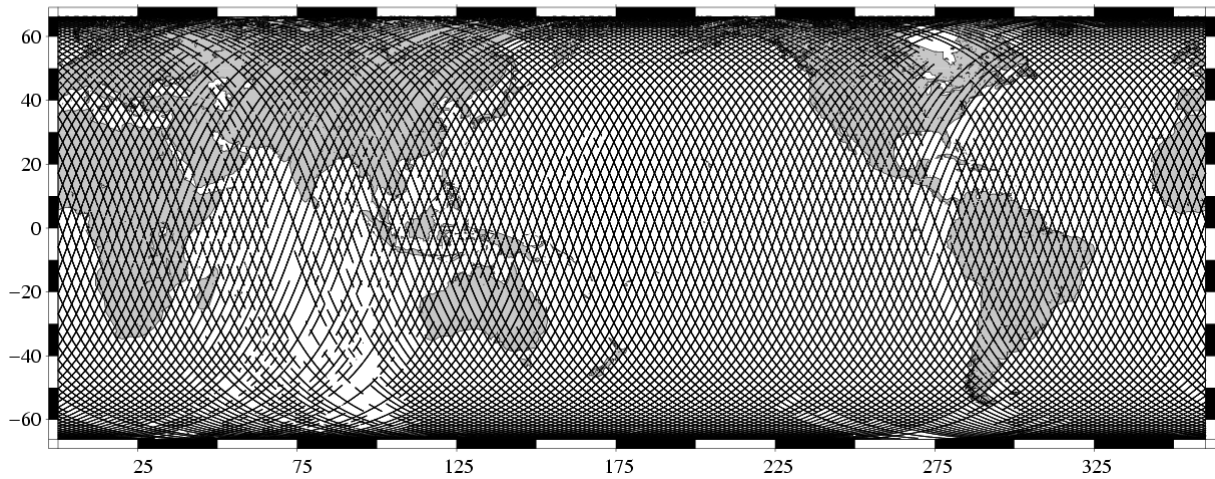
This section presents results that illustrate data quality during this cycle. These verification products are produced operationally so that they allow systematic monitoring of the main relevant parameters.

#### 3.1 Missing measurements

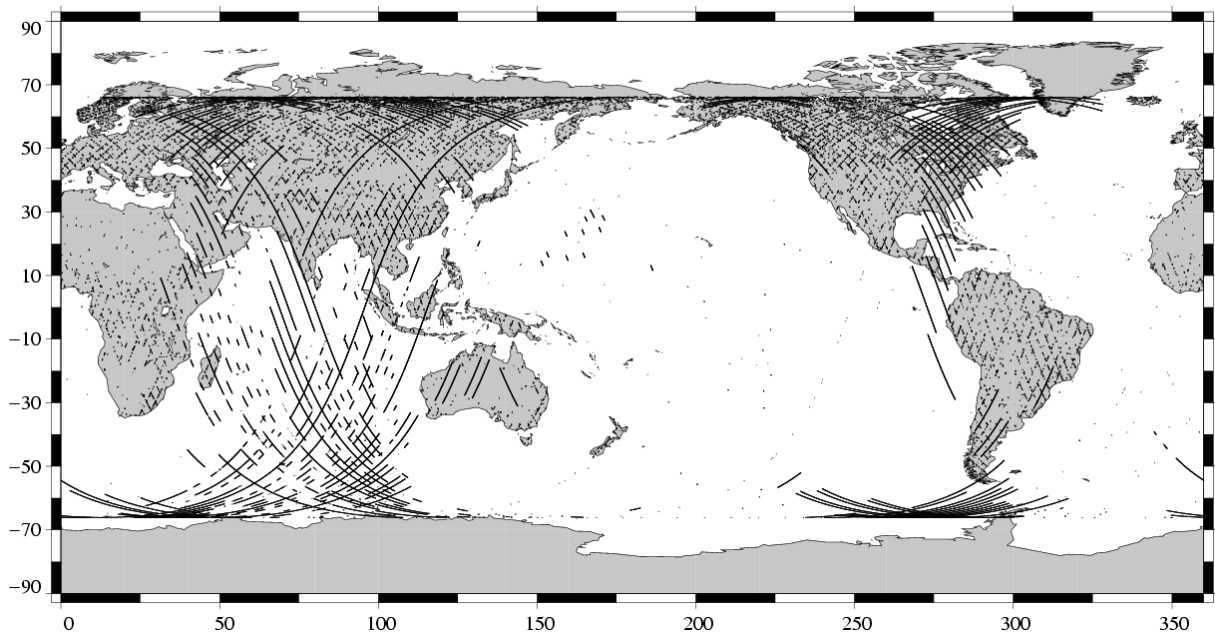
694964 altimeter measurements are present, and 99615 are missing.

The map below shows all the available measurements for this cycle and illustrates the tape recorder problems. The latter figure shows missing 1Hz measurements in the GDRs, with respect to a 1 Hz sampling of a nominal repeat track.

Available measurements  
TOPEX Cycle 404 (02/09/2003 / 12/09/2003)



Missing measurements  
TOPEX/Poseidon Cycle 404 (02/09/2003 / 12/09/2003)



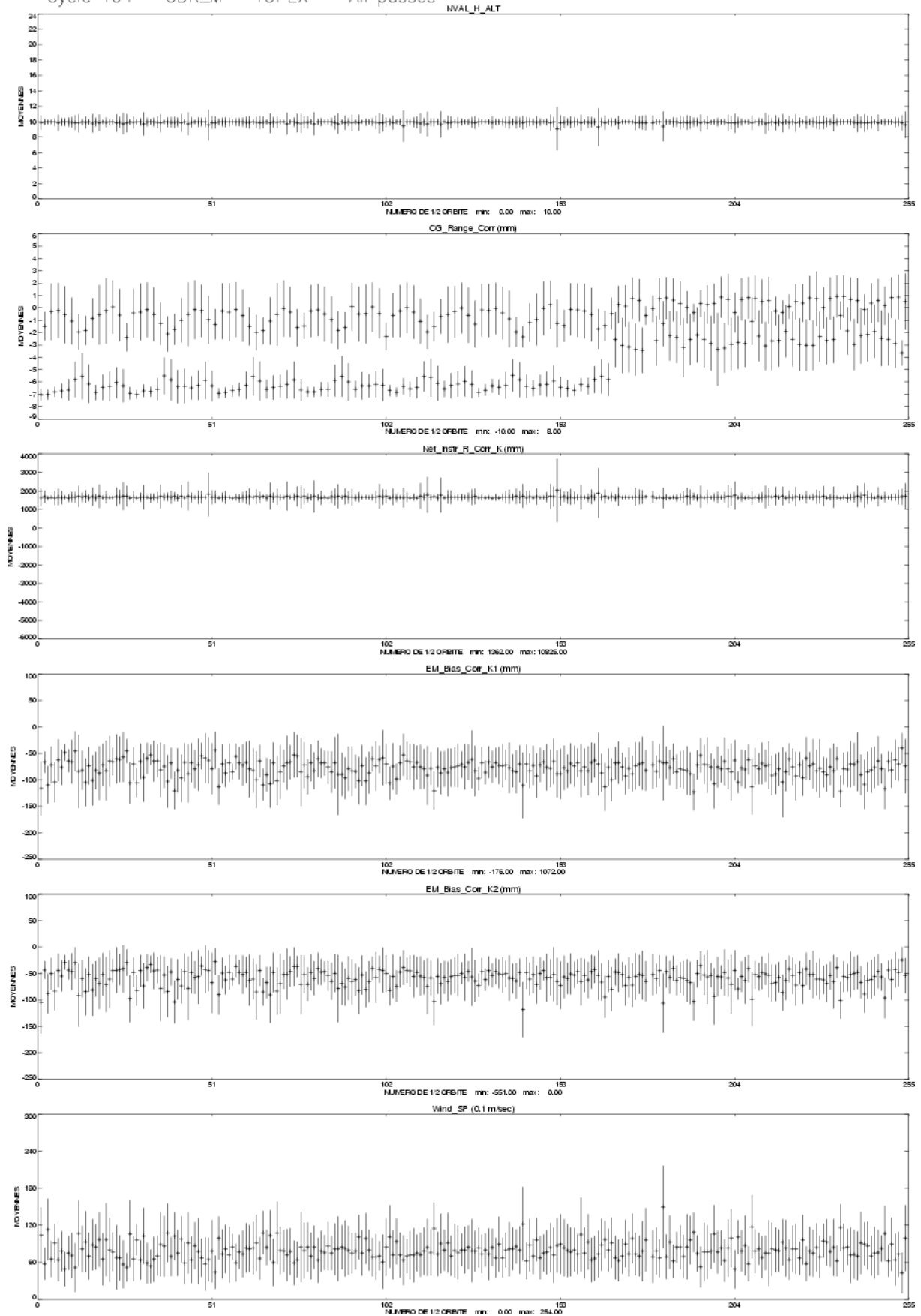
### 3.2 M-GDR quality flags

The following table indicates the percentage of measurements for which those flags are set.

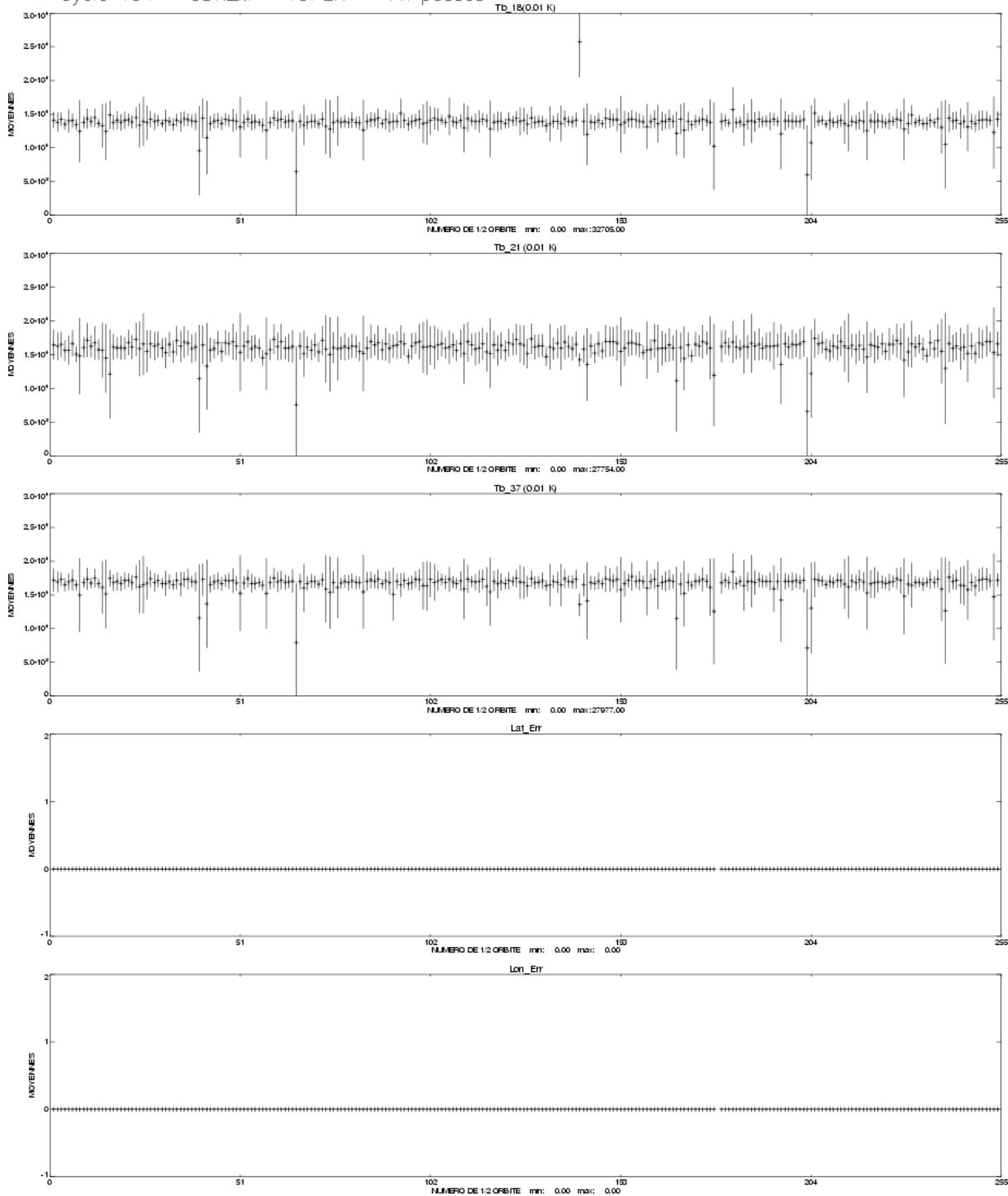
Name	Description	% bad
Geo_Bad_1	altimeter land flag	25.54
Geo_Bad_1	ice flag	8.07
Geo_Bad_1	radiometer land flag	27.68
Alt_Bad_1	conditions 1 altimeter	5.37
Alt_Bad_2	conditions 2 altimeter	5.20
Geo_Bad_2	rain (liquid water in excess)	5.19
Geo_Bad_2	less than 4 points for CSR3.0 tide calculation	0.45
Geo_Bad_2	less than 4 points for FES95.2.1 tide calculation	3.11
TOPEX	TOPEX not valid	0.00
TMR	TMR not valid	0.00
TMR_Bad	Brightness temperatures not valid	5.25
DORIS	DORIS not valid	0.00

### 3.3 M-GDR parameter plots

Cycle 404 – GDR\_M – TOPEX – All passes –

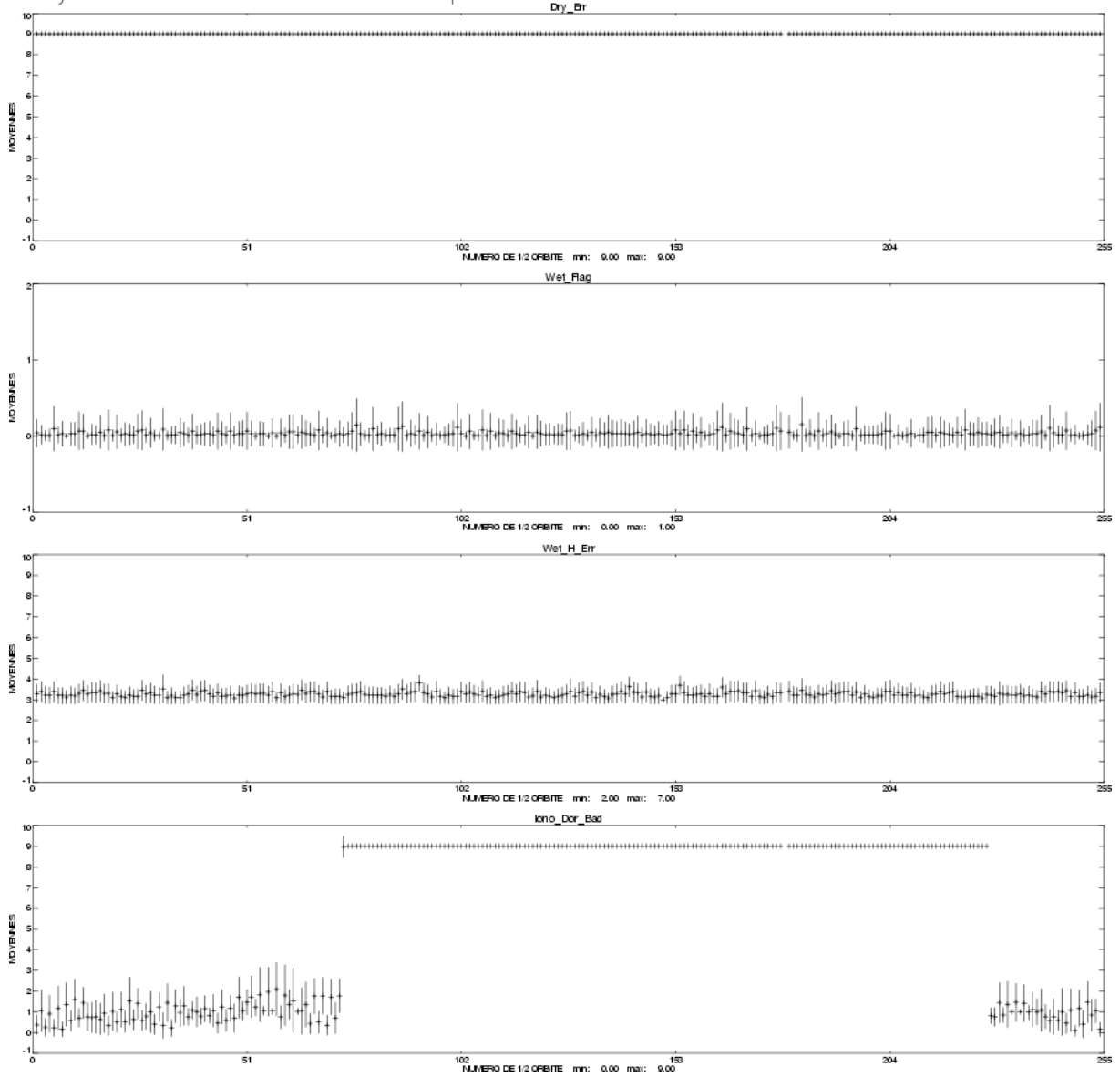


Cycle 404 – GDR\_M – TOPEX – All passes –

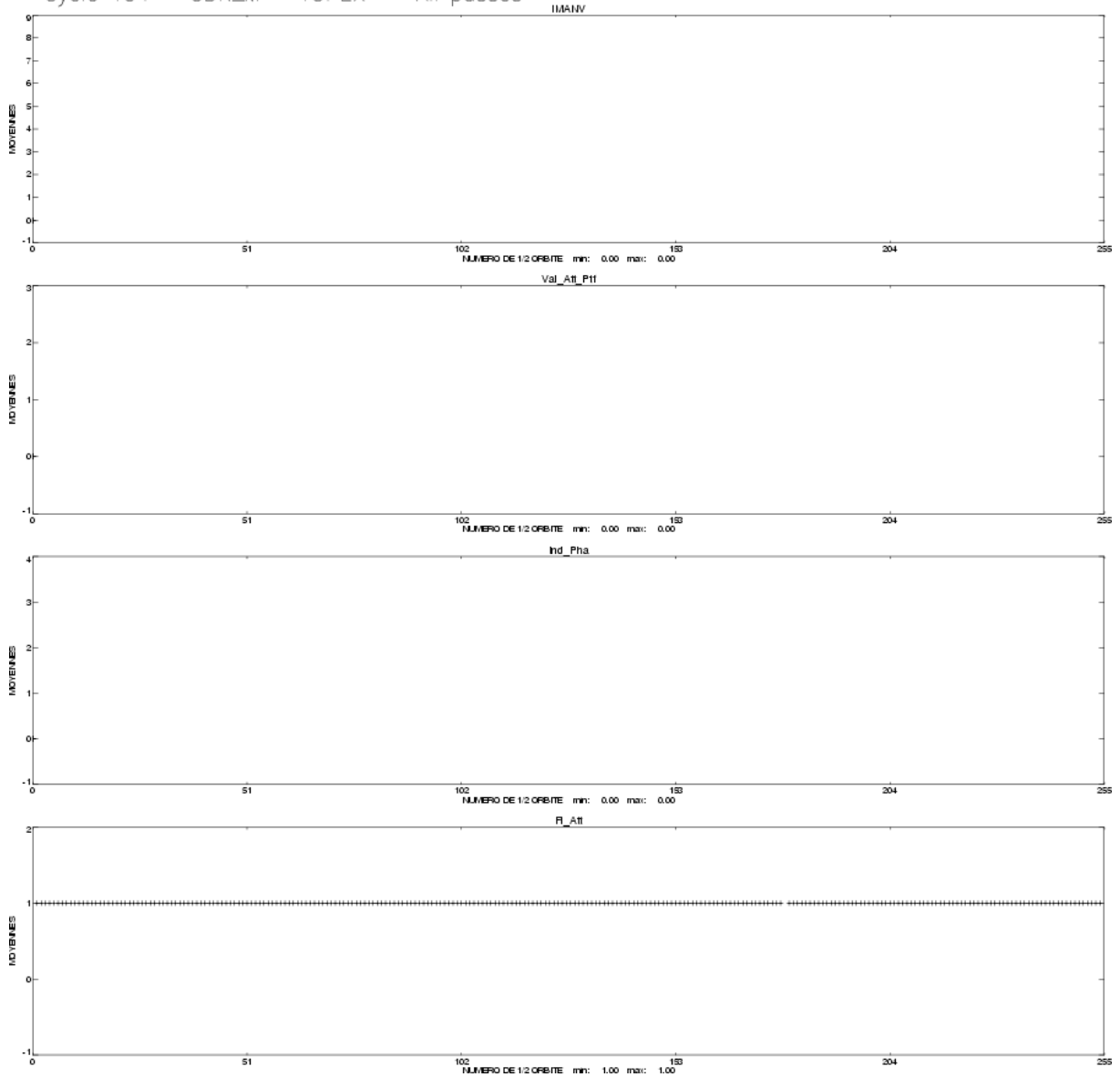


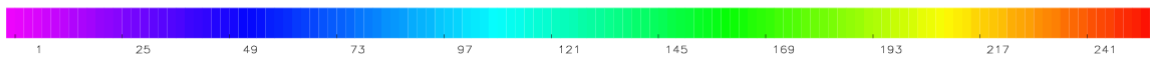
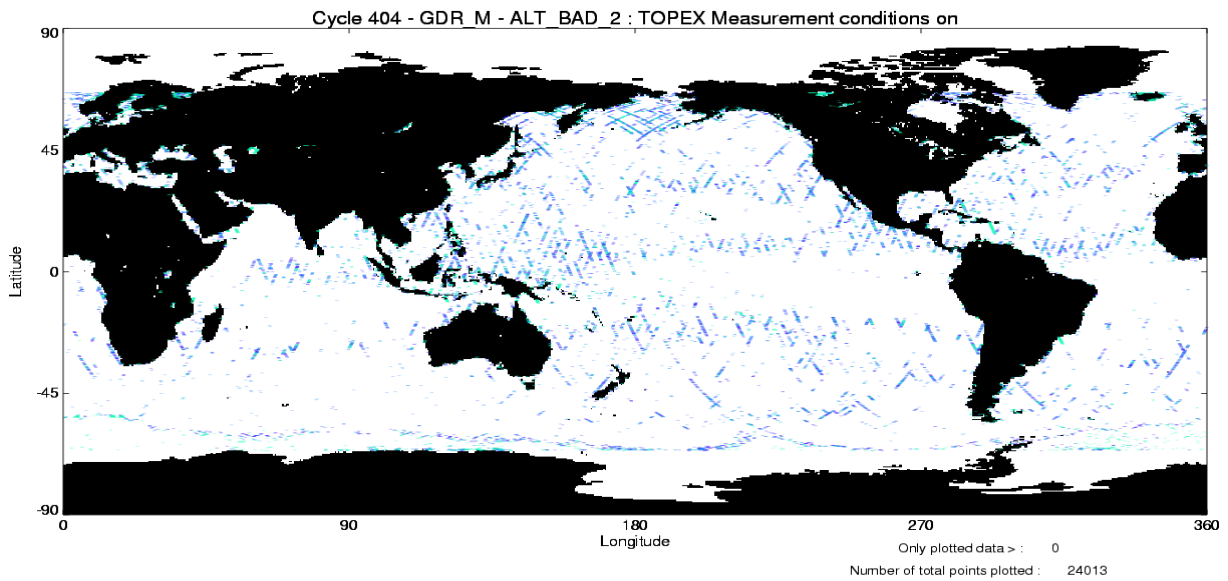
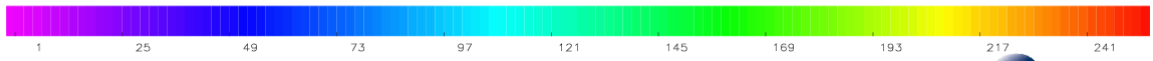
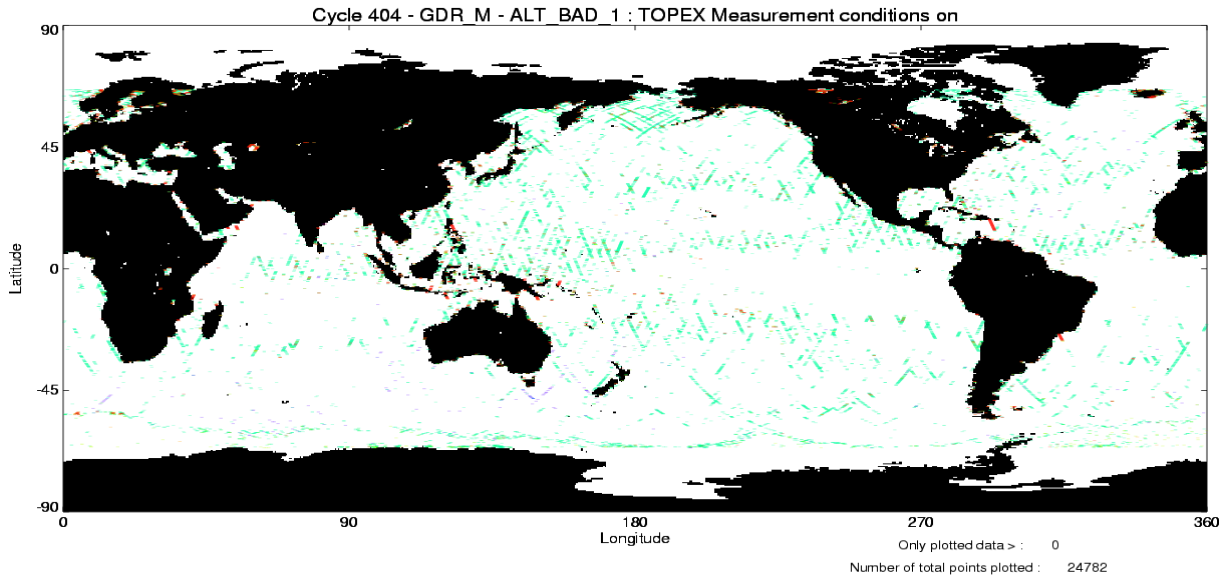


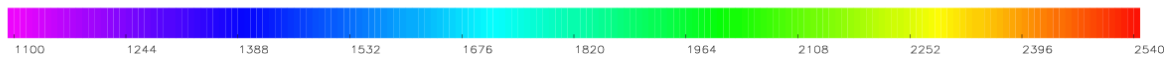
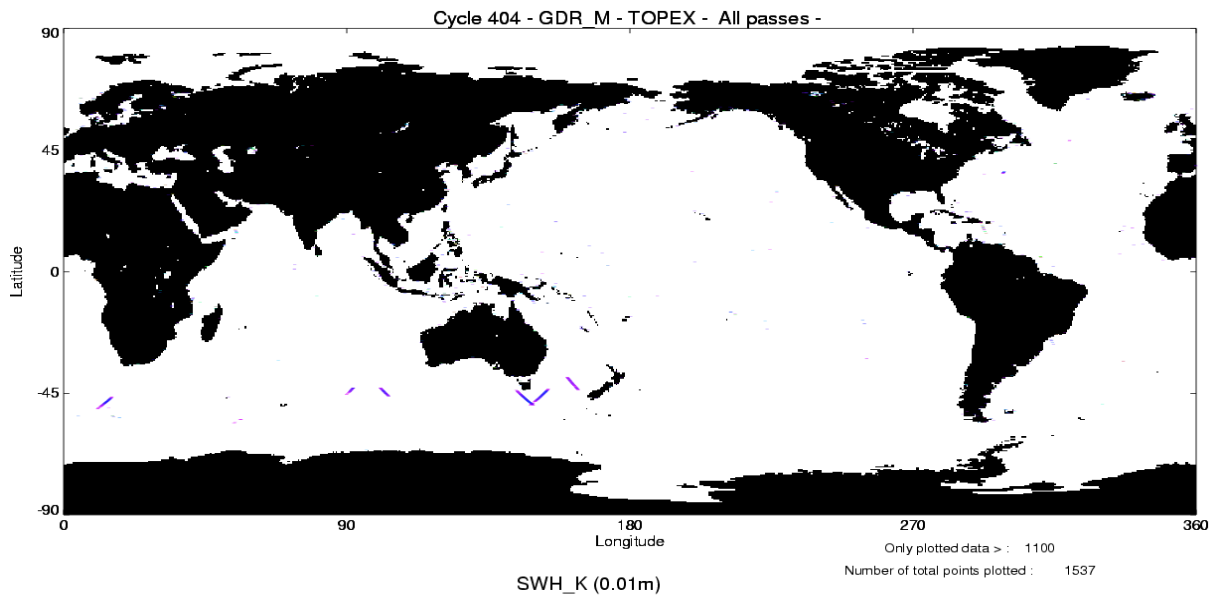
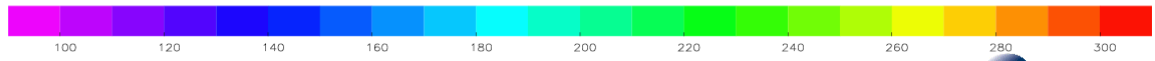
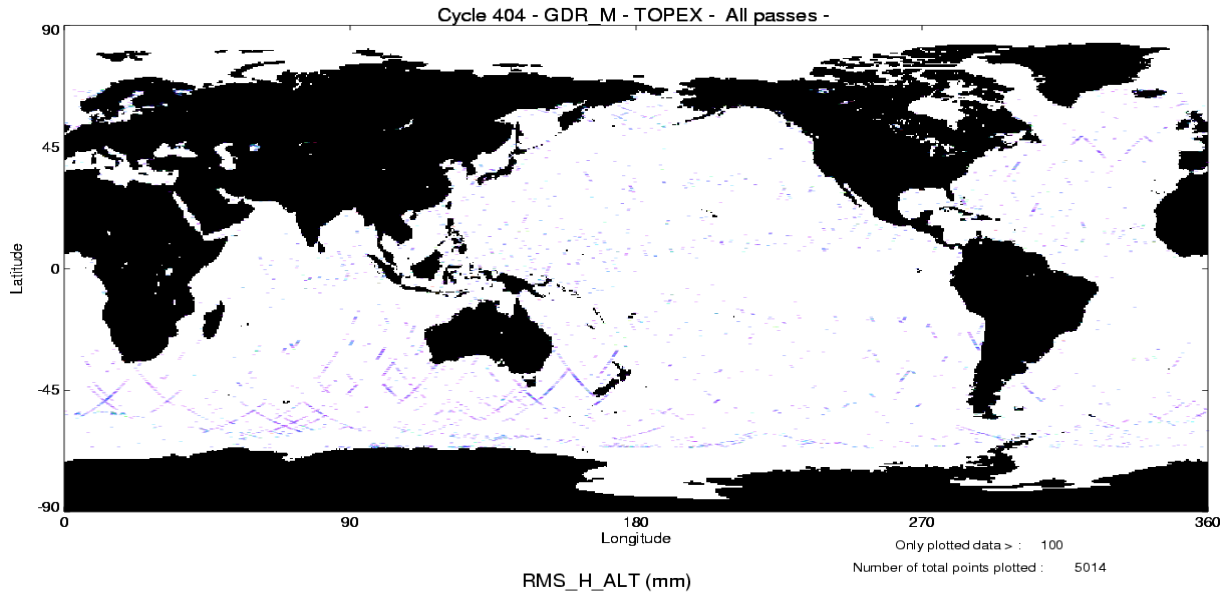
Cycle 404 – GDR\_M – TOPEX – All passes –

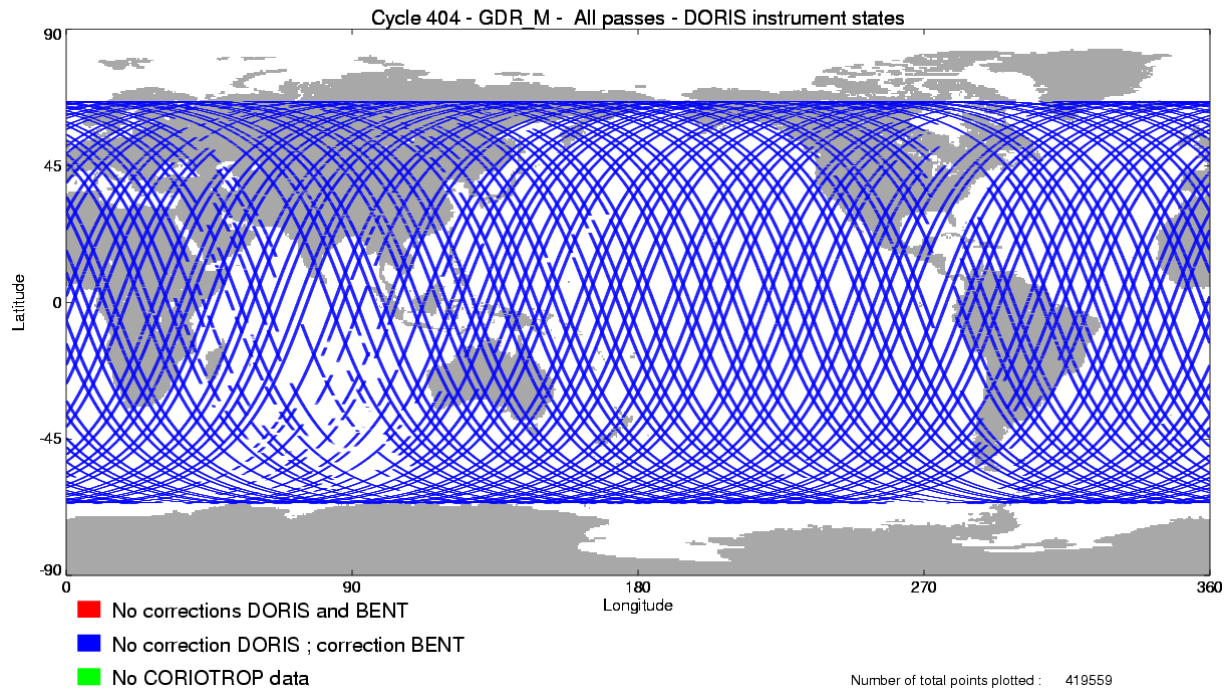


Cycle 404 – GDR\_M – TOPEX – All passes –









### 3.4 Editing

The following table gives for each tested parameter, minimum and maximum thresholds, the number and the percentage of points removed. As a comparison, the mean percentage over one year (1997) is also given.

There are problems in the interpolation of the TMR parameters since cycle 371 when there are missing measurements (tape recorder failures). These bad measurements are removed by the TMR correction criterion but some of them have been kept. Thus a new criterion has been added to the editing procedure since the cycle 376 to remove all the measurements where the absolute value of the difference between the TMR correction and the ECMWF model wet tropospheric correction is greater than 20 cm.

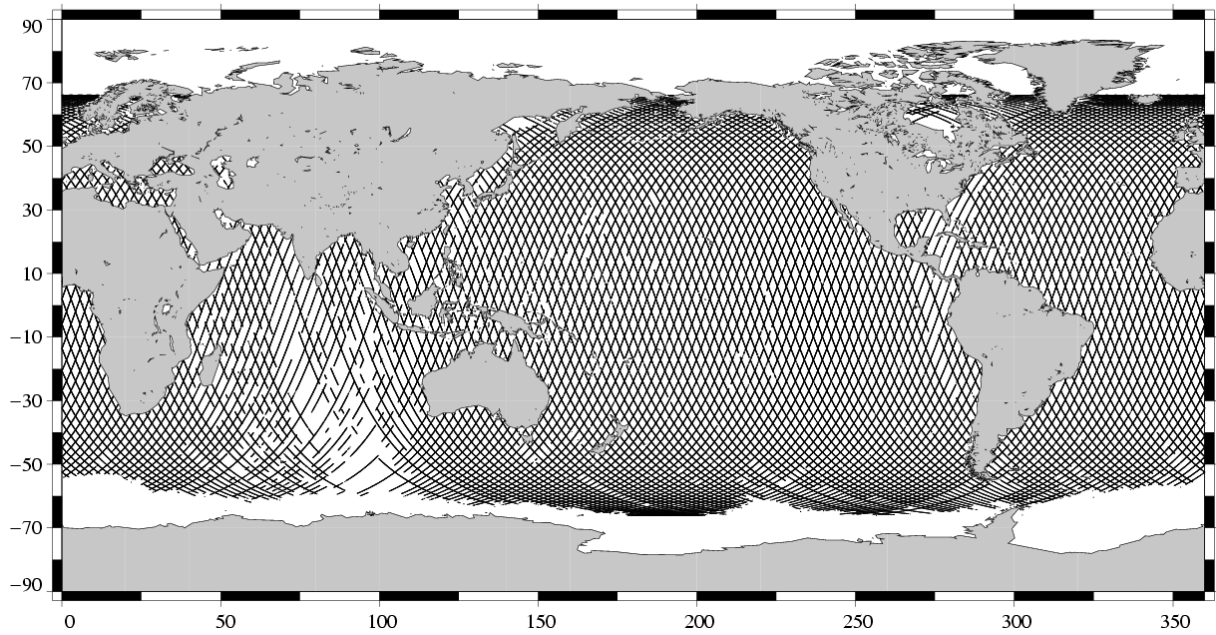
Probably due to the interpolation problem with the TMR, some measurements have radiometer land flag unset over land. This has no impact on the valid data because these measurements have been edited by the altimetric parameter criteria. Nevertheless, this anomaly leads to wrong statistics of the edited measurements. Therefore a new criterion has been added in the editing procedure to remove all the measurements for which the radiometer land flag is set to ocean and the altimeter land flag is set to land.

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 radiometer land flag (27.68 % of points removed) and ice flag ( 8.07 % of points removed).

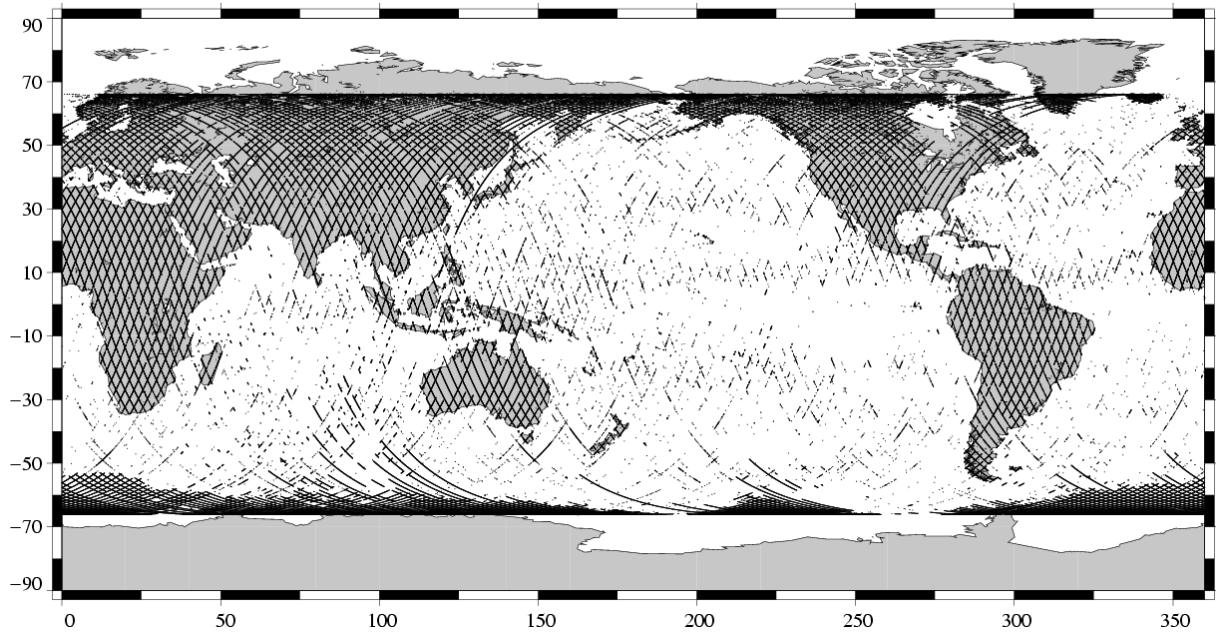
Parameters	Min Thres.	Max Thres.	Unit	Mean % removed in 1997	% removed
Sea surface height	-130.000	100.000	m	1.37	0.18
Number of 20/10Hz valid points Poseidon/TOPEX	5.000	-		1.37	0.27
Std. deviation of range	0.000	0.100	m	1.85	1.13
Off nadir angle from waveform	0.000	0.400	deg	1.36	3.56
Dry tropospheric correction	-2.500	-1.900	m	0.00	0.00
Invert barometer correction	-2.000	2.000	m	0.00	0.00
TMR wet tropospheric correction	-0.500	-0.001	m	0.34	2.27
Ionospheric correction (Poseidon:Doris, TOPEX:Dual)	-0.400	0.040	m	0.00	0.00
Significant wave height	0.000	11.000	m	1.46	0.19
Sea state Bias	-0.500	0.000	m	1.39	0.29
Backscatter coefficient	7.000	30.000	dB	1.44	0.26
Ocean tide height	-5.000	5.000	m	0.01	0.15
Earth tide	-1.000	1.000	m	0.00	0.00
Pole tide	-15.000	15.000	m	0.00	0.00
TMR and ECMWF tropospheric differences	-0.200	0.200	m	NaN	0.36
Spline fitting					0.01

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

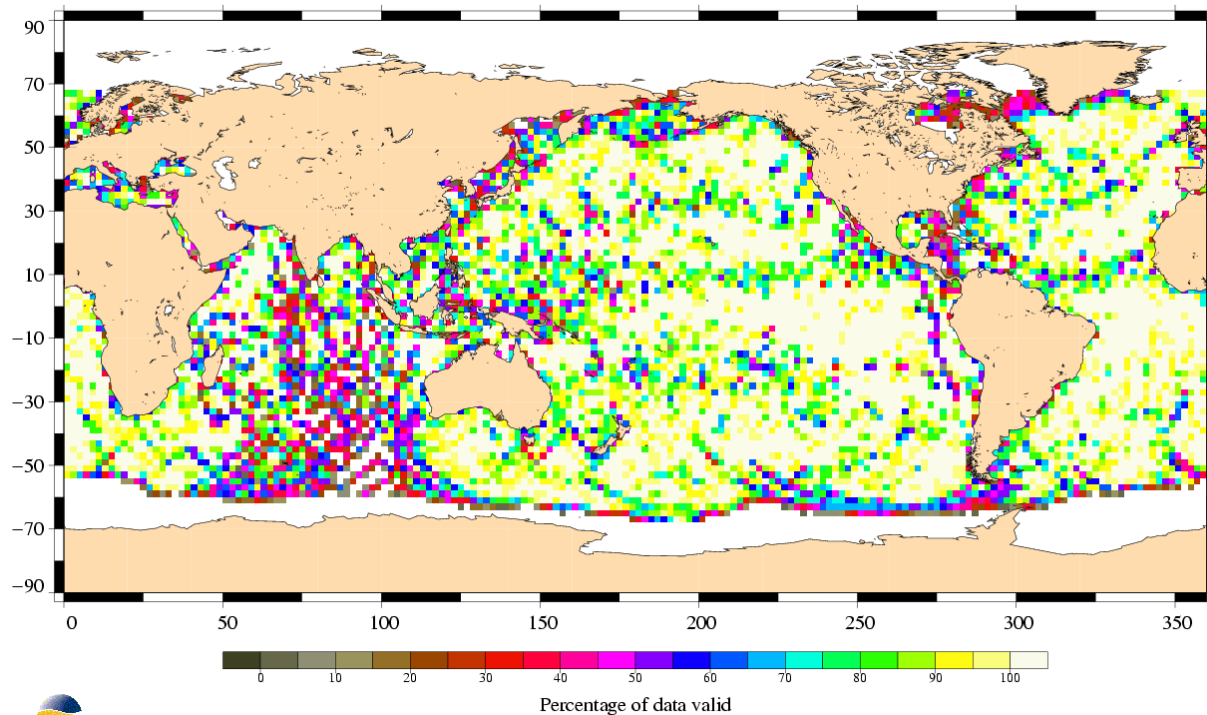
Valid data  
TOPEX/Poseidon Cycle 404 (02/09/2003 / 12/09/2003)



Edited measurements  
TOPEX Cycle 404 (02/09/2003 / 12/09/2003)



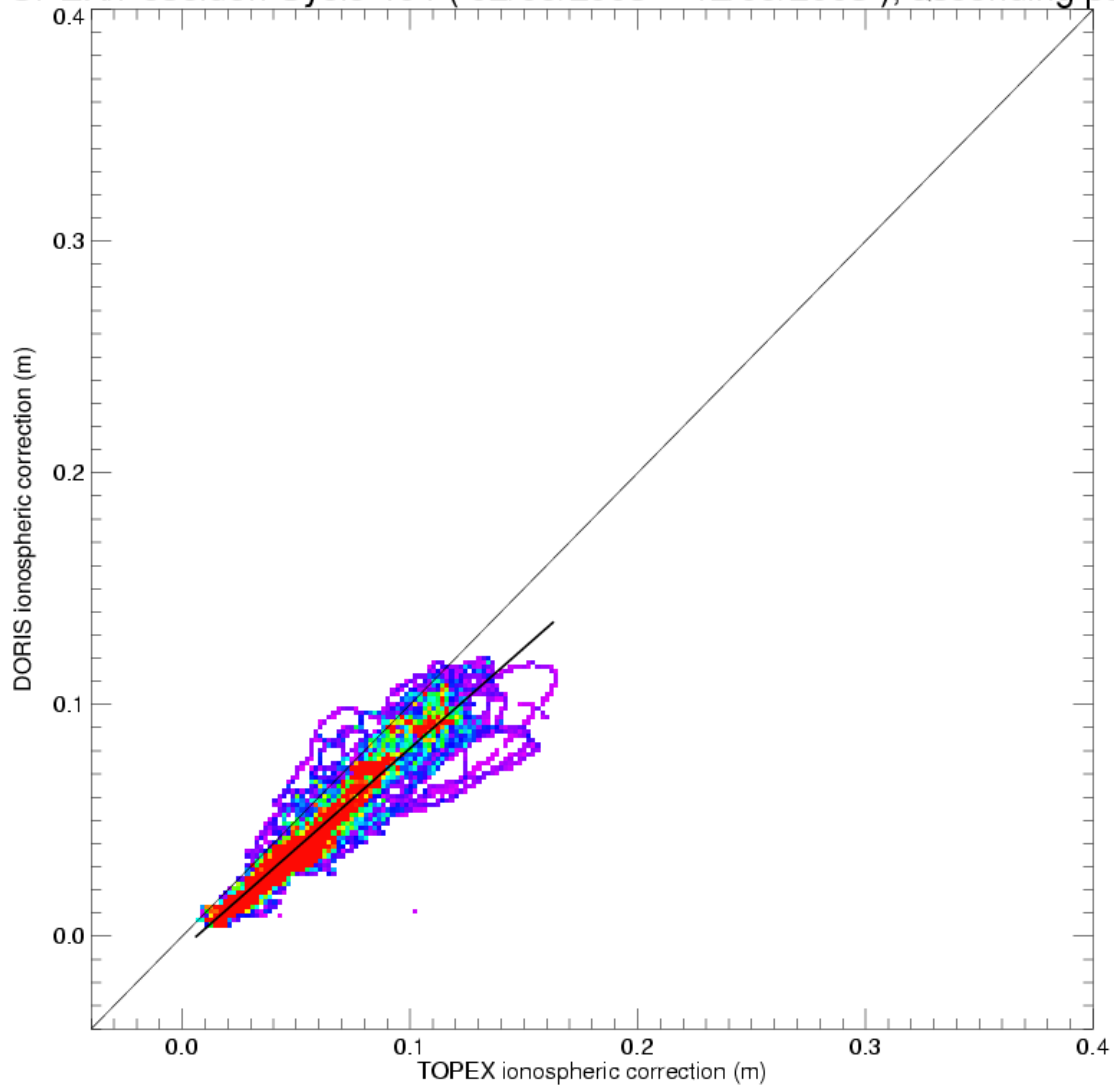
Percentage of valid data relative to the nominal pass  
TOPEX/Poseidon Cycle 404 (02/09/2003 / 12/09/2003)



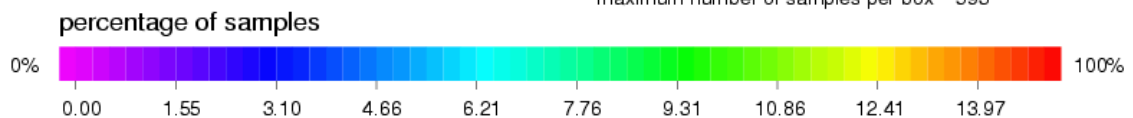


### 3.5 Ionospheric correction

TOPEX/Poseidon Cycle 404 ( 02/09/2003 – 12/09/2003 ), ascending passes



minimum number of samples per box 1  
maximum number of samples per box 593



#### Statistics Y-X

mean = -0.01378  
rms = 0.01711  
std = 0.01014

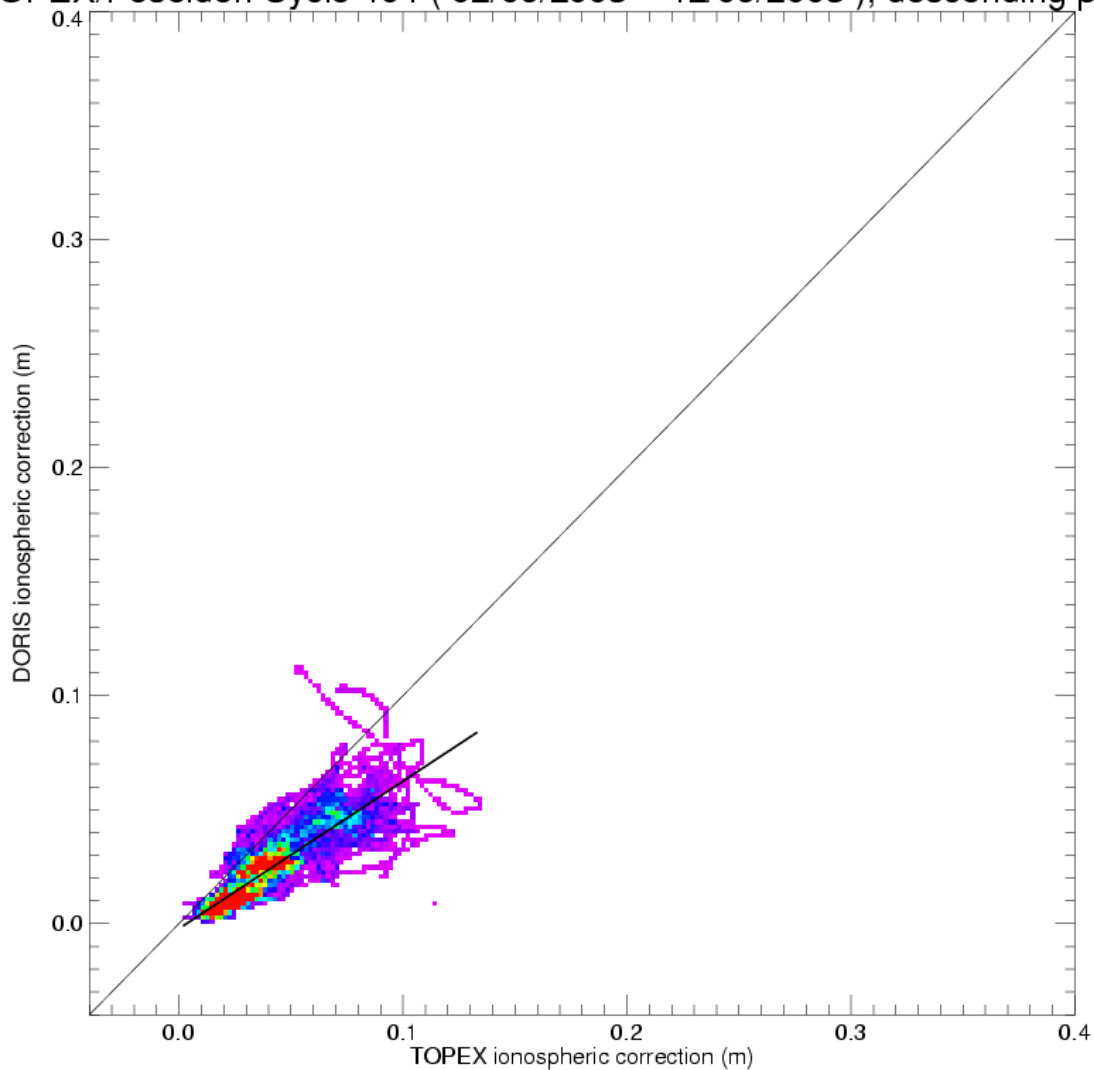
#### Order 1 fit polynomial

$y = a x + b$   
a = 0.86518371  
b = -0.00541358

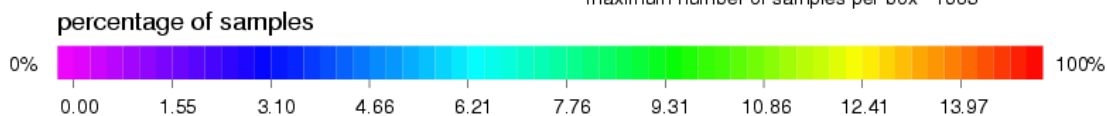
#### Legend

— Order 1 fit polynomial  
— Bisectrix

TOPEX/Poseidon Cycle 404 ( 02/09/2003 – 12/09/2003 ), descending passes



minimum number of samples per box 1  
 maximum number of samples per box 1683



**Statistics Y-X**

mean = -0.01536  
 rms = 0.01865  
 std = 0.01059

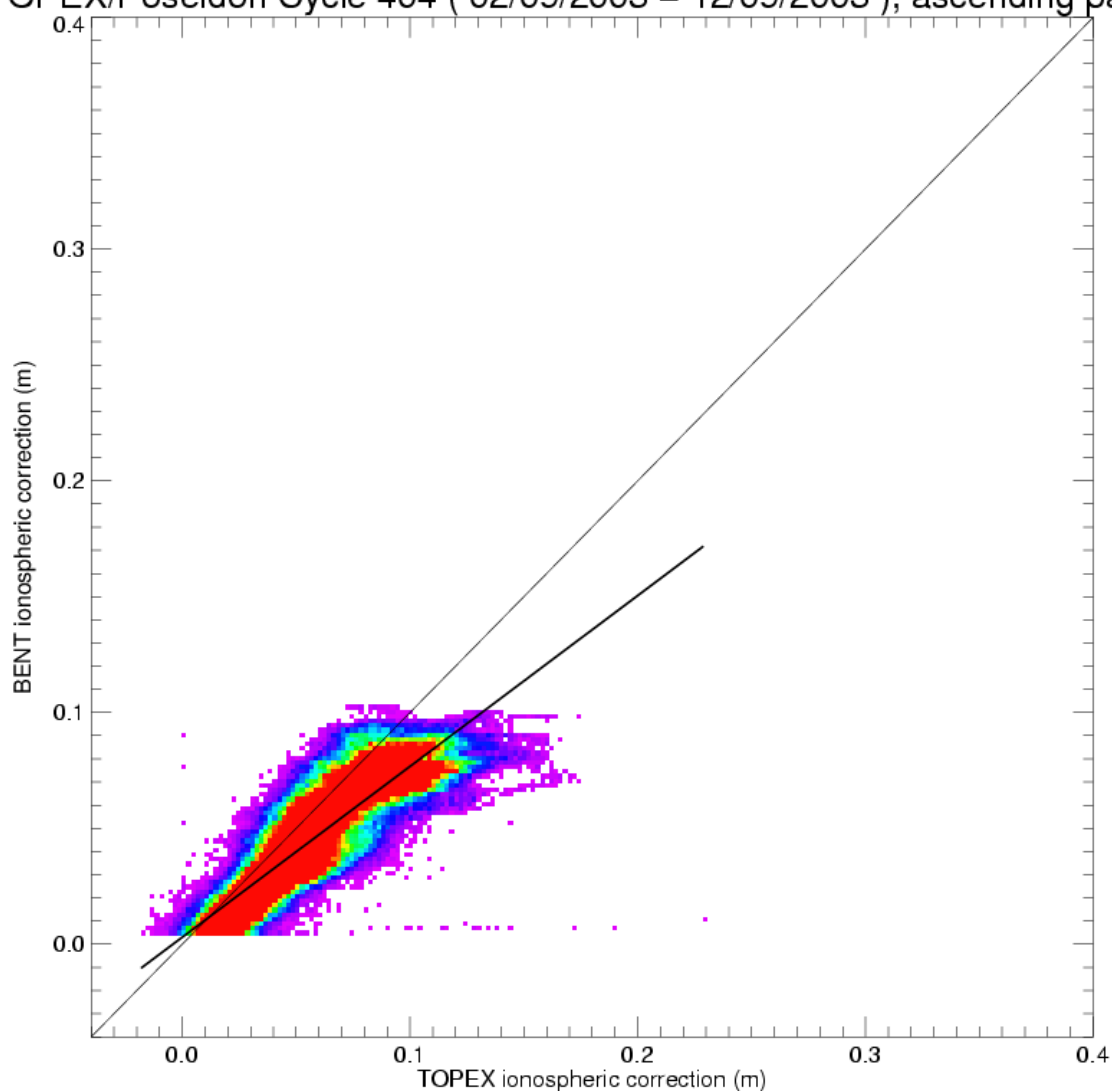
**Order 1 fit polynom**

$y = a x + b$   
 $a = 0.64718169$   
 $b = -0.00222015$

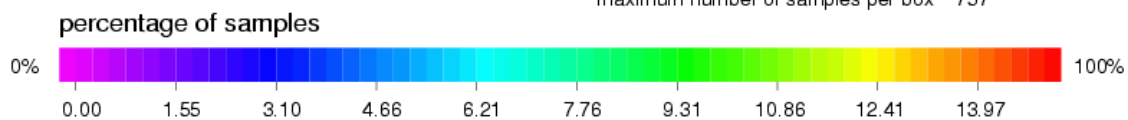
**Legend**

— Order 1 fit polynom  
 - - - Bisectrix

TOPEX/Poseidon Cycle 404 ( 02/09/2003 – 12/09/2003 ), ascending passes



minimum number of samples per box 1  
 maximum number of samples per box 757



**Statistics Y-X**

mean = -0.01226  
 rms = 0.01831  
 std = 0.01360

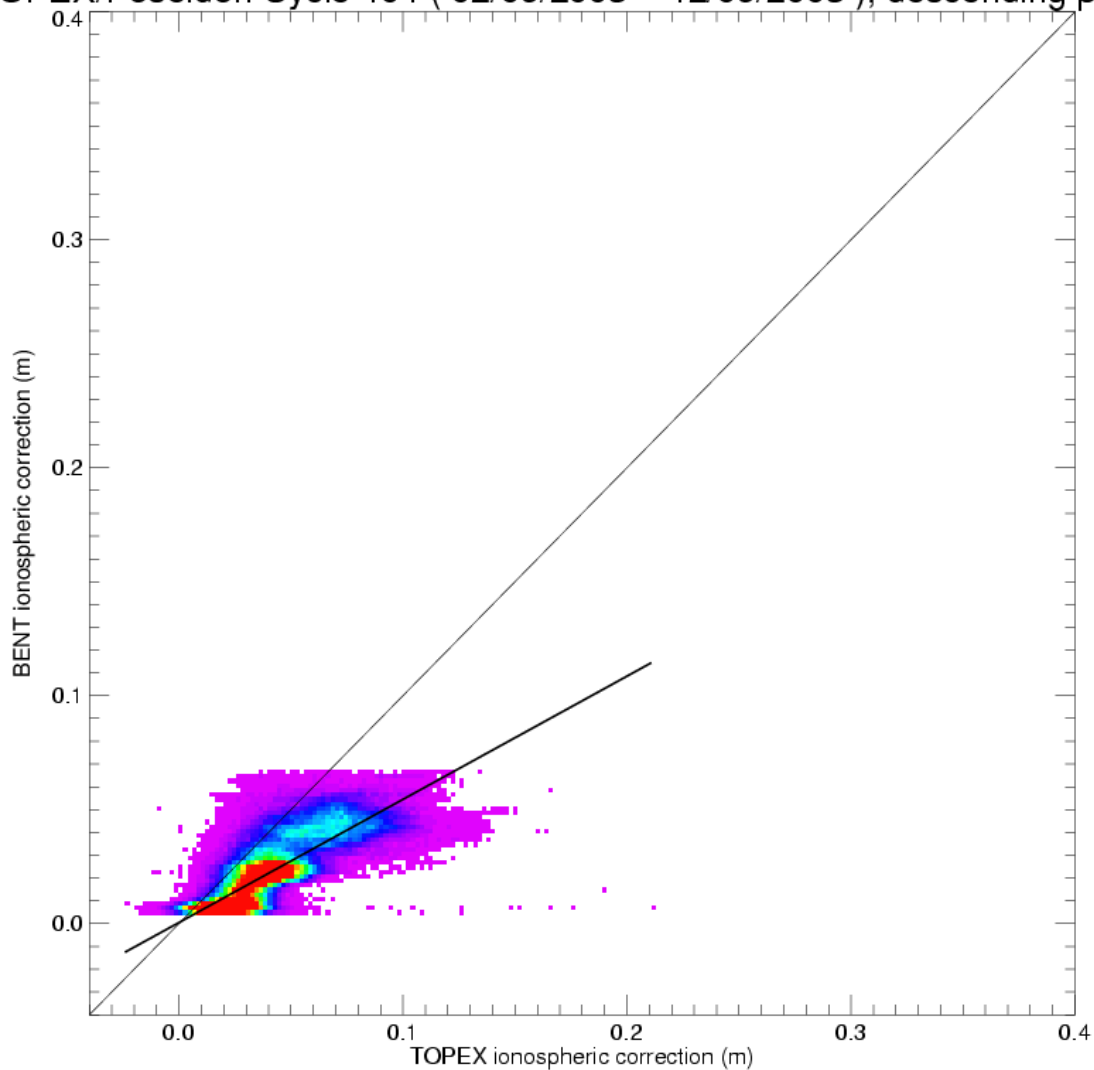
**Order 1 fit polynom**

$y = a x + b$   
 $a = 0.73734158$   
 $b = 0.00301688$

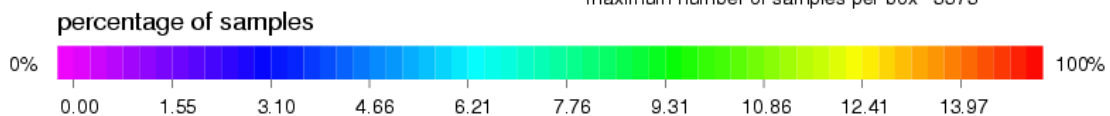
**Legend**

— Order 1 fit polynom  
 — Bisectrix

TOPEX/Poseidon Cycle 404 ( 02/09/2003 – 12/09/2003 ), descending passes



minimum number of samples per box 1  
 maximum number of samples per box 3373



**Statistics Y-X**

mean = -0.01697  
 rms = 0.02147  
 std = 0.01316

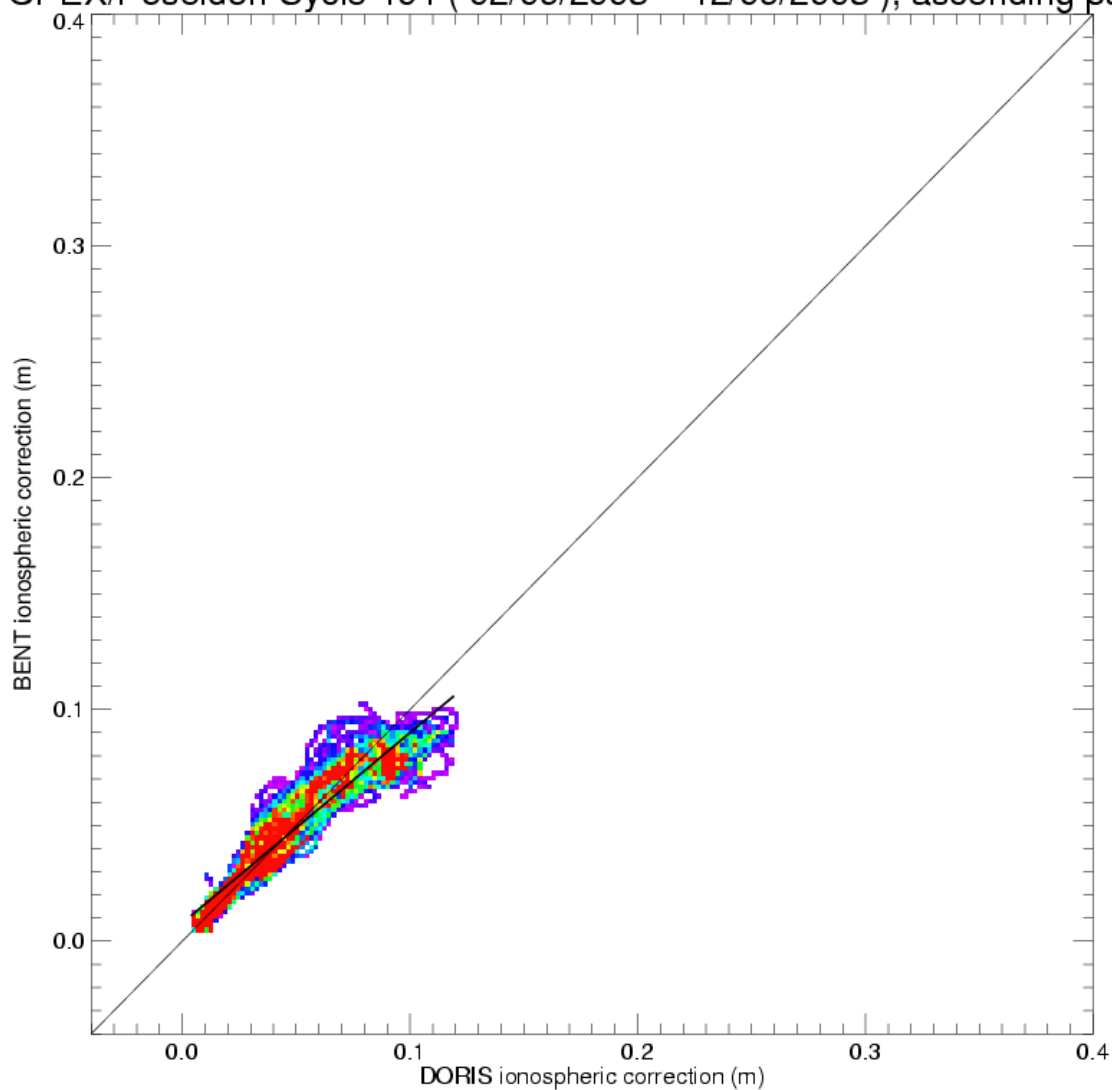
**Order 1 fit polynom**

$y = a x + b$   
 $a = 0.54045236$   
 $b = 0.00047397$

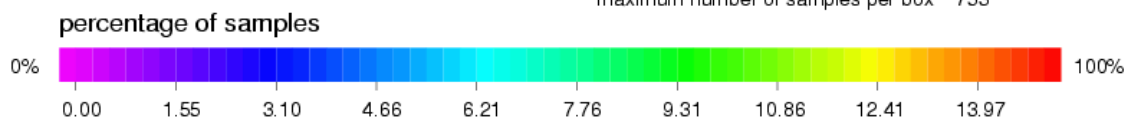
**Legend**

— Order 1 fit polynom  
 — Bisectrix

TOPEX/Poseidon Cycle 404 ( 02/09/2003 – 12/09/2003 ), ascending passes



minimum number of samples per box 1  
 maximum number of samples per box 753



**Statistics Y-X**

mean = -0.00078  
 rms = 0.00971  
 std = 0.00968

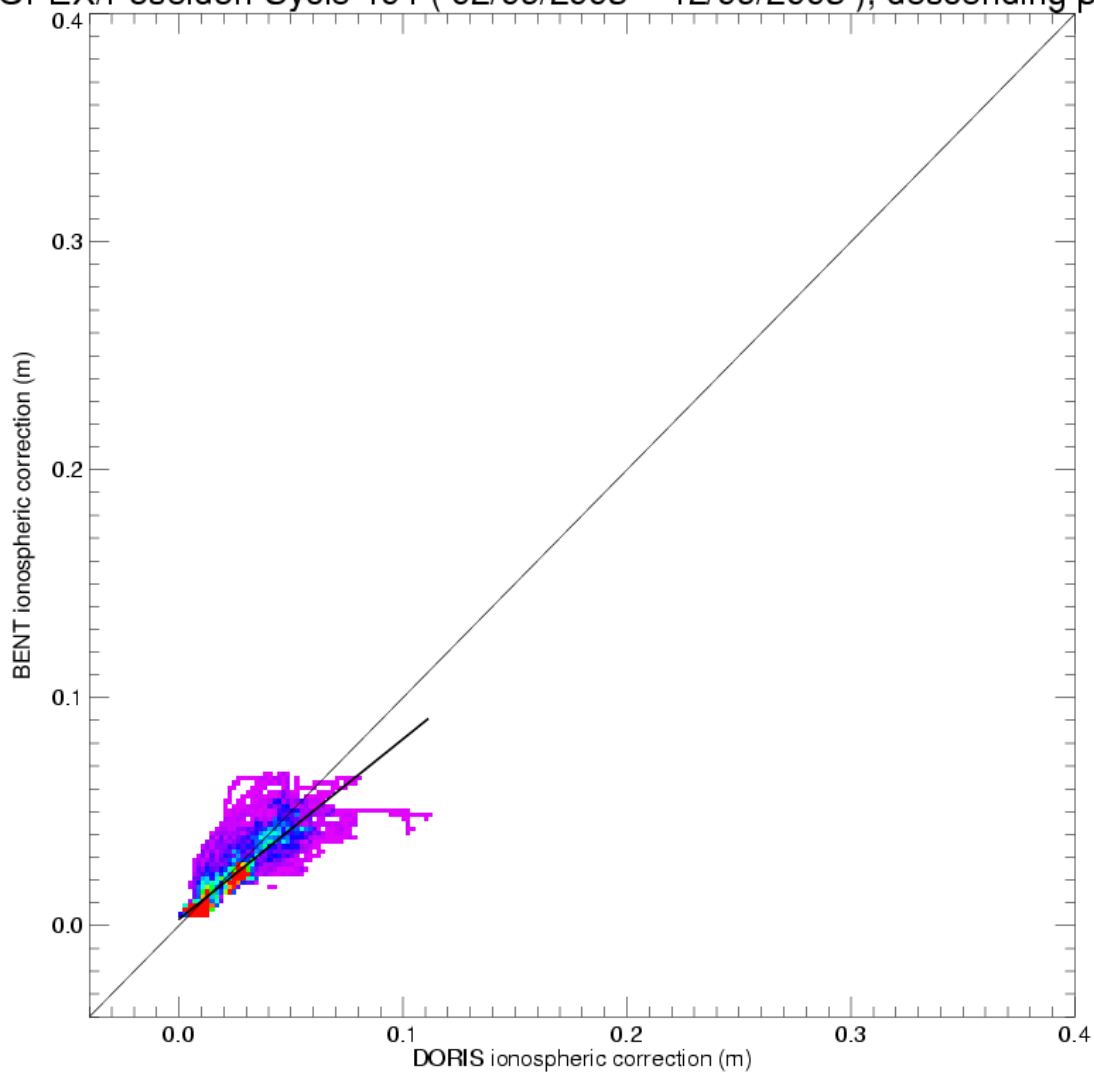
**Order 1 fit polynom**

$y = a x + b$   
 $a = 0.82186317$   
 $b = 0.00781800$

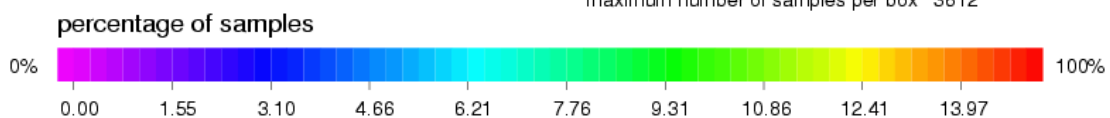
**Legend**

— Order 1 fit polynom  
 — Bisectrix

TOPEX/Poseidon Cycle 404 ( 02/09/2003 – 12/09/2003 ), descending passes



minimum number of samples per box 1  
 maximum number of samples per box 3612



**Statistics Y-X**

mean = -0.00178  
 rms = 0.00775  
 std = 0.00754

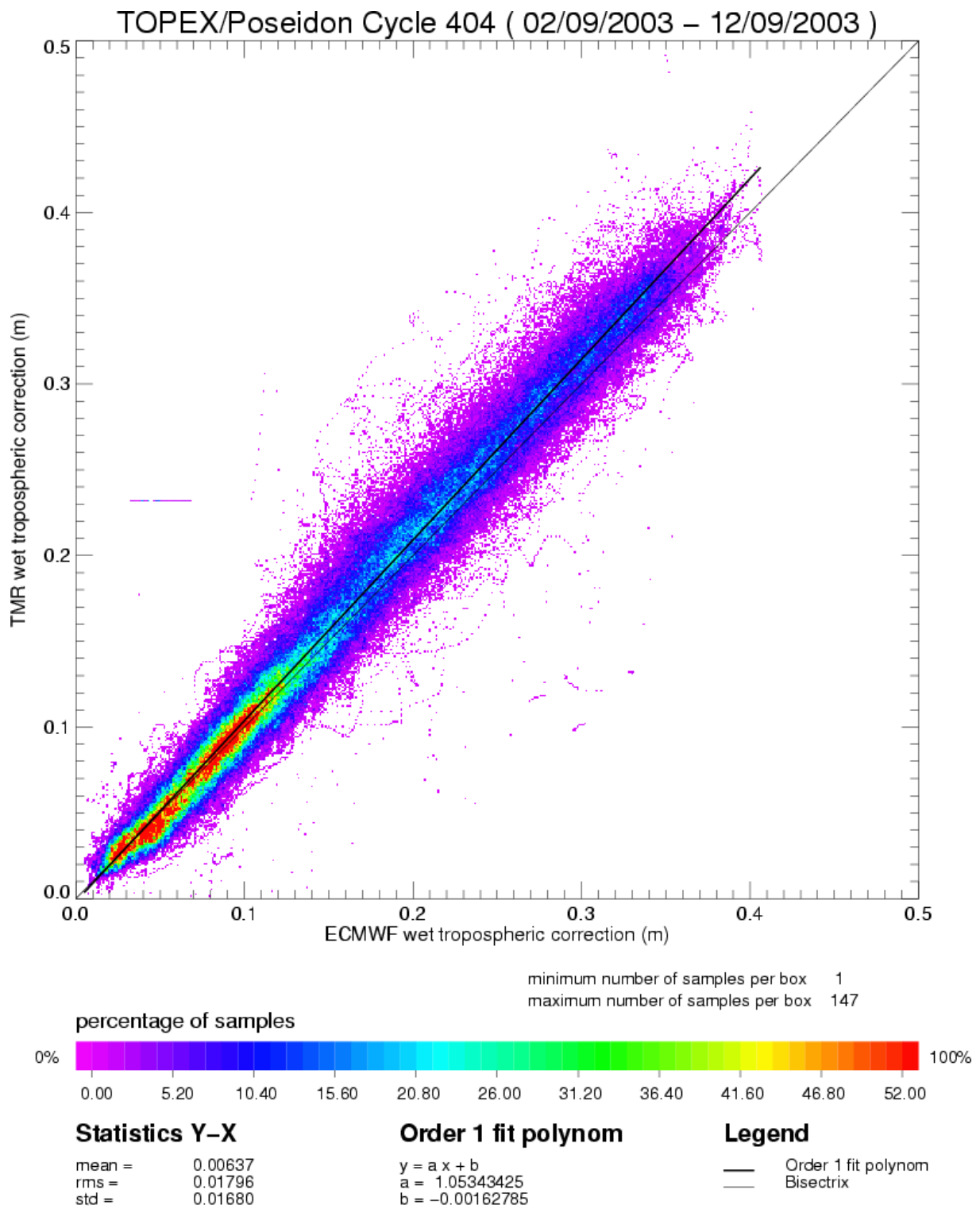
**Order 1 fit polynom**

$y = a x + b$   
 $a = 0.79061103$   
 $b = 0.00279895$

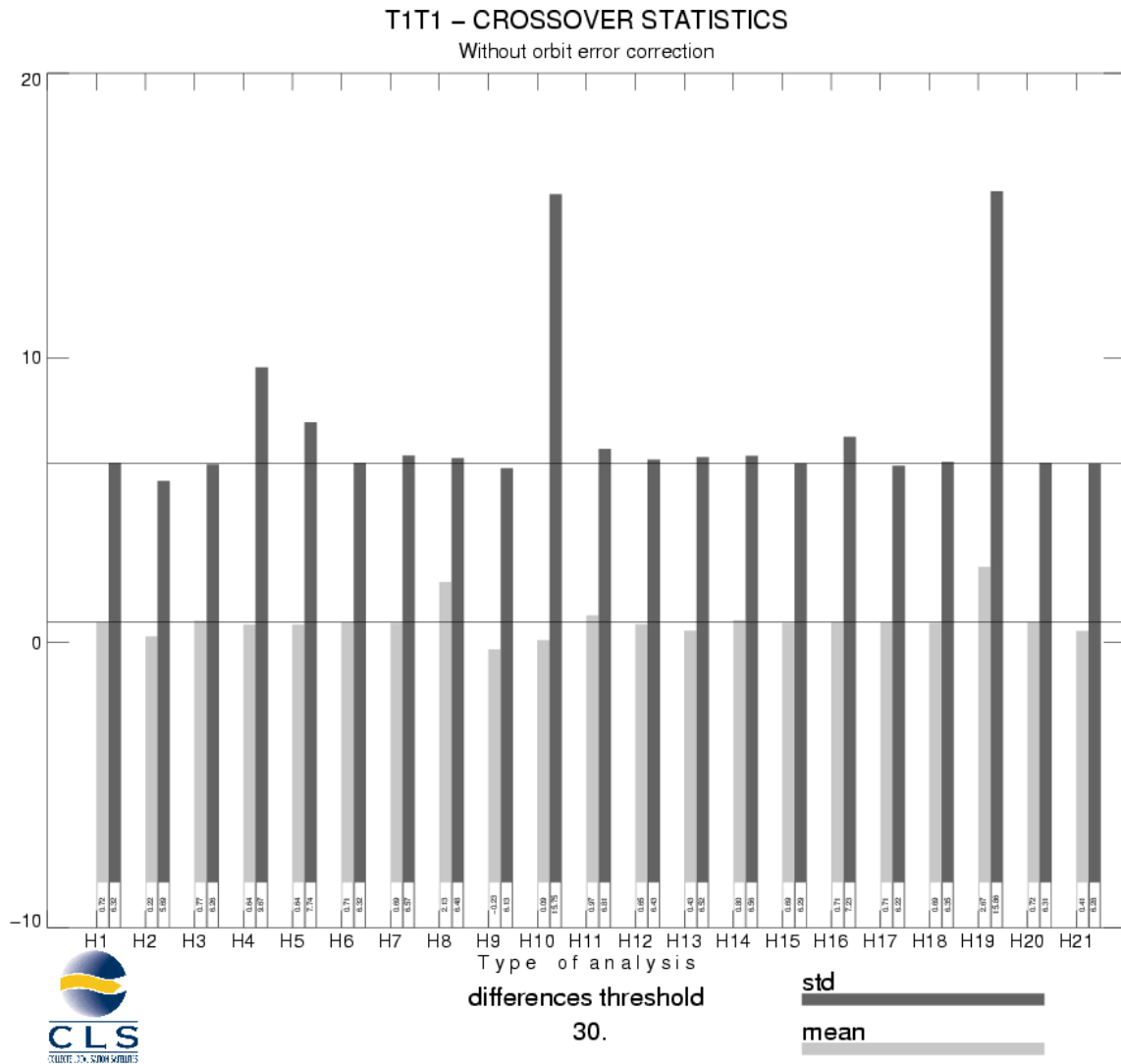
**Legend**

— Order 1 fit polynom  
 — Bisectrix

### 3.6 Wet tropospheric correction



### 3.7 Crossover statistics



SSH = Corrected sea surface height	SSH with FES99 tide model instead of GOT99
SSH = Corrected sea surface height with orbit error	SSH with FES02 tide model instead of GOT99
SSH without dry thopospheric correction	SSH with CSR3 tide model instead of GOT99
SSH without inverse barometer correction	SSH with GOT002 tide model instead of GOT99
SSH without wet topospheric correction	SSH without BM4 SSB correction
SSH with corrected tropo instead of TMR tropo	SSH with no-parametric SSB correction instead of BM4 SSB correction
SSH with ECMWF tropo instead of TMR tropo	SSH with BM3 SSB correction instead of BM4 SSB correction
SSH without ionospheric correction filtered	SSH without solid earth tide correction
SSH with DORIS iono correction instead of iono filtered	SSH without polar tide correction
SSH without GOT99 tide model	SSH = Corrected sea surface height with CNES orbit
SSH with FES95 tide model instead of GOT99	



### T1T1 – CROSSOVER STATISTICS

Without orbit error correction

SSH = Corrected sea surface height

#### RAPPEL DES SELECTIONS

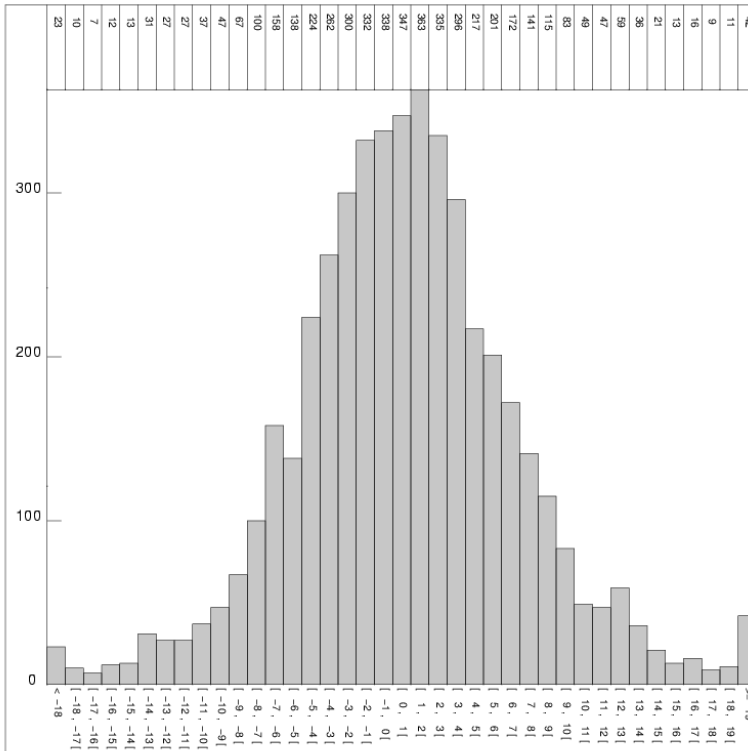
Type de points de croisement: T1T1  
 Zone géographique (deg): -90 / 90 , 0 / 360  
 Seuil sur les écarts d'analyse 0.00 (moy) 30.00 (seuil)  
 Selection(s) sur les champs :  
 CL Arc 1 :=INTERP\_SPLN  
 CL Arc 2 :=INTERP\_SPLN  
 Seuil Min +: 0.0000000  
 Seuil Max : 0.0000000

Selection(s) sur les écarts :  
 Aucune

#### RESULTATS STATISTIQUES

Valeur minimale : -29.9000  
 Valeur maximale : 29.0100  
 Différence Max – Min: 58.9100  
 Nombre de points lus: 4835  
 Nombre de points sélectionnés: 4726  
 Moyenne : 0.716007  
 Écart-type : 6.31563  
 Moyenne Quadratique : 6.35608

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### T1T1 – CROSSOVER STATISTICS

With orbit error correction

SSH = Corrected sea surface height

#### RAPPEL DES SELECTIONS

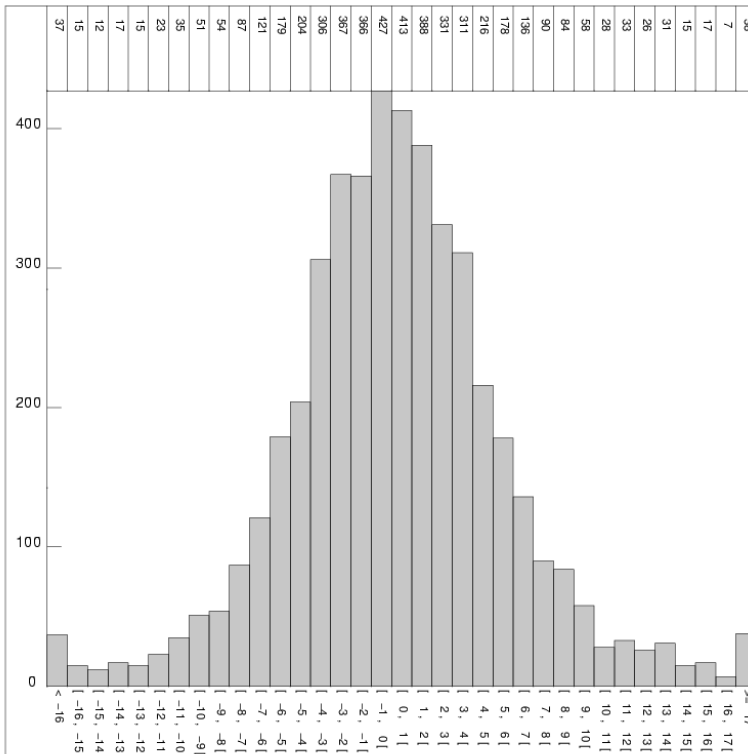
Type de points de croisement: T1T1  
 Zone géographique (deg): -90 / 90 , 0 / 360  
 Seuil sur les écarts d'analyse 0.00 (moy) 30.00 (seuil)  
 Selection(s) sur les champs :  
 CL Arc 1 :=INTERP\_SPLN  
 CL Arc 2 :=INTERP\_SPLN  
 Seuil Min +: 0.0000000  
 Seuil Max : 0.0000000

Selection(s) sur les écarts :  
 Aucune

#### RESULTATS STATISTIQUES

Valeur minimale : -29.9100  
 Valeur maximale : 29.8100  
 Différence Max – Min: 59.7200  
 Nombre de points lus: 4835  
 Nombre de points sélectionnés: 4716  
 Moyenne : 0.223338  
 Écart-type : 5.68732  
 Moyenne Quadratique : 5.69170

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**T1T1 – CROSSOVER STATISTICS**  
**SSH, BATHY < -1000 m, VAR\_OCE < 20 cm, LAT [-50°, +50]**

**SSH = Corrected sea surface height before orbit error**

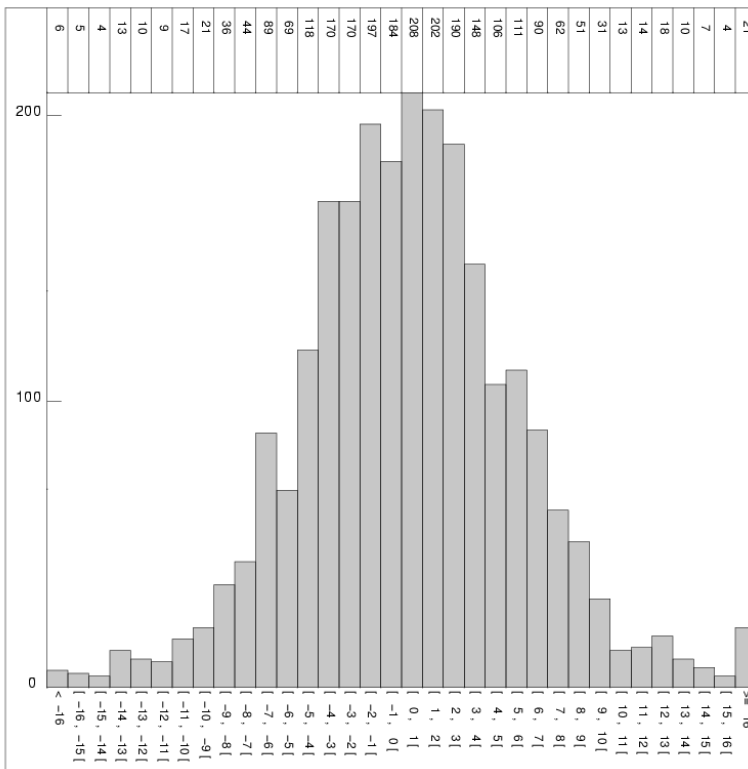
**RAPPEL DES SELECTIONS**

Type de points de croisement: T1T1  
 Zone géographique (deg): -50 / 50 , 0 / 360  
 Seuil sur les écarts d'analyse : aucun  
 Selection(s) sur les champs :  
 CL\_Arc 1 :=BATHY  
 CL\_Arc 2 :=BATHY  
 Seuil Min : aucun  
 Seuil Max : -100000.00  
 CL\_Arc 1 :=VAR\_OCE  
 CL\_Arc 2 :=VAR\_OCE  
 Seuil Min : aucun  
 Seuil Max : 20.000000  
 [...]
   
 Selection(s) sur les écarts :  
 Aucune

**RESULTATS STATISTIQUES**

Valeur minimale : -31.9700  
 Valeur maximale : 30.6700  
 Différence Max – Min: 62.6400  
 Nombre de points lus: 2672  
 Nombre de points sélectionnés: 2448  
 Moyenne : 0.365012  
 Écart-type : 5.49846  
 Moyenne Quadratique : 5.51056

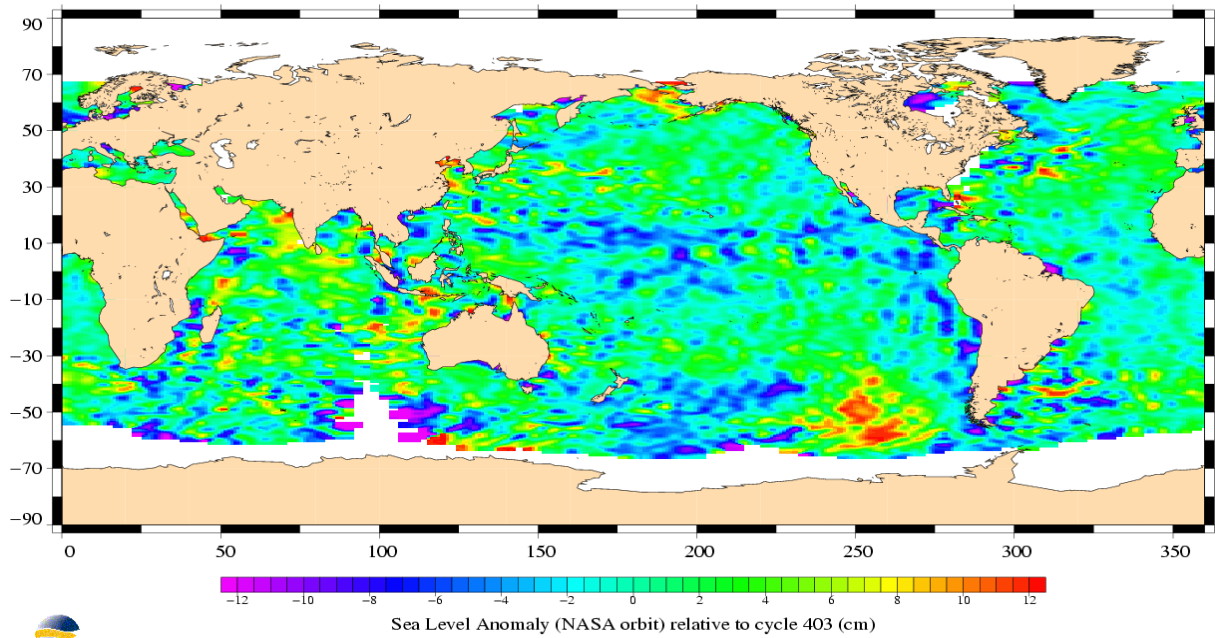
*CLS Space Oceanography Division*



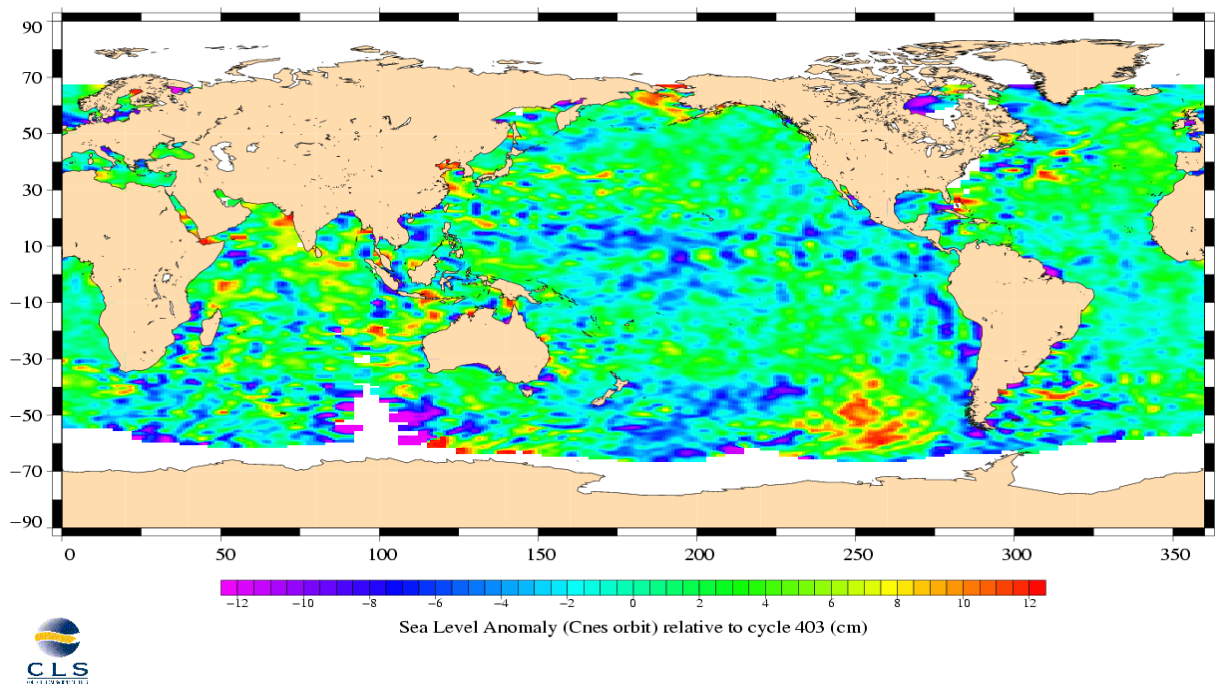
### 3.8 SSH variability

#### 3.8.1 Sea Level Anomaly

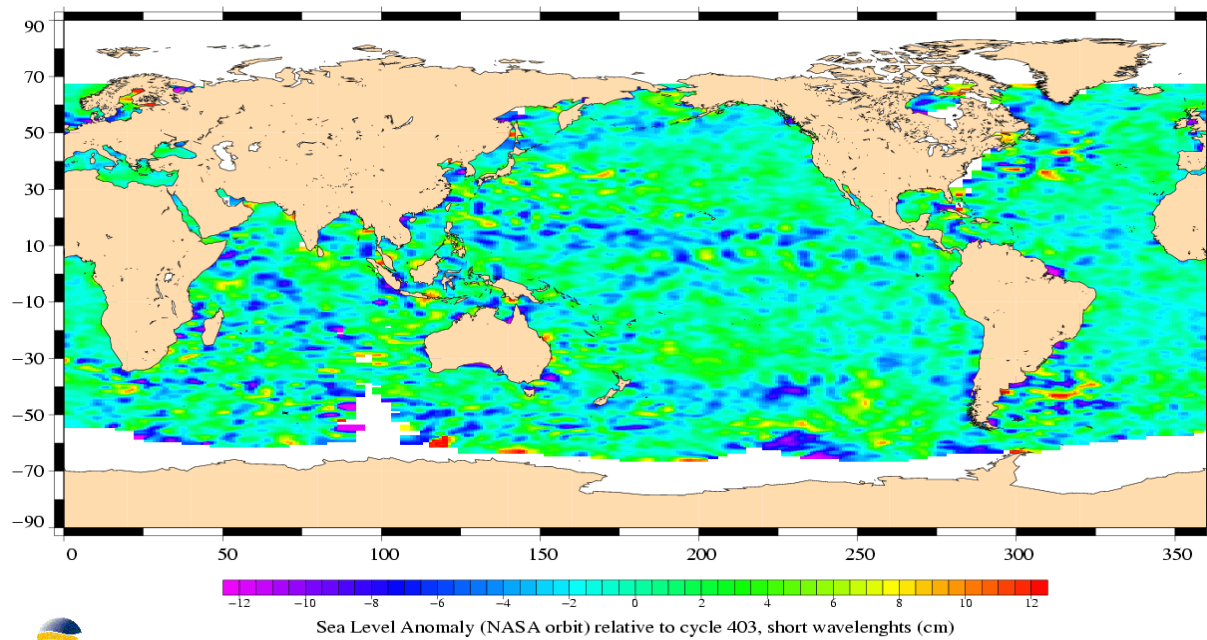
TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003



TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003



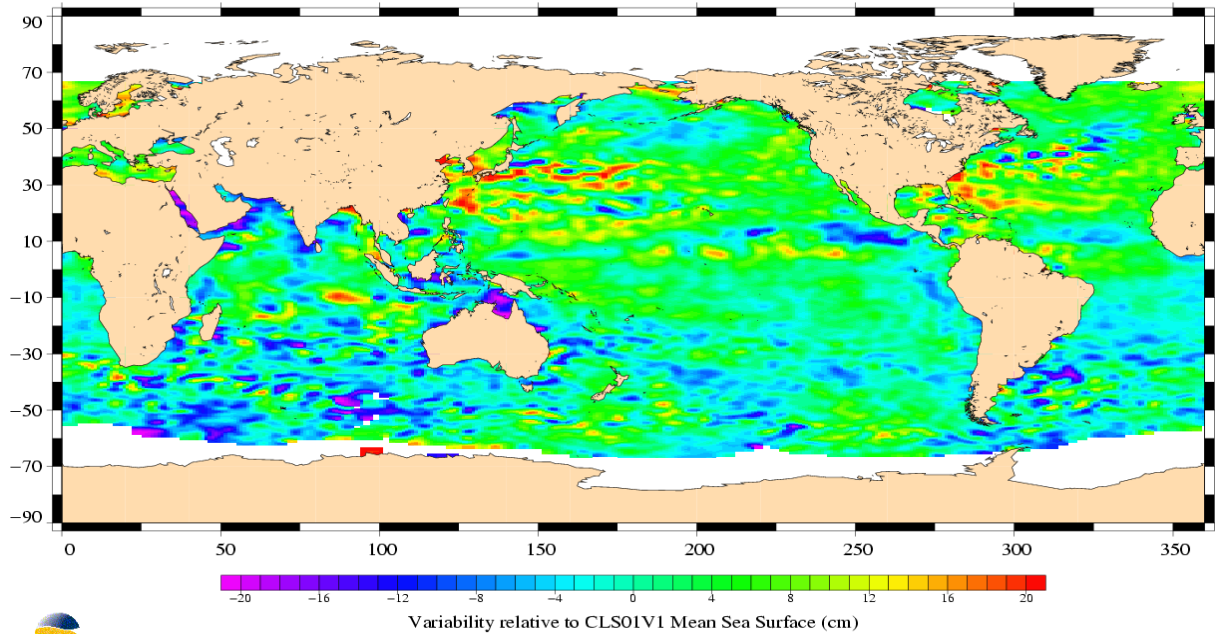
TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003



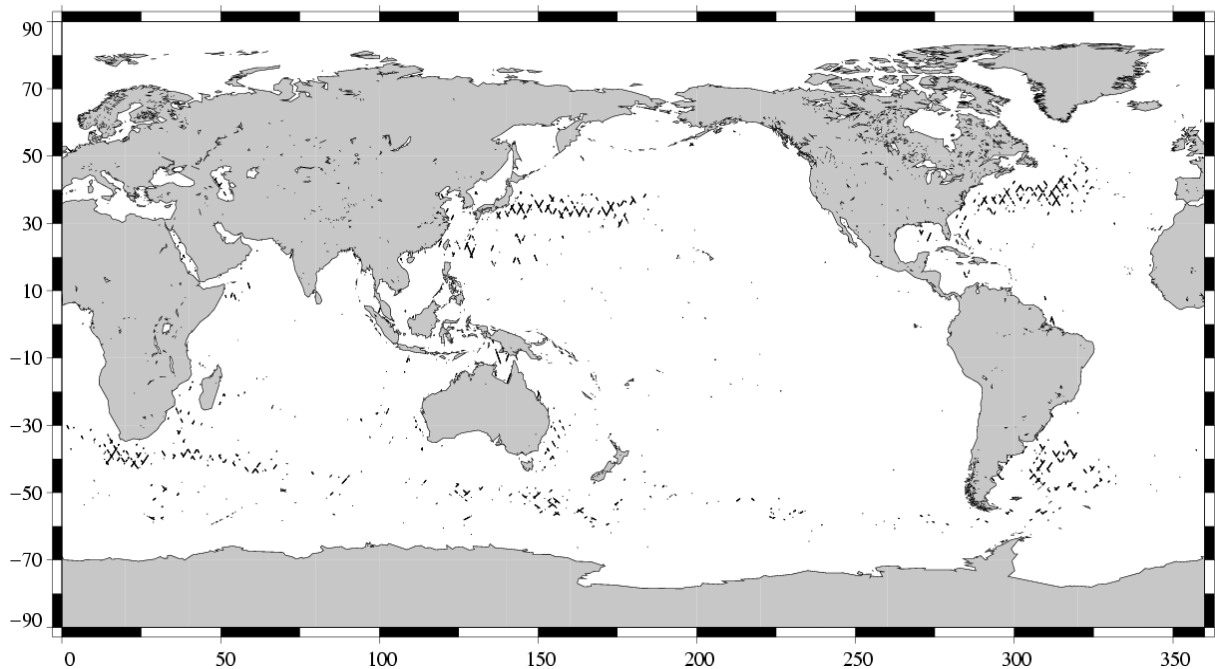
### 3.8.2 Comparison to a precise Mean Sea Surface

The CLS (2001) MSS model is used as a reference to compute SLA. The two following maps respectively show the map of Topex SLA relative to the MSS and differences higher than a 30 cm threshold (after centering the data). The latter figure shows that higher differences are located in high ocean variability areas, as expected.

TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003

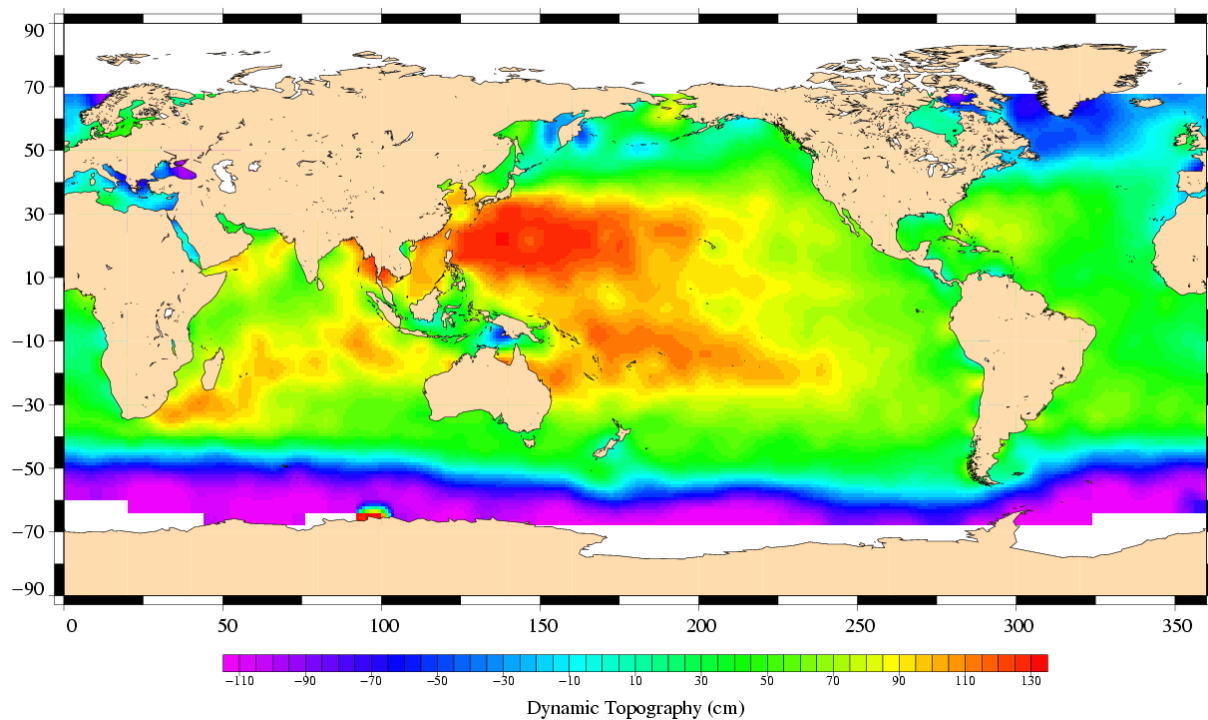


(SSH - MSS) differences greater than 0.3 m  
TOPEX/Poseidon Cycle 404 (02/09/2003 / 12/09/2003)



### 3.9 Dynamic topography

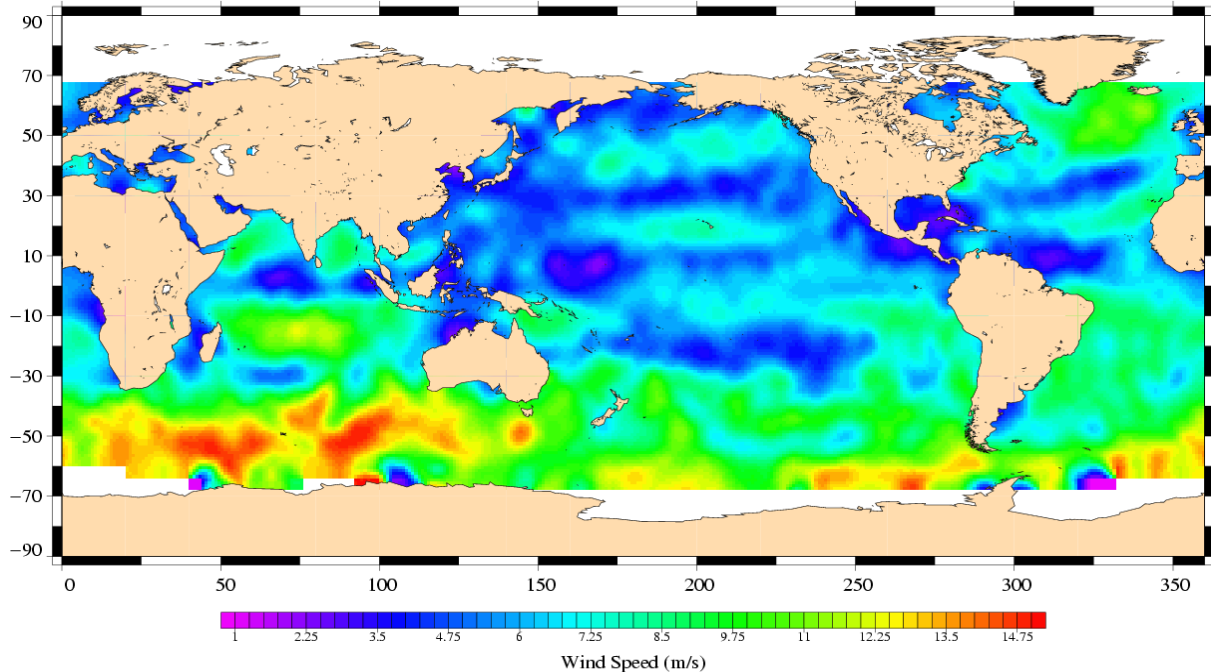
TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003



### 3.10 Wind and wave maps

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

TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003



TOPEX/Poseidon, cycle 404  
Period : 02/09/2003 – 12/09/2003

