TOPEX/Poseidon MGDR
Quality Assessment Report

Cycle 450

01-12-2004 / 11-12-2004

Prepared by :	C. Schgounn, CLS G. Pontonnier, CLS M. Ablain, CLS	
Accepted by :	J. Dorandeu, CLS	
Quality visa :	M. Destouesse, CLS	
Approved by :	N. Picot, CNES	

SALP-RP-P2-EX-21120-CLS450
Edition 01.0, March 2005

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 is nominal.

For this cycle, the crossover standard deviation is 6.54 cm rms. When using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes (> |50| deg.) it decreases down to 5.81 cm rms.

The standard deviation of Sea Level Anomalies (SLA) relative to a 7-year Mean Sea Surface is 21.61 cm. When using a selection to remove shallow waters (1000 m), areas of high ocean variability and high latitudes (> |50| deg), it lowers to 9.63 cm .

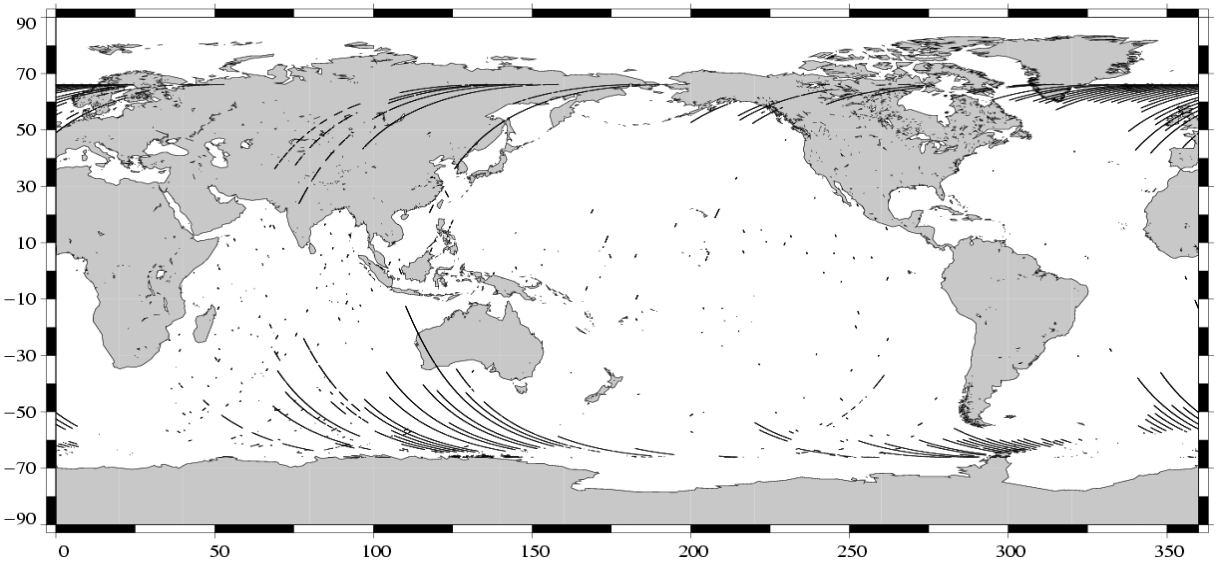
2.2 Missing measurements

Pass 98 and a large part of pass 97 are missing due to an Altimeter SEU on 05, December 2004.

2.3 Warnings and recommendations

- Missing measurements :
  - Since October 08th all mission data recovery requirements have been met via TDRSS real time contacts.
    Therefore there is a lot of data gaps, especially in the Indian Ocean, between the East and Southeast Pacific basin, in the South Pacific Ocean close to the South and Central America coasts and below the Groenland coasts.
- Doris switch off :
  The DORIS instrument was switched off since the incident on 01, November 2004. All the POE requirements are now met using lasernet tracking data. Only bent ionospheric correction is available.
- 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 :
  - 6.20% of the measurements are removed by the TMR correction criterion (see the following figure).
  - Some measurements have radiometer earth flag set to valid over earth. A new criterion has been added to the editing procedure to remove all these measurements (see **Editing**) .

Edited parameter : Radiometer wet tropospheric correction
T/P Cycle 450 (01/12/2004 / 11/12/2004)

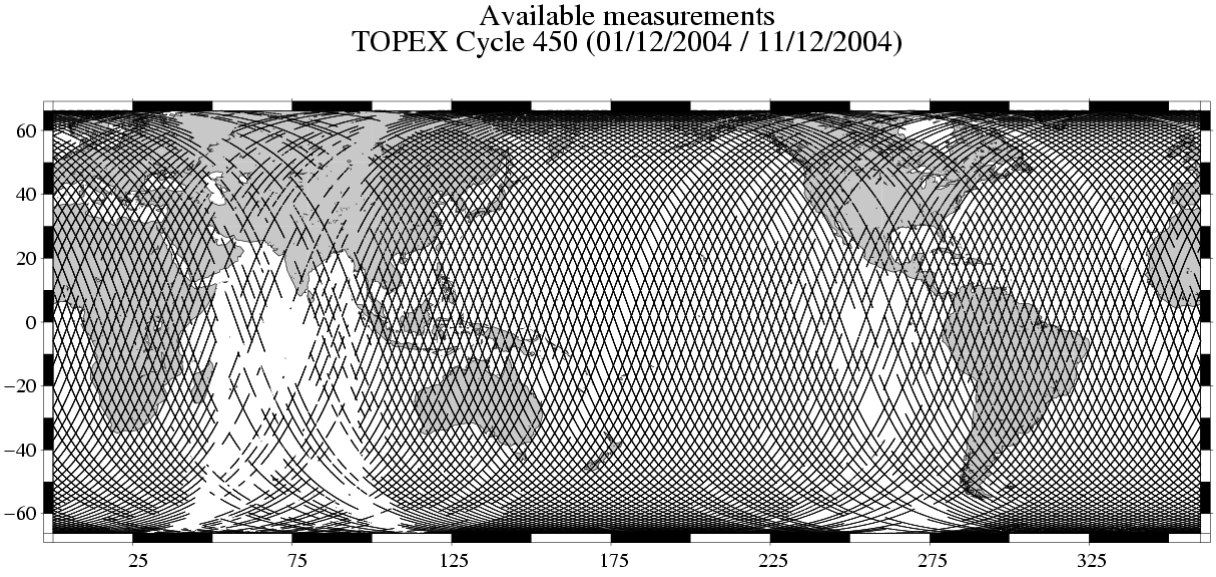


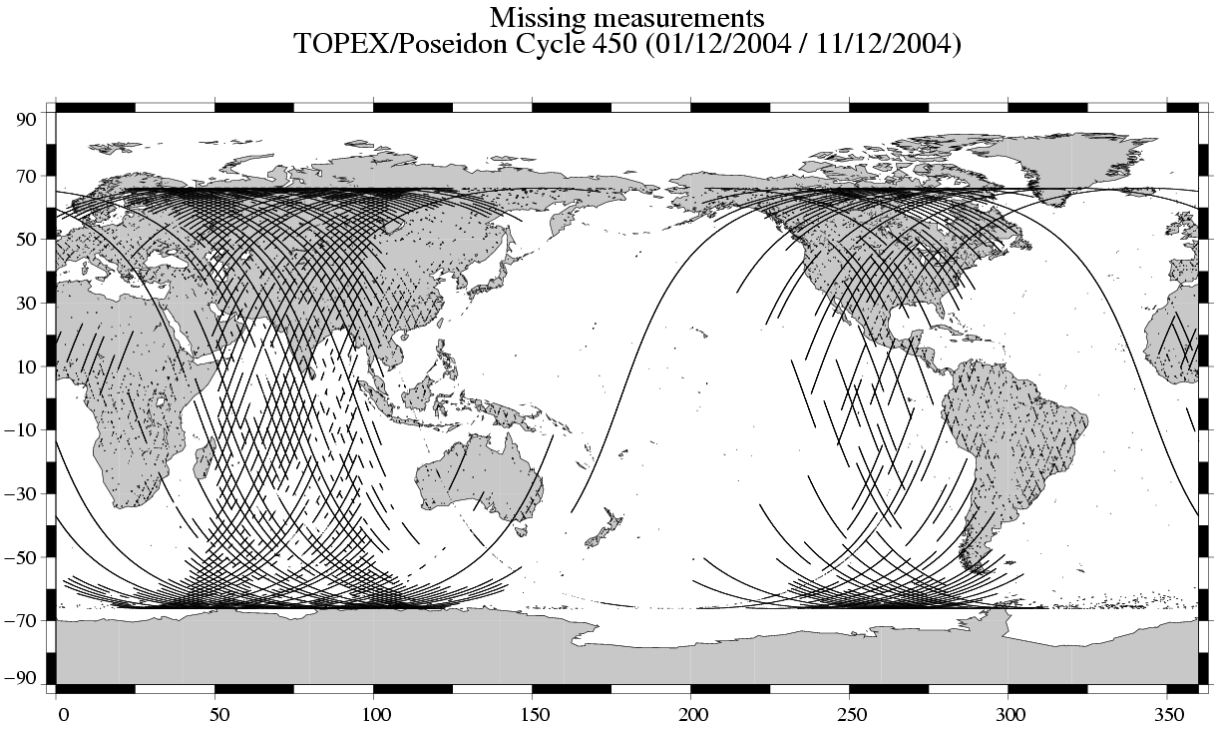
3 CALVAL main results

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

617537 altimeter measurements are present, and 177118 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.



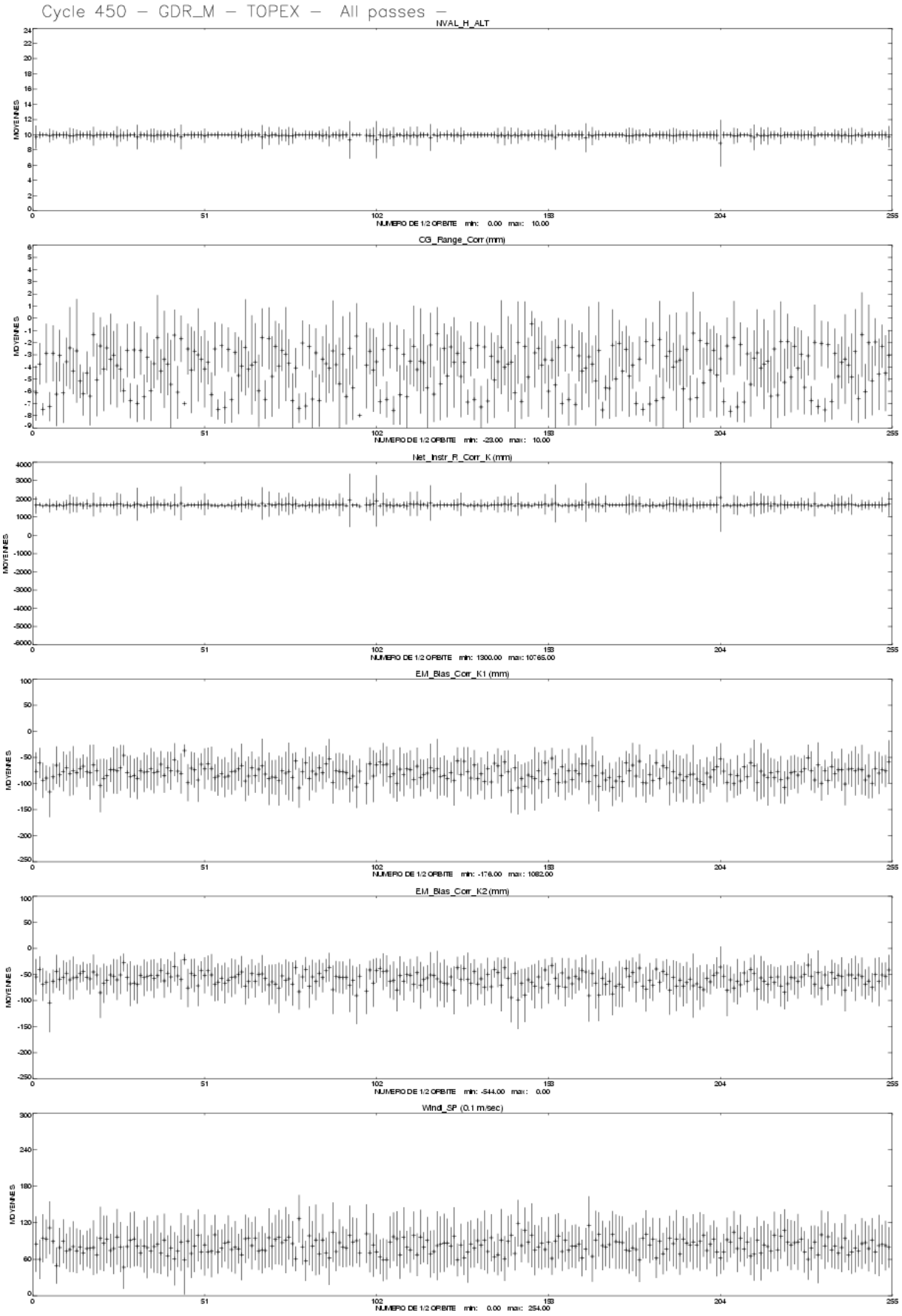


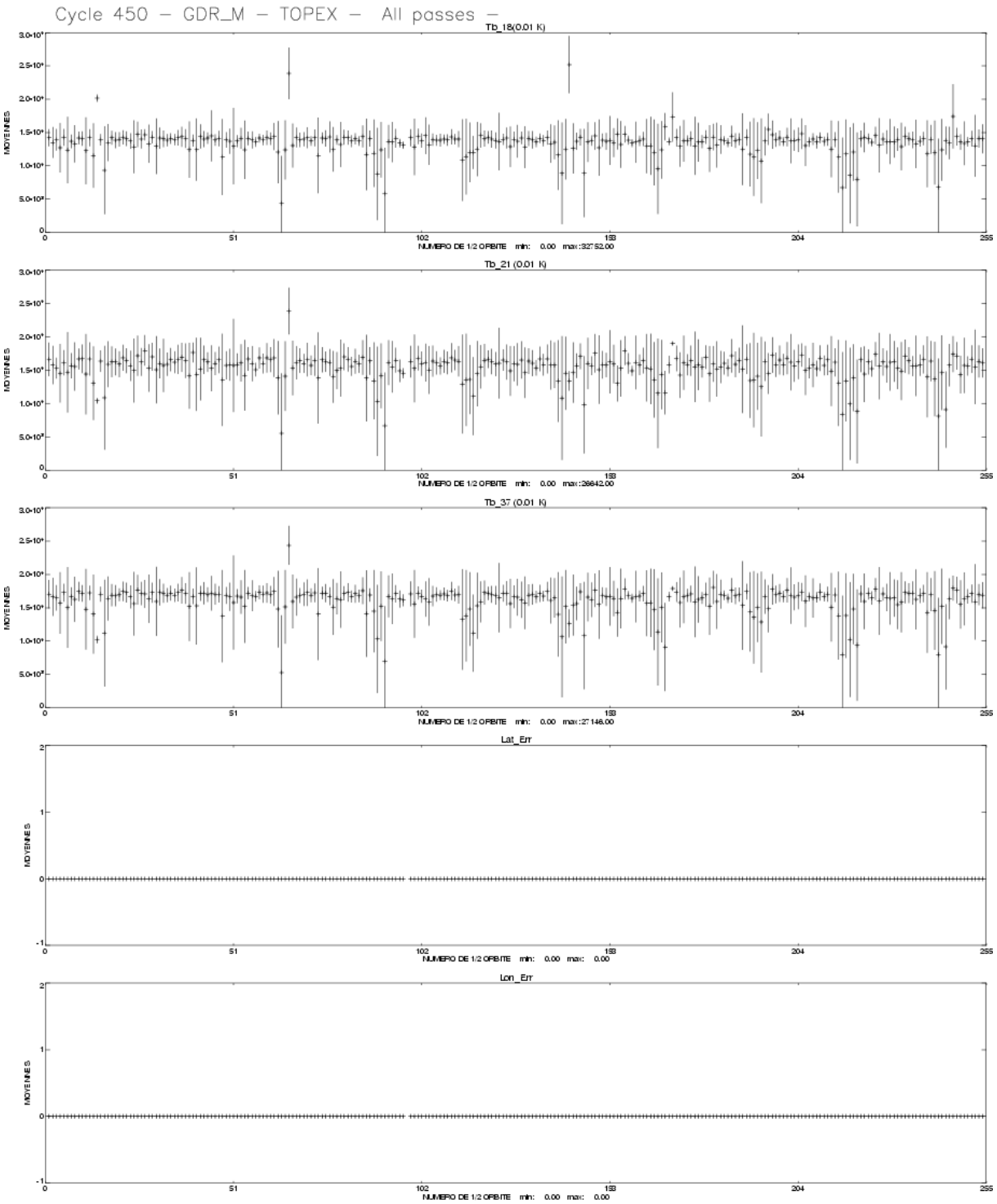
3.2 M-GDR quality flags

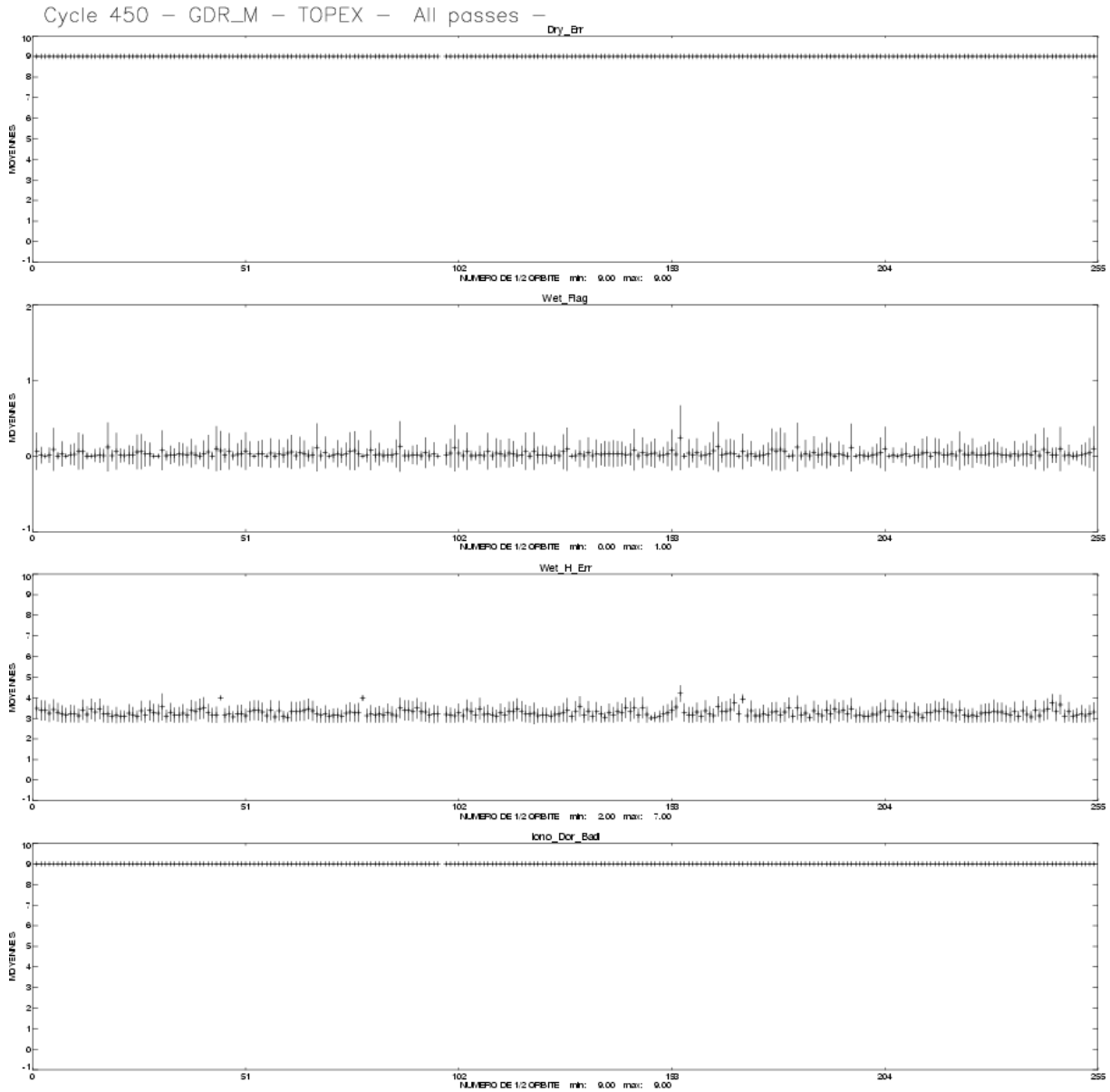
The following table indicates the percentage of measurements for which those flags are set.

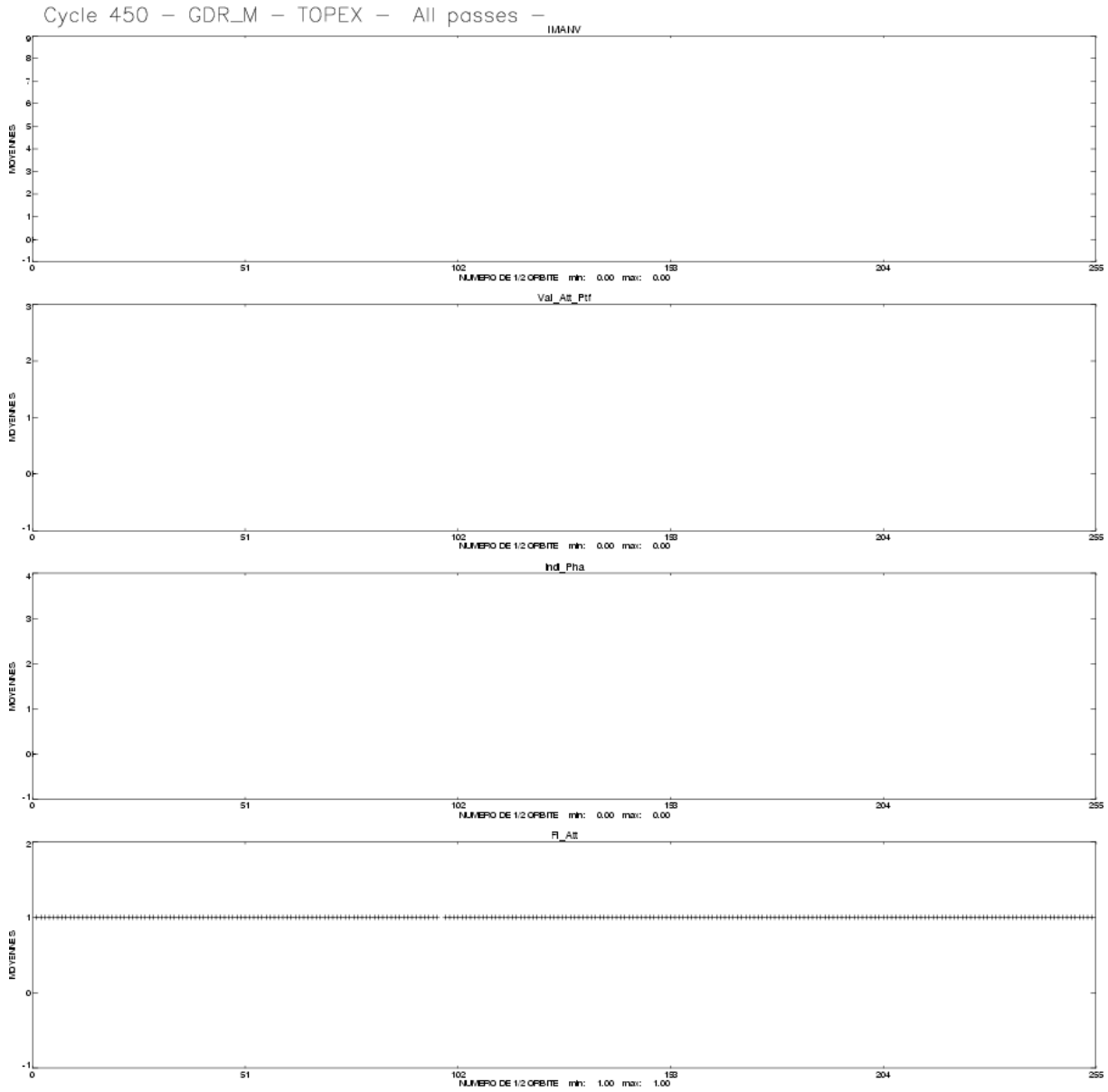
Name	Descrition	% bad
Geo_Bad_1	altimeter land flag	25.71
Geo_Bad_1	ice flag	6.57
Geo_Bad_1	radiometer land flag	27.49
Alt_Bad_1	conditions 1 altimeter	4.42
Alt_Bad_2	conditions 2 altimeter	4.25
Geo_Bad_2	rain (liquid water in excess)	10.26
Geo_Bad_2	less than 4 points for CSR3.0 tide calculation	0.40
Geo_Bad_2	less than 4 points for FES95.2.1 tide calculation	2.81
TOPEX	TOPEX not valid	0.00
TMR	TMR not valid	0.00
TMR_Bad	Brightness temperatures not valid	11.68
DORIS	DORIS not valid	0.00

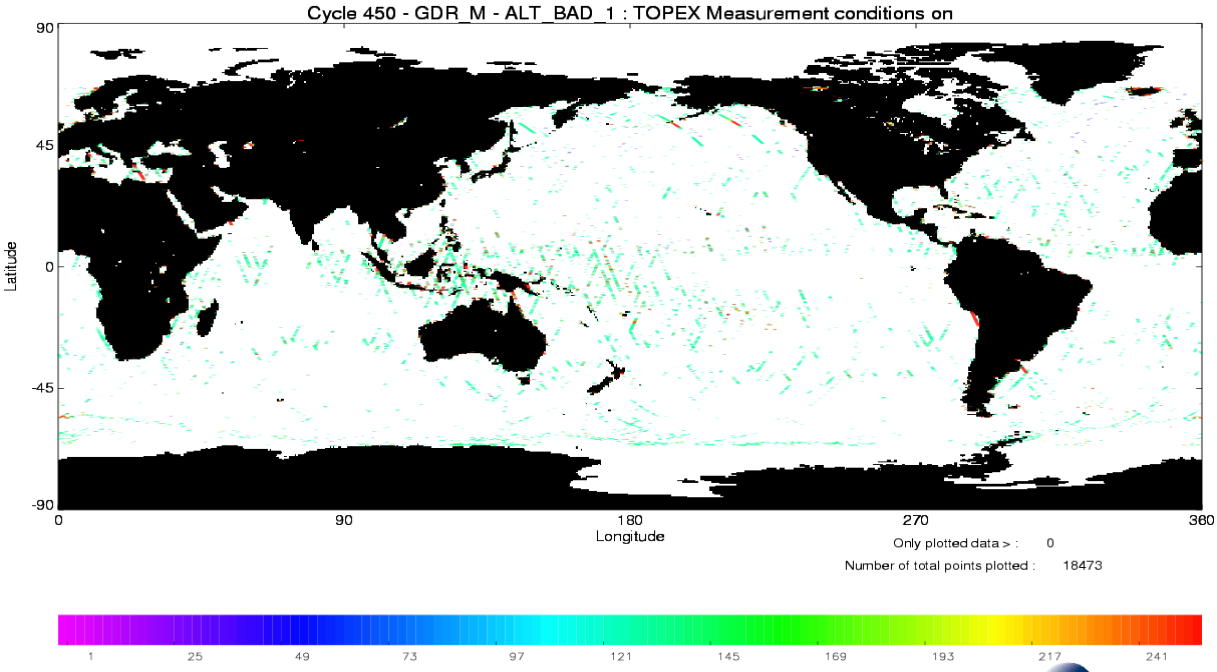
3.3 M-GDR parameter plots

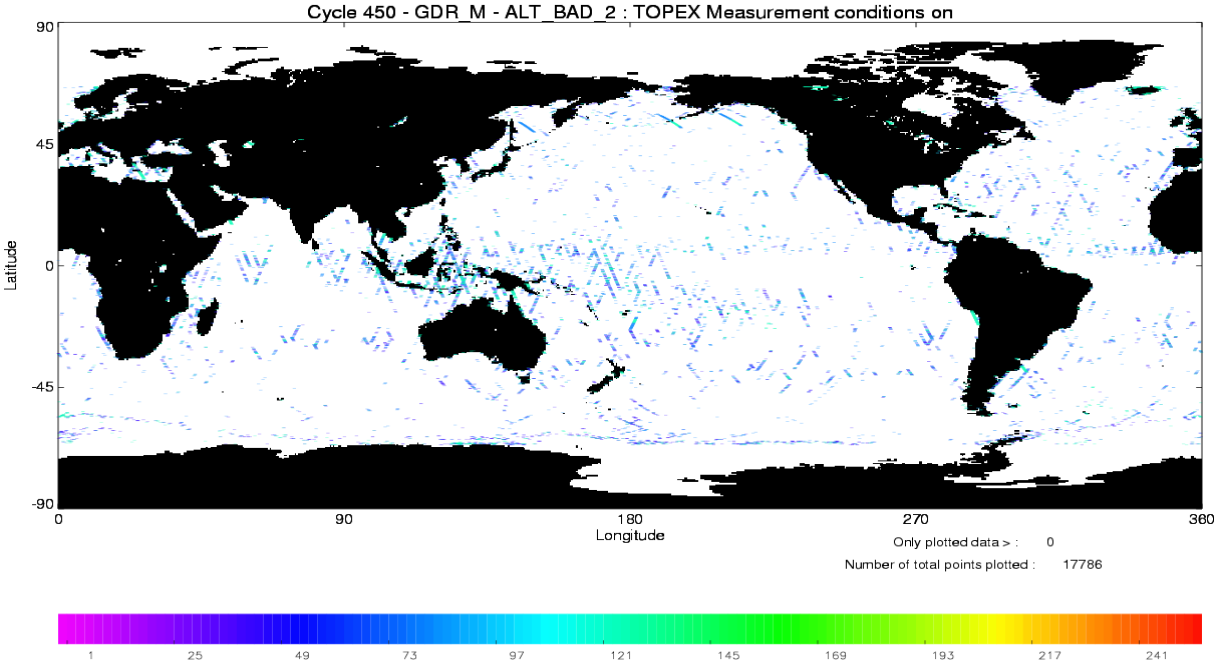


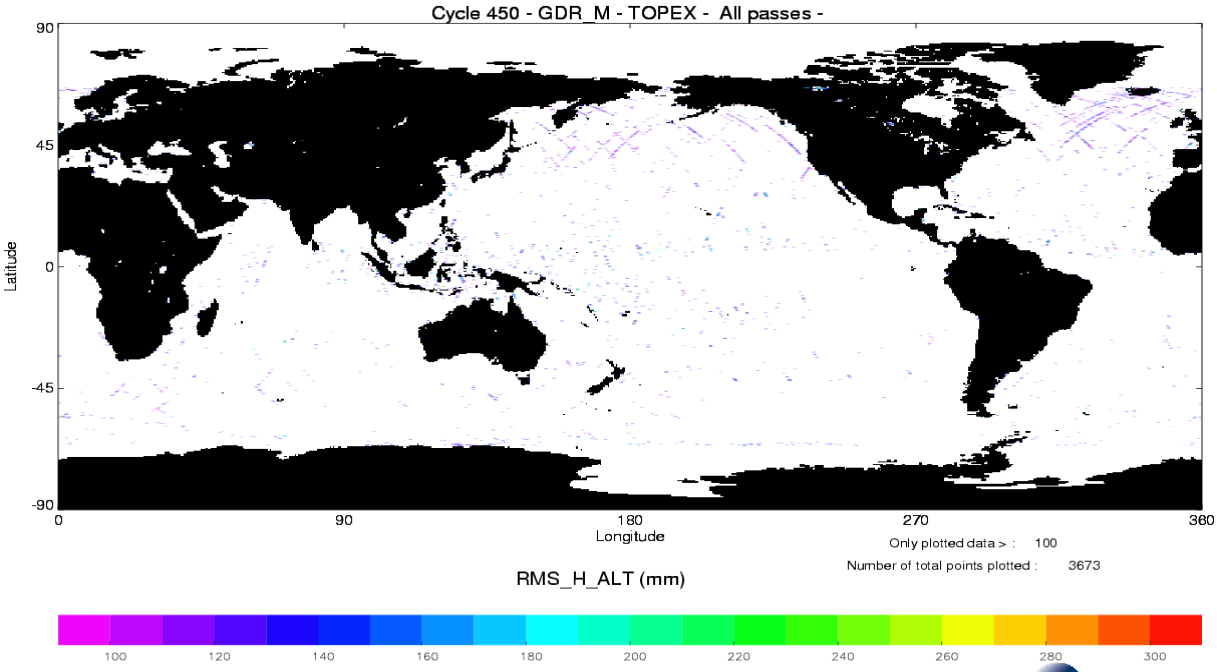

Cycle 450 – GDR_M – TOPEX – All passes –
Tb_18(0.01 K)
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 32752.00
Tb_21 (0.01 K)
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 28842.00
Tb_37 (0.01 K)
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 27146.00
Lat_Err
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 0.00
Lon_Err
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 0.00

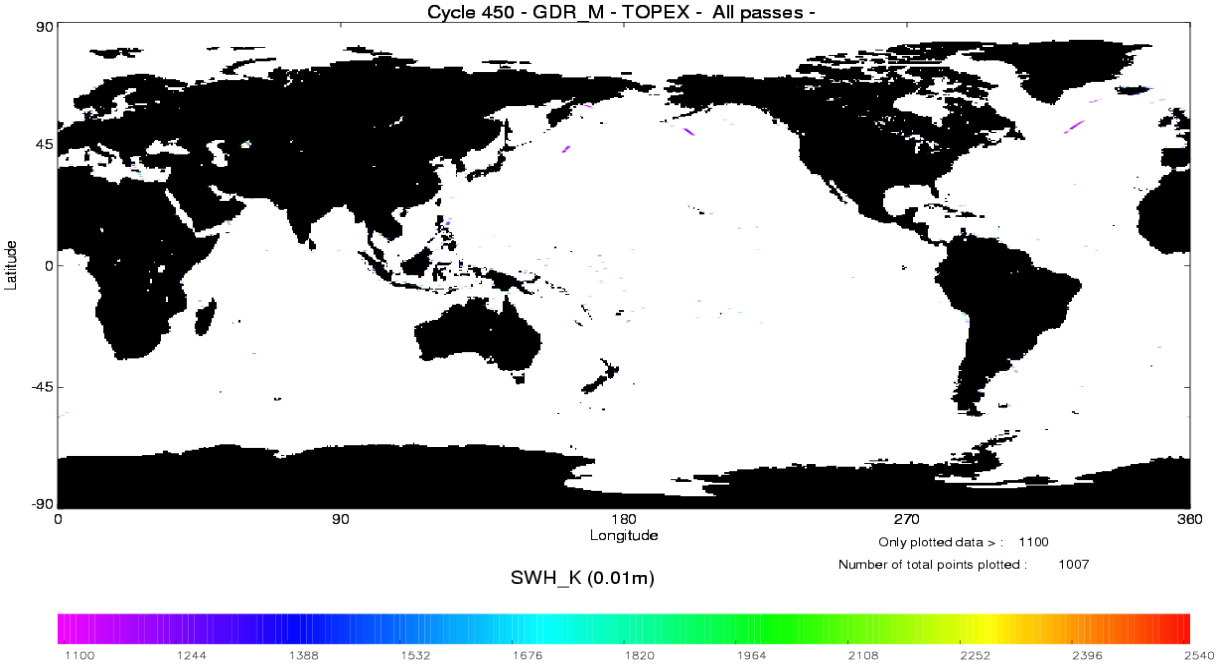

Cycle 450 – GDR_M – TOPEX – All passes –
Dry_Err
MOYENNES
NUMERO DE 1/2 ORBITE min: 9.00 max: 9.00
Wet_Flag
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 1.00
Wet_H_Err
MOYENNES
NUMERO DE 1/2 ORBITE min: 2.00 max: 7.00
Iono_Dor_Badl
MOYENNES
NUMERO DE 1/2 ORBITE min: 9.00 max: 9.00

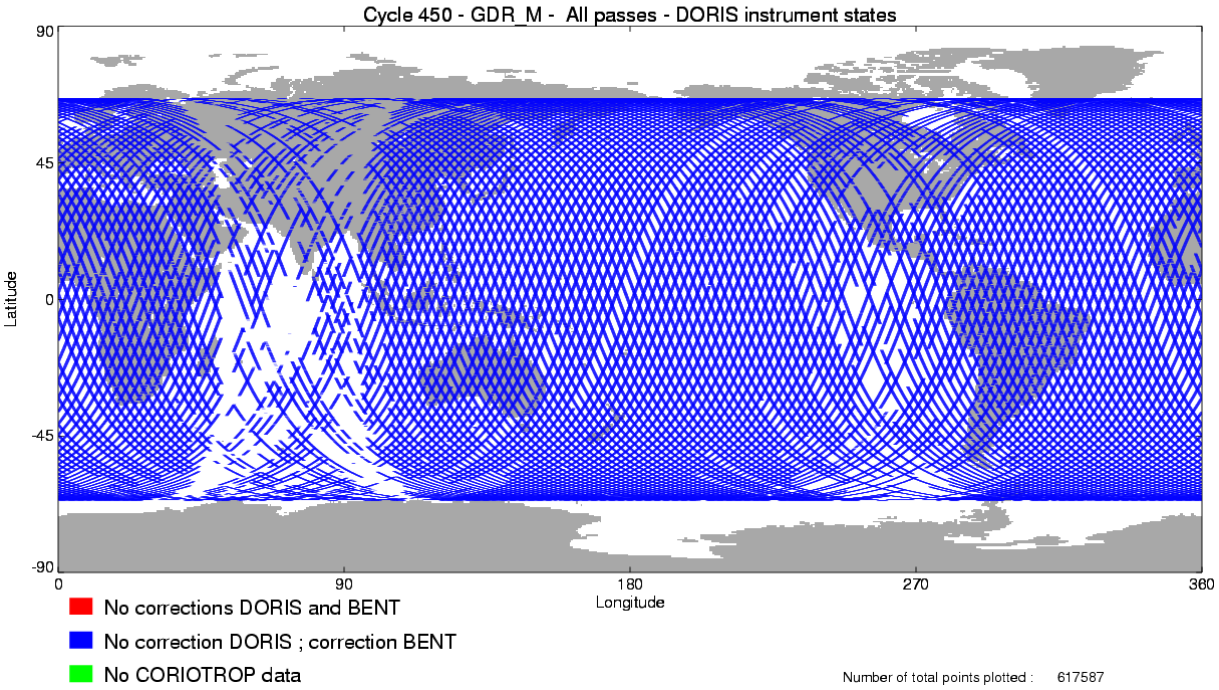

Cycle 450 – GDR_M – TOPEX – All passes –
IMANV
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 0.00
Val_Att_Ptf
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 0.00
Indi_Pha
MOYENNES
NUMERO DE 1/2 ORBITE min: 0.00 max: 0.00
Fl_Att
MOYENNES
NUMERO DE 1/2 ORBITE min: 1.00 max: 1.00


Cycle 450 - GDR_M - ALT_BAD_1 : TOPEX Measurement conditions on
90
45
0
-45
-90
Latitude
0
90
180
270
360
Longitude
Only plotted data > : 0
Number of total points plotted : 18473
1
25
49
73
97
121
145
169
193
217
241


Cycle 450 - GDR_M - ALT_BAD_2 : TOPEX Measurement conditions on
90
45
0
-45
-90
Latitude
0
90
180
270
360
Longitude
Only plotted data > : 0
Number of total points plotted : 17786
1
25
49
73
97
121
145
169
193
217
241


Cycle 450 - GDR_M - TOPEX - All passes -
Latitude
Longitude
Only plotted data > : 100
Number of total points plotted : 3673
RMS_H_ALT (mm)


Cycle 450 - GDR_M - TOPEX - All passes -
Latitude
Longitude
Only plotted data > : 1100
Number of total points plotted : 1007
SWH_K (0.01m)


Cycle 450 - GDR_M - All passes - DORIS instrument states
90
45
0
-45
-90
Latitude
0
90
180
270
360
Longitude
No corrections DORIS and BENT
No correction DORIS ; correction BENT
No CORIOTROP data
Number of total points plotted : 617587

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.

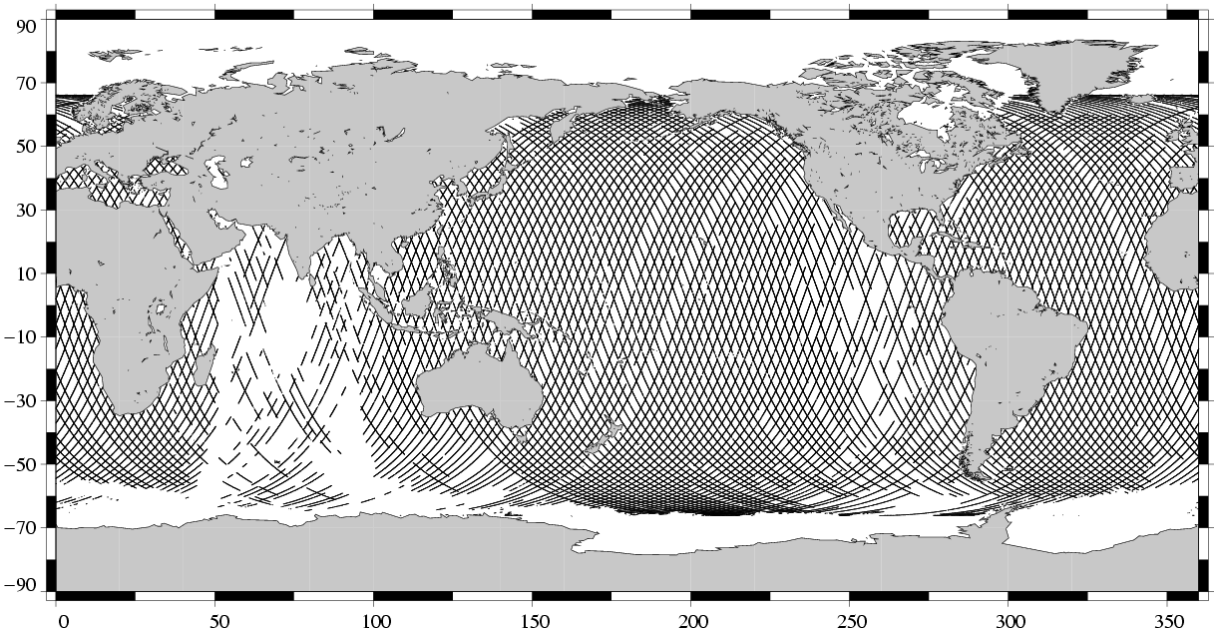
There are problems in the interpolation of the TMR parameters since cycle 371 when there are missing measurements (tape recorder failures). These bad measurements are removed by the TMR correction criterion but some of them have been kept. Thus a new criterion has been added to the editing procedure since the cycle 376 to remove all the mesurements 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 (27.49 % of points removed) and ice flag (6.57 % of points removed).

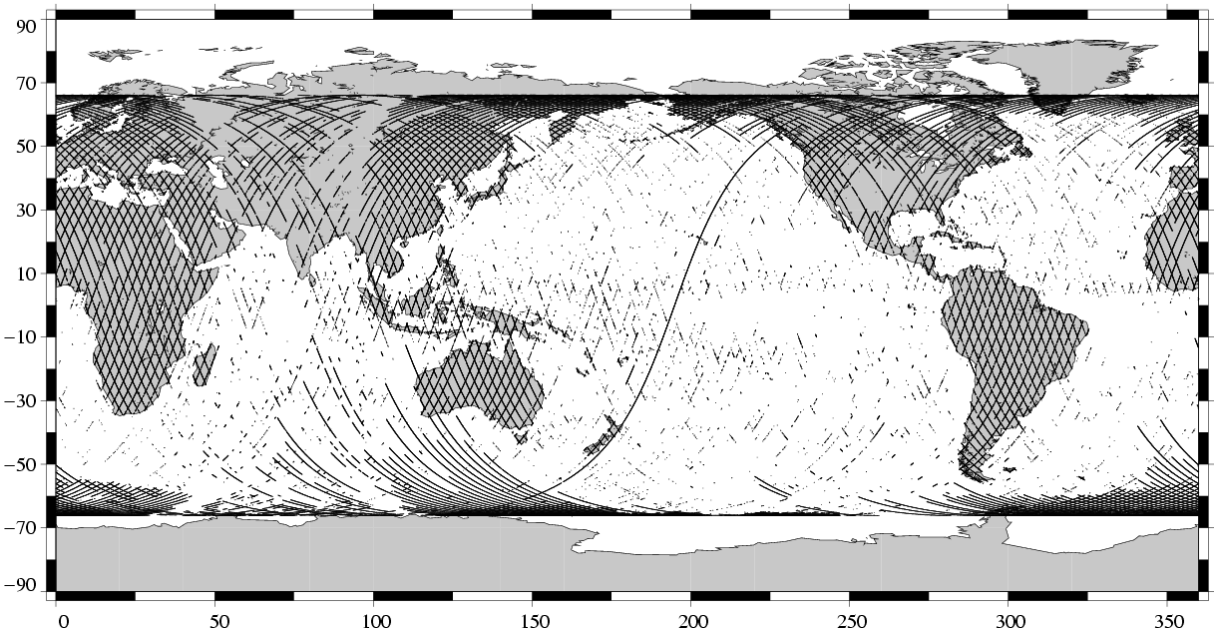
Parameters	Min Thres.	Max Thres.	Unit	Mean % removed in 1997	% removed
Sea surface height	-130.000	100.000	m	1.37	0.20
Number of 20/10Hz valid points Poseidon/TOPEX	5.000	-		1.37	0.31
Std. deviation of range	0.000	0.100	m	1.85	1.01
Off nadir angle from waveform	0.000	0.400	deg	1.36	3.22
Dry tropospheric 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	6.20
Ionospheric correction (Poseidon:Doris, TOPEX:Dual)	-0.400	0.040	m	0.00	0.34
Significant wave height	0.000	11.000	m	1.46	0.15
Sea state Bias	-0.500	0.000	m	1.39	0.32
Backscatter coefficient	7.000	30.000	dB	1.44	0.36
Ocean tide height	-5.000	5.000	m	0.01	0.16
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	0.44
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.

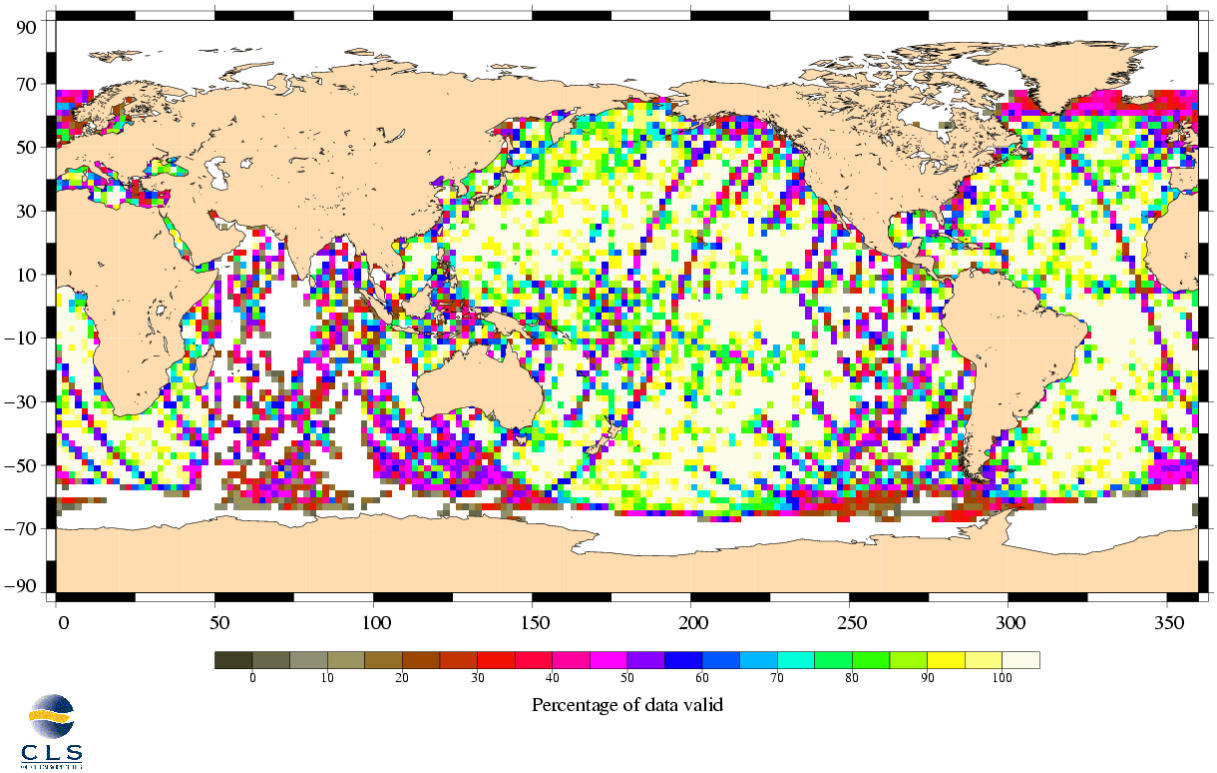
Valid data
TOPEX/Poseidon Cycle 450 (01/12/2004 / 11/12/2004)



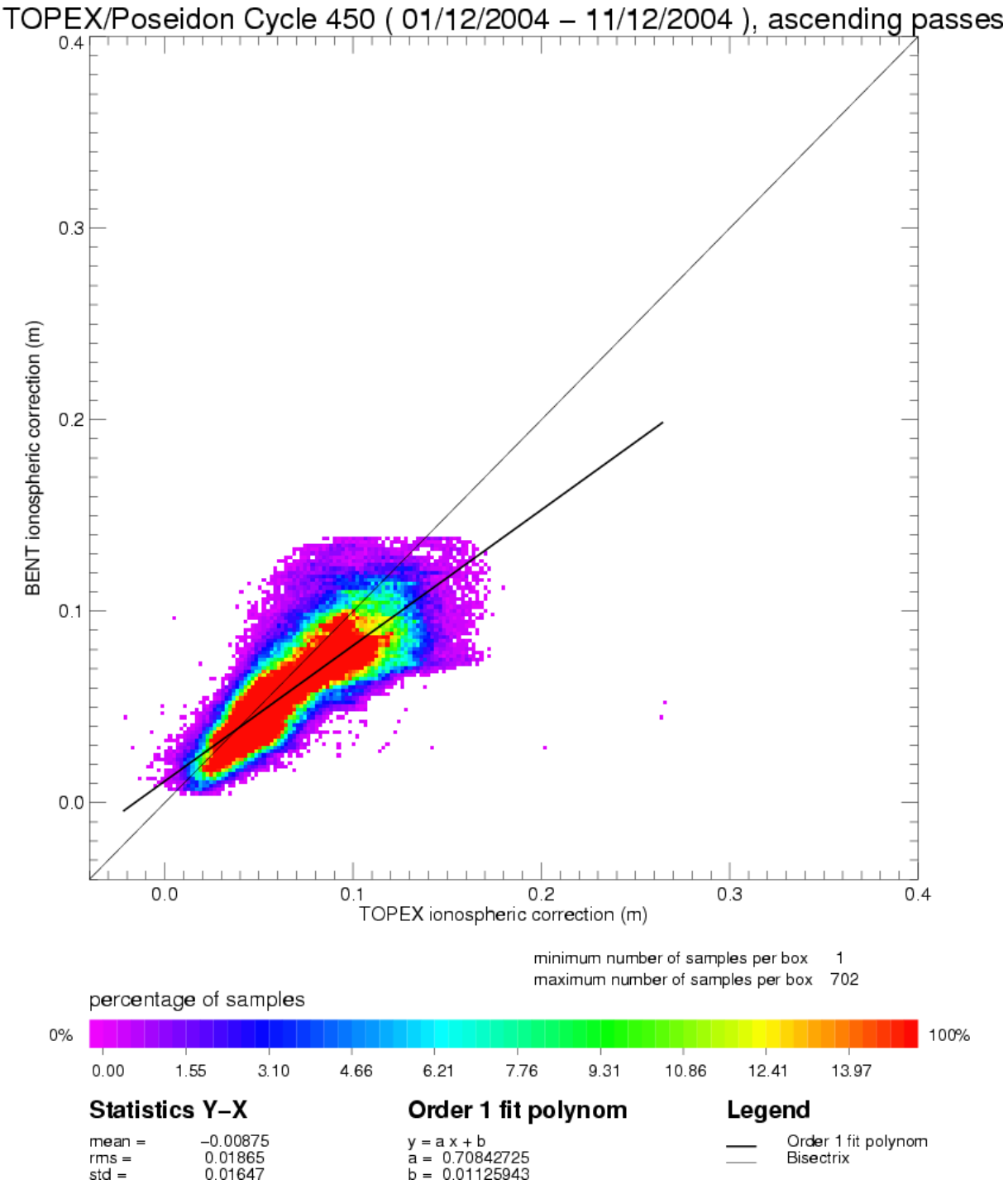
Edited measurements
TOPEX Cycle 450 (01/12/2004 / 11/12/2004)

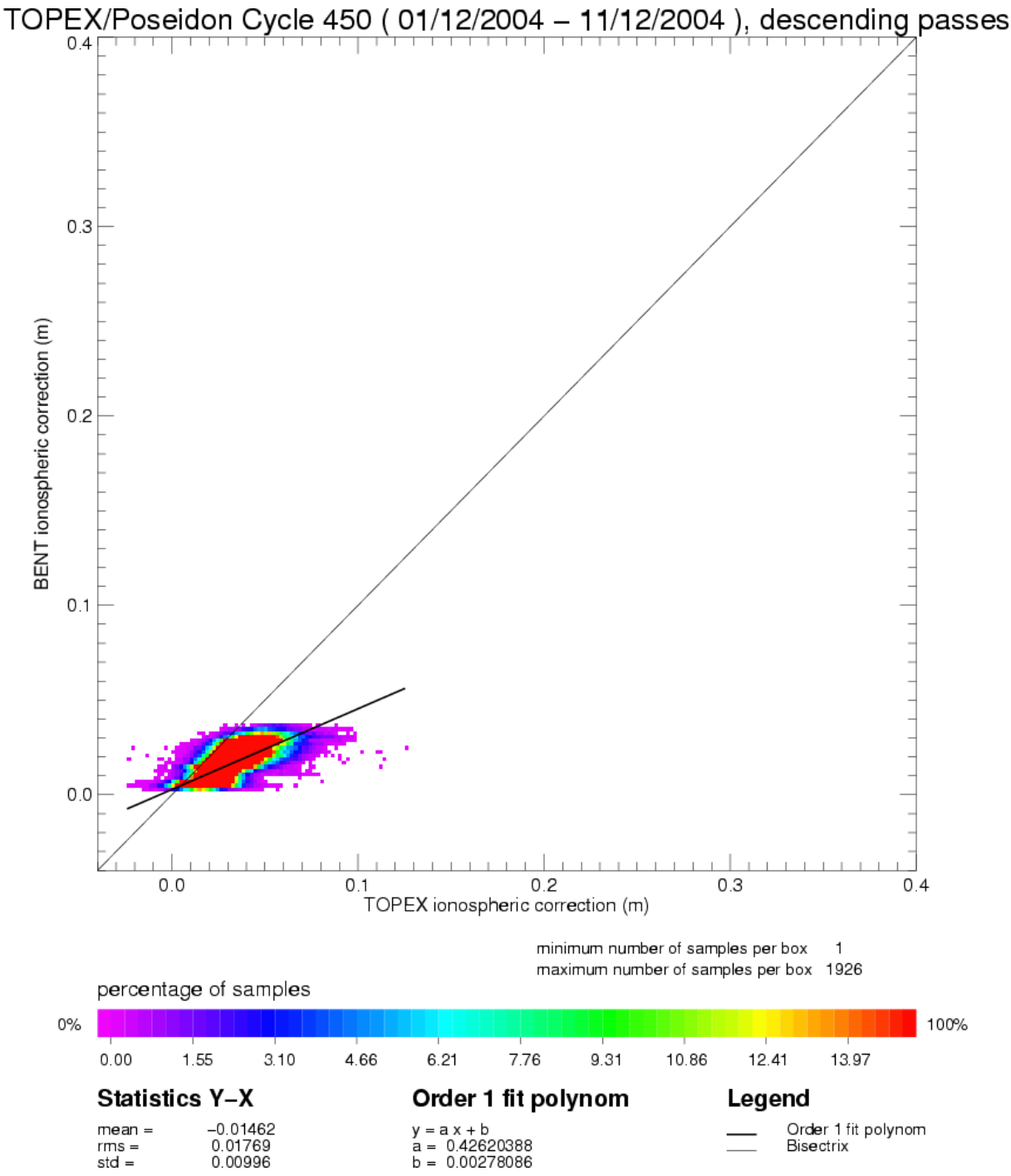


Percentage of valid data relative to the nominal pass
TOPEX/Poseidon Cycle 450 (01/12/2004 / 11/12/2004)

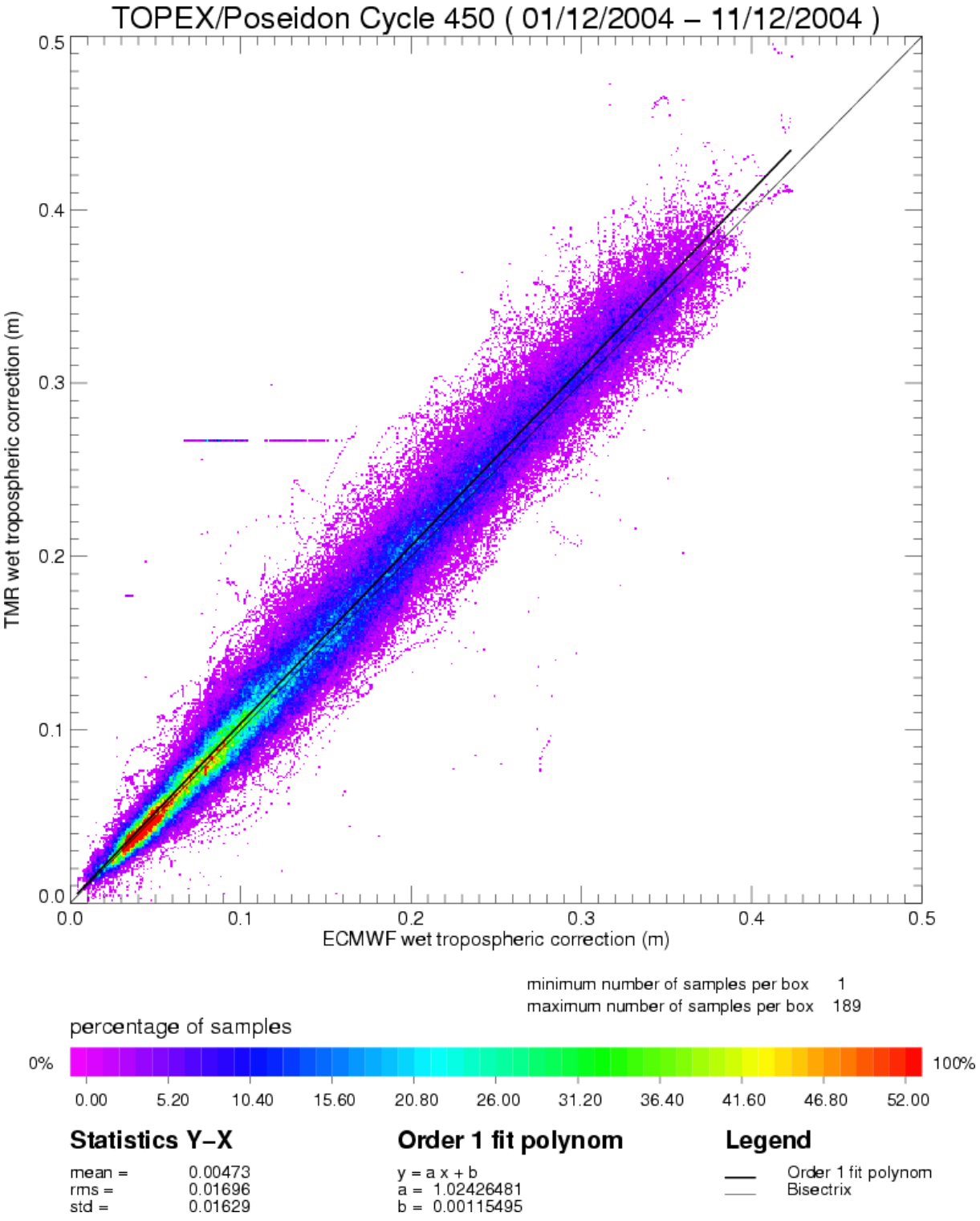


3.5 Ionospheric correction

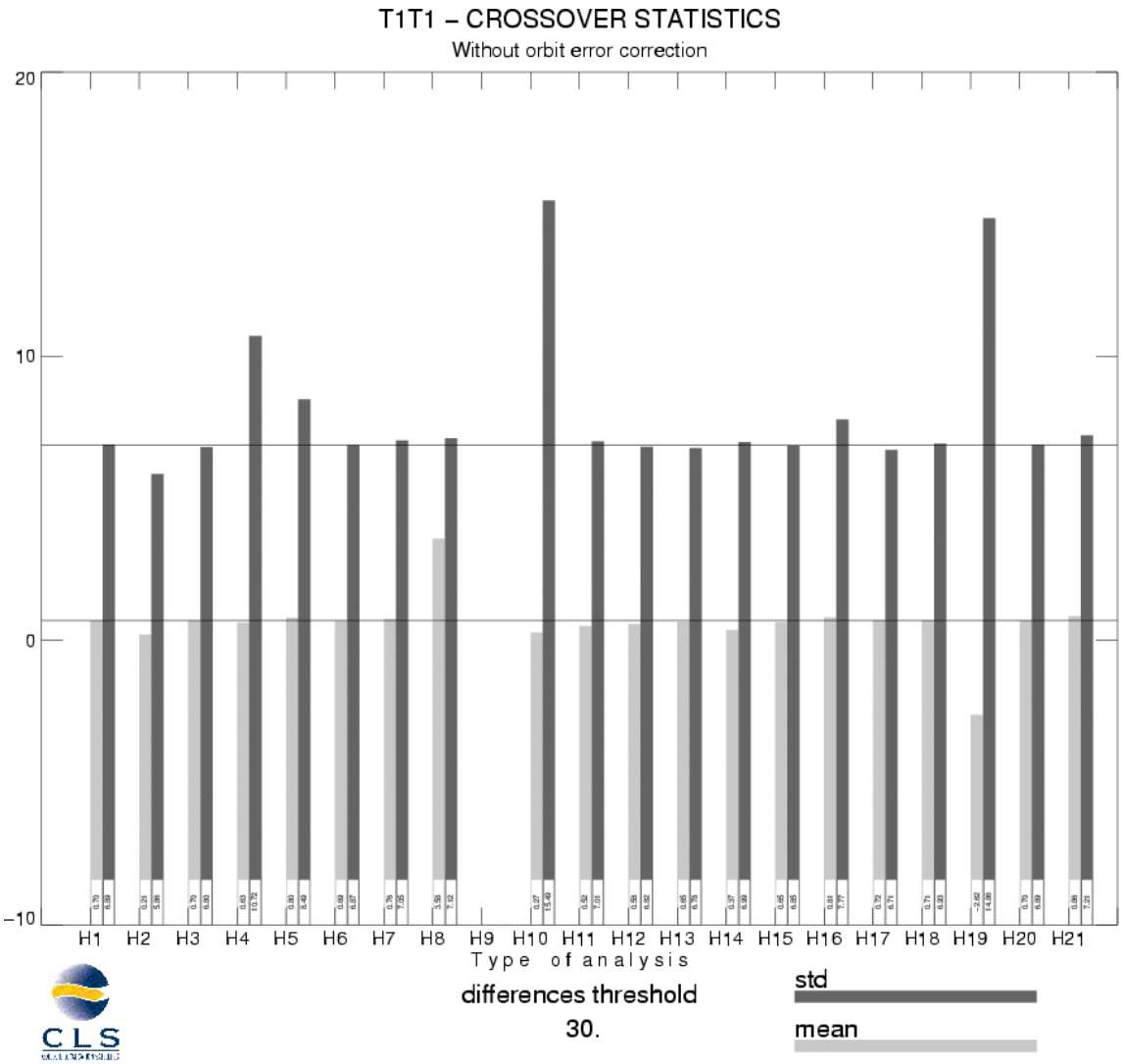



TOPEX/Poseidon Cycle 450 (01/12/2004 – 11/12/2004), descending passes
BENT ionospheric correction (m)
TOPEX ionospheric correction (m)
0.0
0.1
0.2
0.3
0.4
minimum number of samples per box 1
maximum number of samples per box 1926
percentage of samples
0%
100%
0.00
1.55
3.10
4.66
6.21
7.76
9.31
10.86
12.41
13.97
Statistics Y–X
mean = −0.01462
rms = 0.01769
std = 0.00996
Order 1 fit polynom
y = a x + b
a = 0.42620388
b = 0.00278086
Legend
Order 1 fit polynom
Bisectrix

3.6 Wet tropospheric corection



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 geographique (deg): –90 / 90 , 0 / 360

Seuil sur les ecarts d'analyse — DV (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

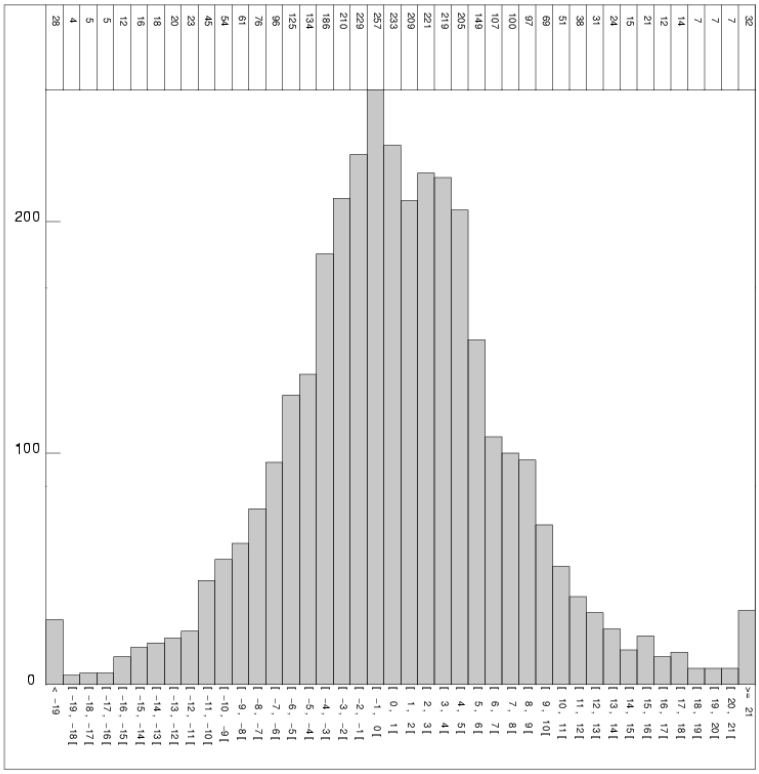
Selection(s) sur les ecarts :

Aucune

RESULTATS STATISTIQUES

Valeur minimale : –29.6100
Valeur maximale : 29.9500
Difference Max – Min: 59.5600
Nombre de points lus: 3565
Nombre de points selectionnes: 3468
Moyenne : 0.702875
Ecart–type : 6.89271
Moyenne Quadratique : 6.92846

CLS Space Oceanography Division



T1T1 – CROSSOVER STATISTICS

With orbit error correction

SSH = Corrected sea surface height

RAPPEL DES SELECTIONS

Type de points de croisement: T1T1

Zone geographique (deg): –90 / 90 , 0 / 360

Seuil sur les ecarts d'analyse — DV (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

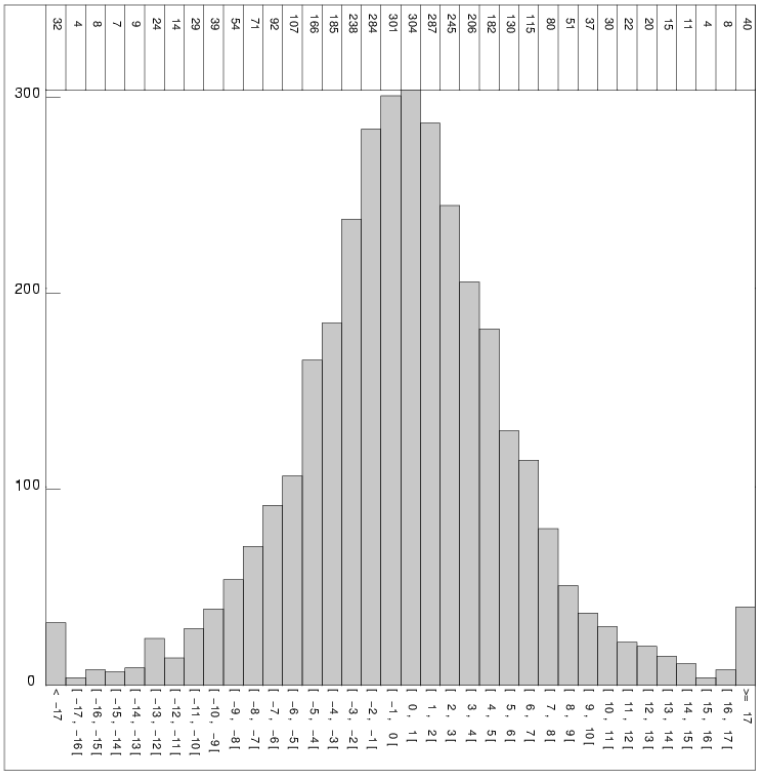
Selection(s) sur les ecarts :

Aucune

RESULTATS STATISTIQUES

Valeur minimale : –28.0500
Valeur maximale : 29.5200
Difference Max – Min: 57.5700
Nombre de points lus: 3565
Nombre de points selectionnes: 3444
Moyenne : 0.209535
Ecart–type : 5.86233
Moyenne Quadratique : 5.86607

CLS Space Oceanography Division



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 geographique (deg): –50 / 50 , 0 / 360

Seuil sur les ecarts 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 ecarts :

Aucune

RESULTATS STATISTIQUES

Valeur minimale : –27.0400

Valeur maximale : 25.3300

Difference Max – Min: 52.3700

Nombre de points lus: 2678

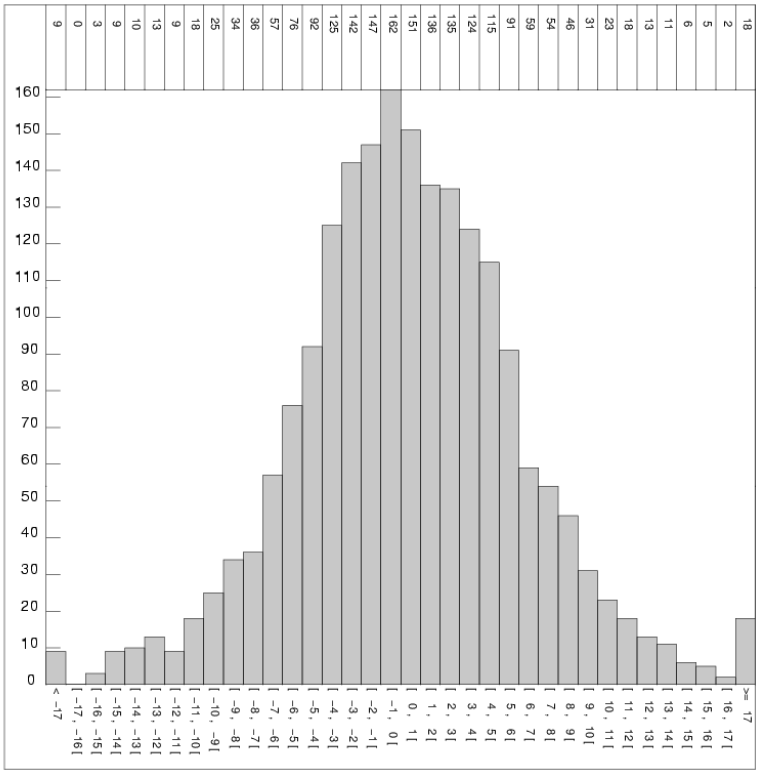
Nombre de points selectionnes: 2005

Moyenne : 0.394150

Ecart–type : 5.81136

Moyenne Quadratique : 5.82471

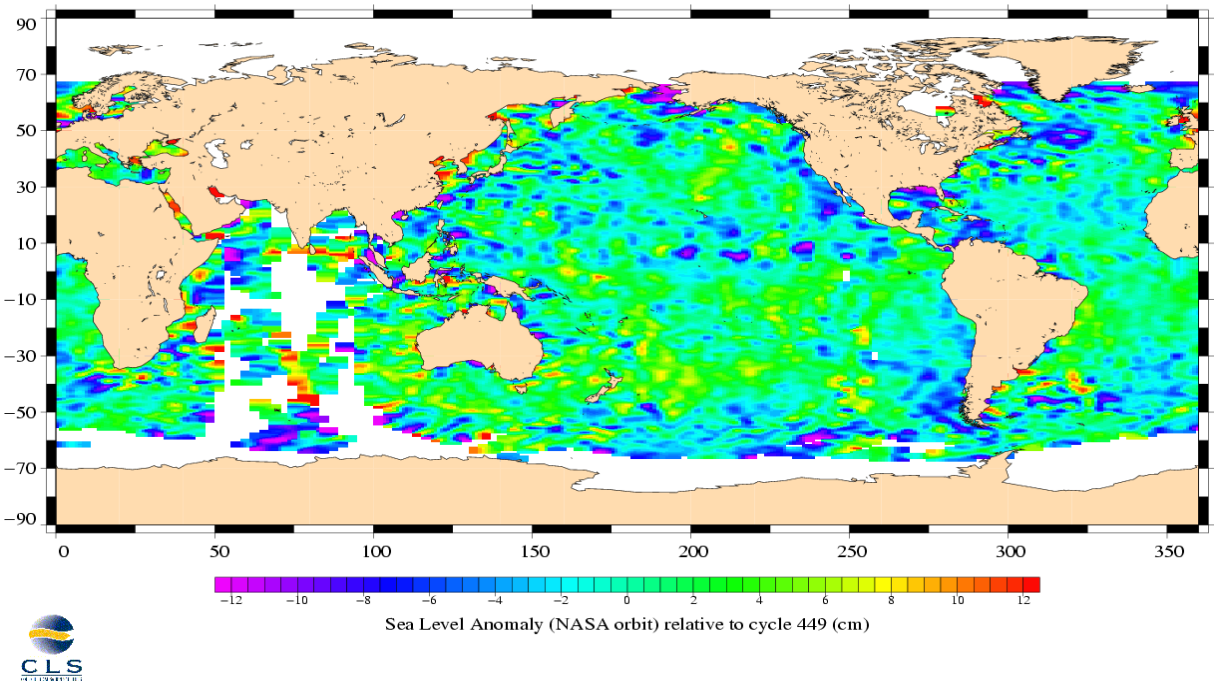
CLS Space Oceanography Division



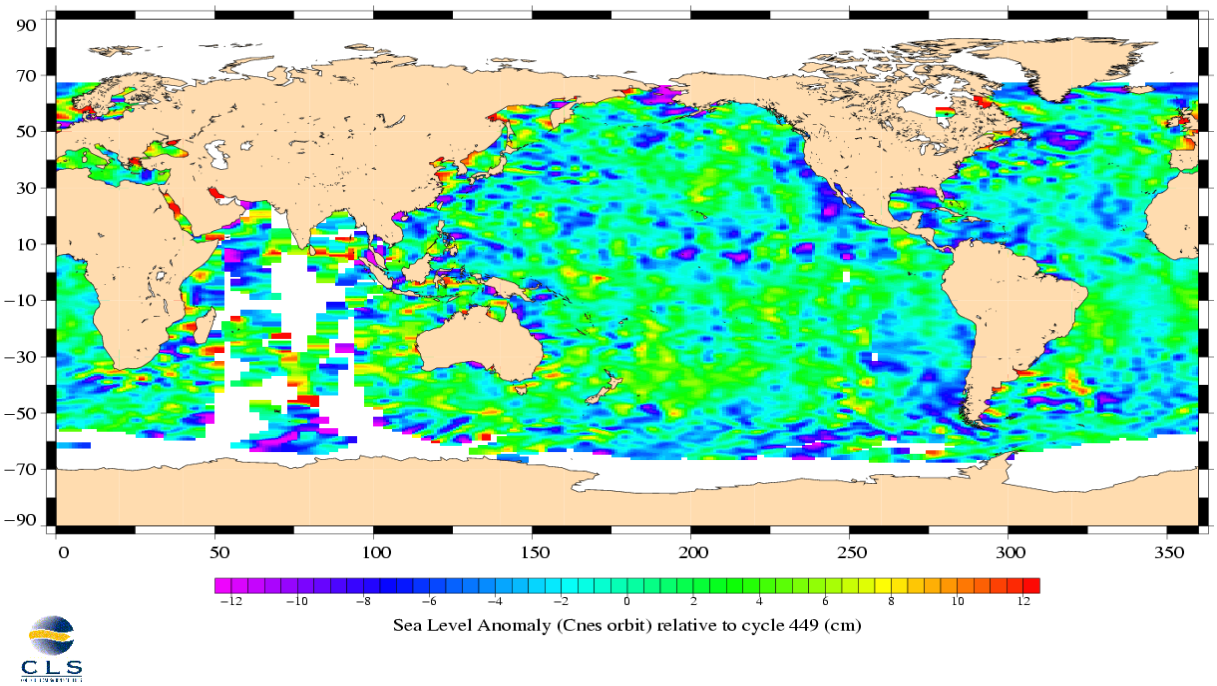
3.8 SSH variability

3.8.1 Sea Level Anomaly

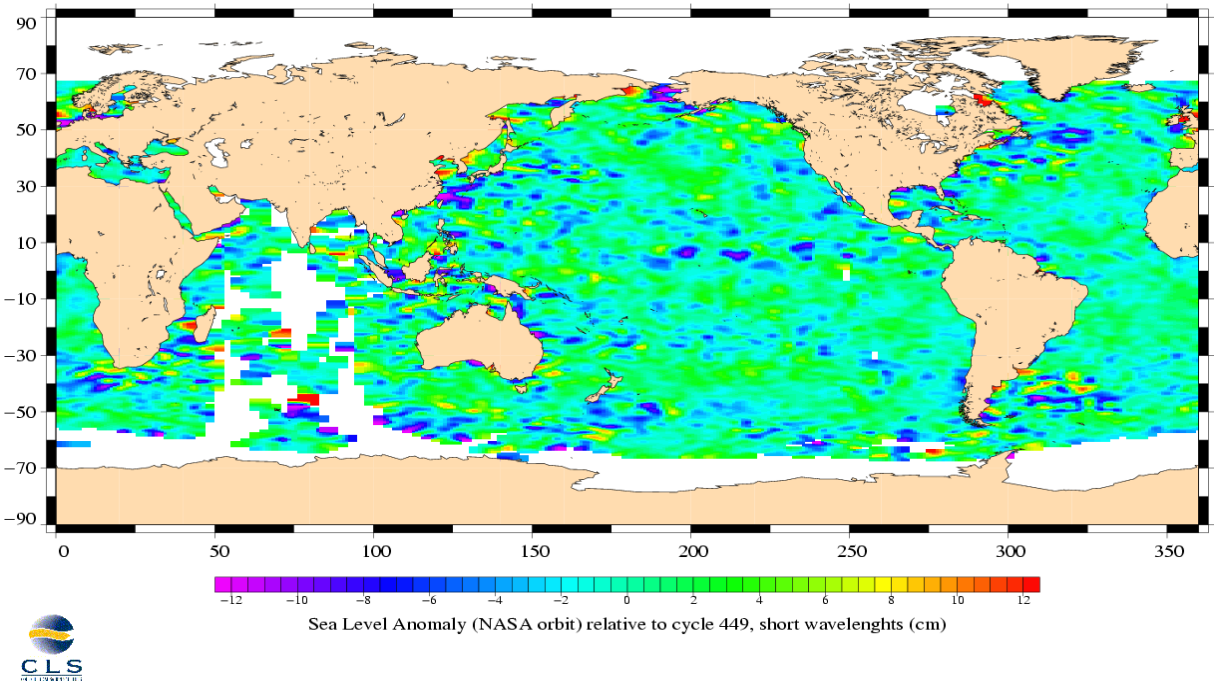
TOPEX/Poseidon, cycle 450
Period : 01/12/2004 – 11/12/2004



TOPEX/Poseidon, cycle 450
Period : 01/12/2004 – 11/12/2004

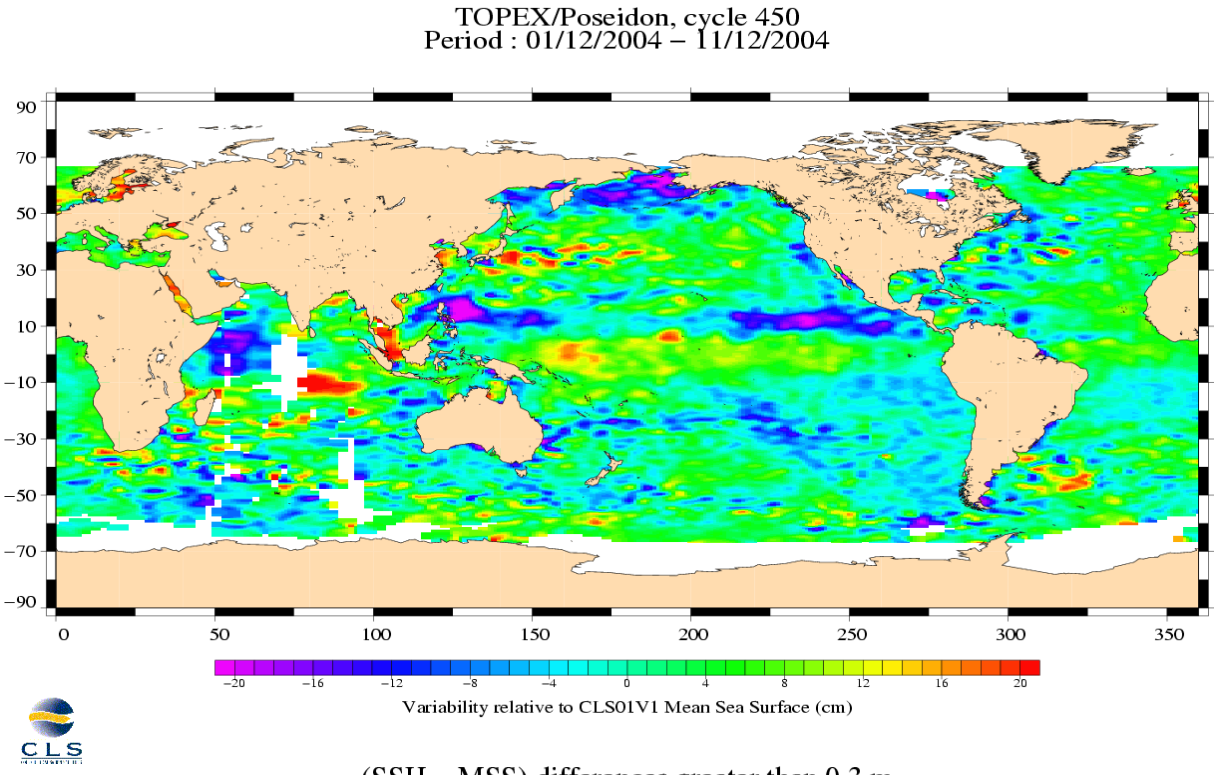


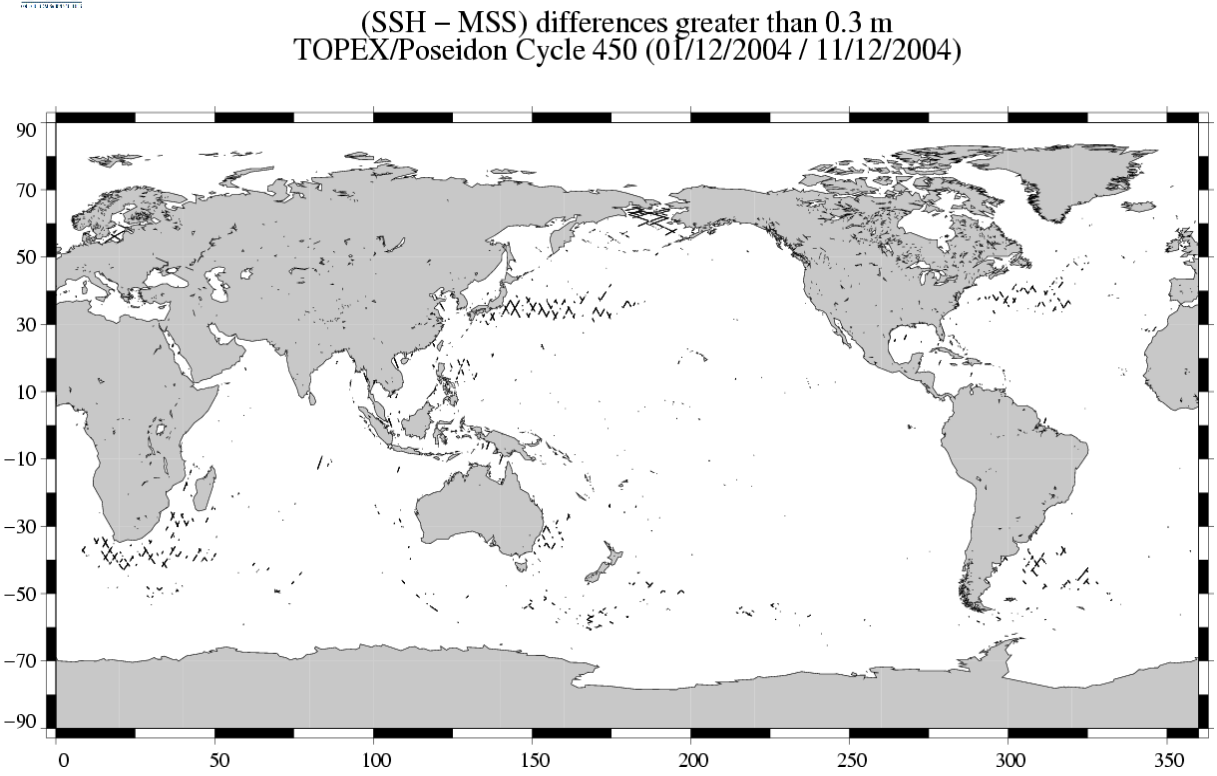
TOPEX/Poseidon, cycle 450
Period : 01/12/2004 – 11/12/2004



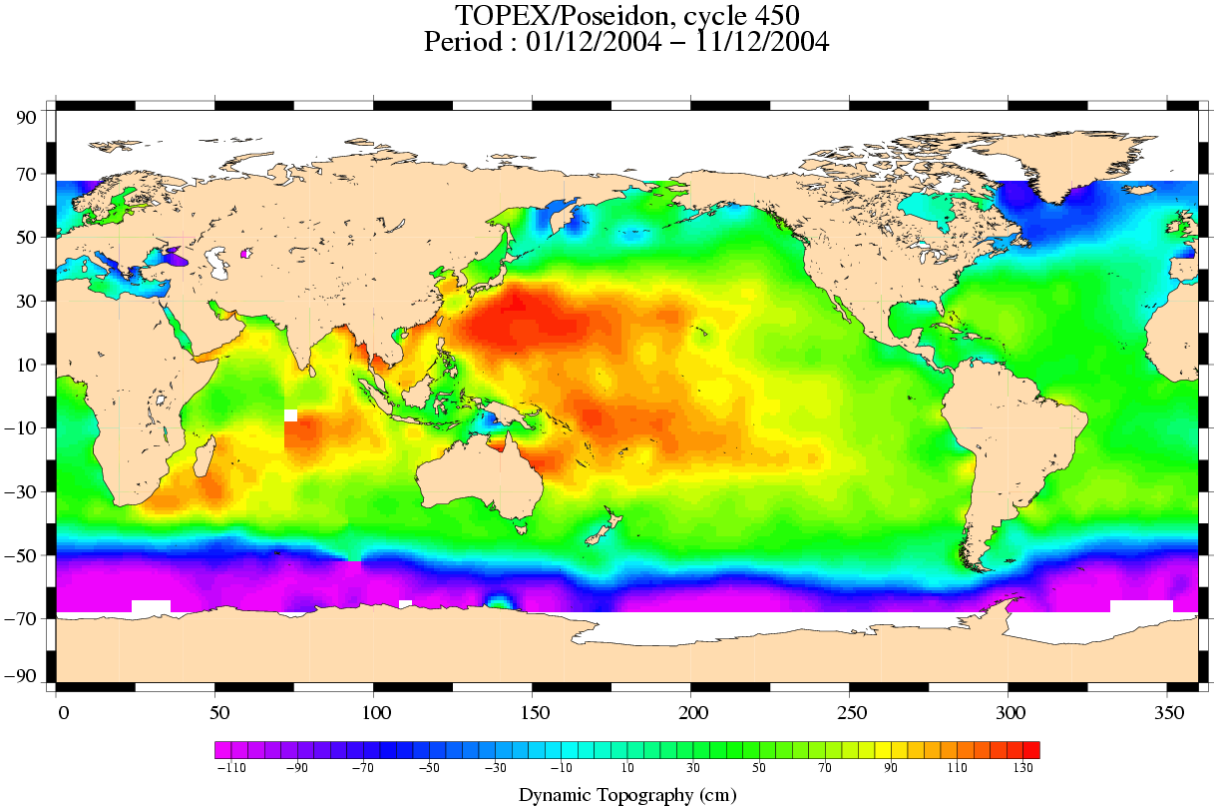
3.8.2 Comparison to a precise Mean Sea Surface

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.





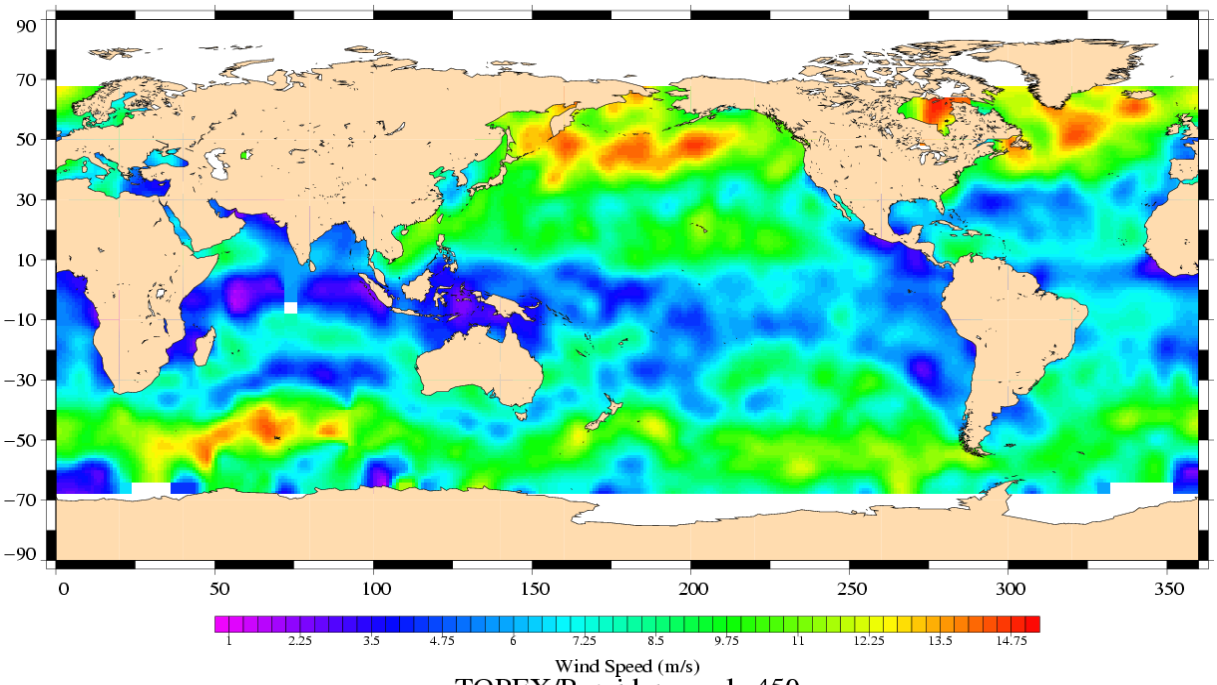
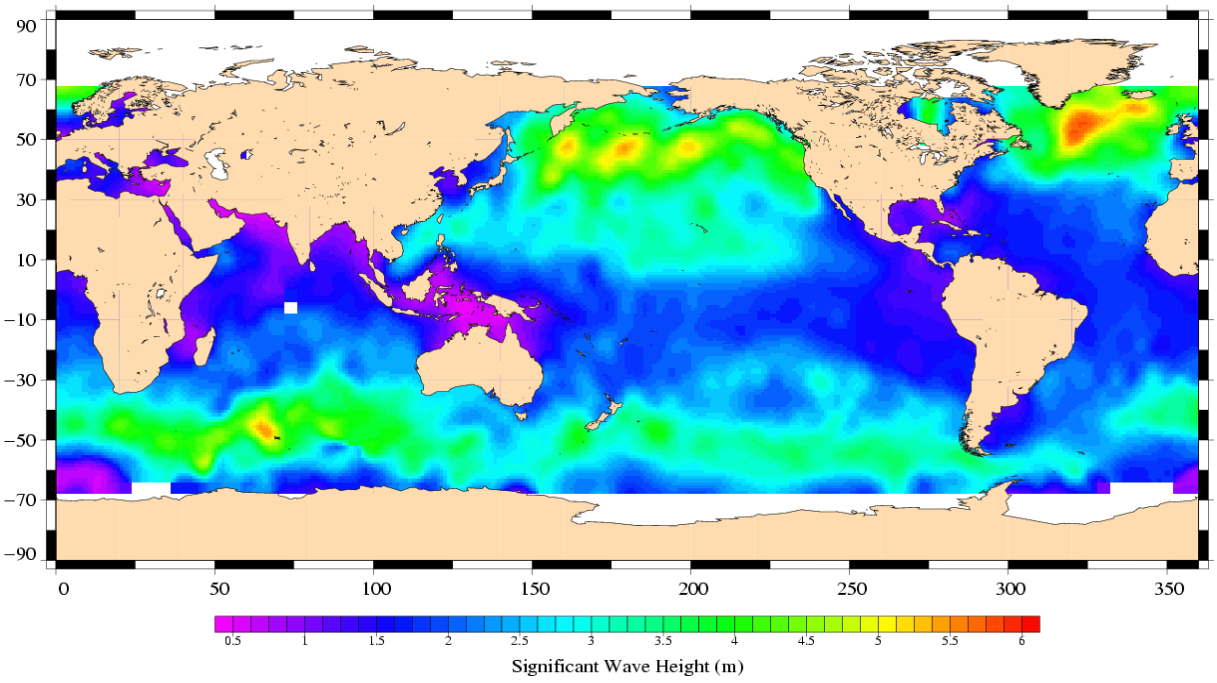
3.9 Dynamic topography



3.10 Wind and wave maps

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

TOPEX/Poseidon, cycle 450
Period : 01/12/2004 – 11/12/2004



TOPEX/Poseidon, cycle 450
Period : 01/12/2004 – 11/12/2004