Altimetric mean Sea Surfaces – and inter-annual ocean variability

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ABSTRACT

Different global mean sea surfaces (CSR98, GSFC00, CLS-SHOM98, CLS01, KMS01, KMS03) are all based on different time-epoch for the T/P altimetry used in their derivation. Consequently, inter-annual ocean variability (like the major El-Nino event in 1997-1998) will be visible to a larger or smaller extend in these different MSS. (the MSS are actually quasi-stationary MSS).

In this presentation we will present a new global mean sea surface from multimission satellite altimetry called KMS03 and focus on the effect of inter-annual variability and how this affects the MSS computation.

This way the derived mean sea surface can be adjusted to model the inter-annual variability for a specific period (creating a quasi-stationary MSS over the selected period).

From the 9 years of T/P altimetry the inter-annual ocean variability have been modeled using the averaged sea level height once the "intra"-annual ocean variability have been removed

THE KMS03 MEAN SEA SURFACE

The newest version of the KMS Mean Sea Surface is derived from a combination of T/P, T/P TDM, ERS1 ERM+GM, ERS2 ERM, GEOSAT GM, and GFO-ERM data.

The resolution of the mean sea surface exists as both a 1 minute and a 2 minutes corresponding to 1/60 degree and 1/30 degree respectively, which is equivalent to 2 or 4 km at the Equator.

Unlike for older surfaces a method has been included to account for the inter-annual ocean variability (like the major El-Niño event in 1997-98).

The model is based on 9 years of data using T/P as reference.

In the computation a simultaneous computation of global sea level change was taken into account.

All computations have been performed relative to the GGM01EGM geoid model. The GM01EGM is a hybrid between GGM01S (up to degree and order 95) and EGM96 to degree 360.

KMS 03	T/P mean profile	ERS2 mean profile	T/P TDM	GFO	GEOSAT geodetic data	ERS-1 geodetic data
Selected time period	1993-2001 9 years (cycles 10-344)	1995-2001 74 cycles (1-74)	2002-2002 0.7 years (cycles 368-383)	2000-2001 0.7 years (cycles 368-383)	1985-1986 1.5 years (cycles 1-44)	1994-95 - ERS-1 phase E - ERS-1 phase G
Coverage	66°S-66°N	82°S-82°N	66°S-66°N	72°S-72°N	72°S-72°N	82°S-82°N
Groundtracks spacing	320 km	~80 km	320 km	150 km	~6 km	~8 km
Comments	used to reference GM data	ERS2 referenced to T/P data separately. DGM04 orbits combined with T/P to refence GM data.	referenced upon 9 Year T/P+ERS MSS xover corrected sea surface heights used	referenced upon 9 Year T/P+ERS MSS xover corrected sea surface heights used	DEOS upgraded set used to resolve fine spatial scale signals xover corrected sea surface heights used	used to resolve fine spatial scale signals xover corrected sea surface heights used.

INTER ANNUAL OCEAN VARIABILITY

The inter-annual ocean variability can be computed for each of the nine year (1993-2001).

Computing the inter-annual ocean variability.

All TOPEX/POSEIDON normal points have initially the trend removed in a joint estimation with the mean sea surface height.

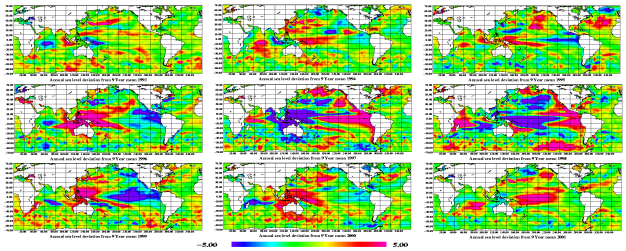
Subsequently monthly mean values are computed.

The computation of the intra-annual ocean variability was performed by computing mean values for all month from all 9 year of data. Subsequently these 12 mean values were removed from the data.

Finally the 9 years of T/P altimetry is used to compute the inter-annual ocean variability, by computing the averaged sea level height for each year once the "intra"-annual ocean variability have been removed.

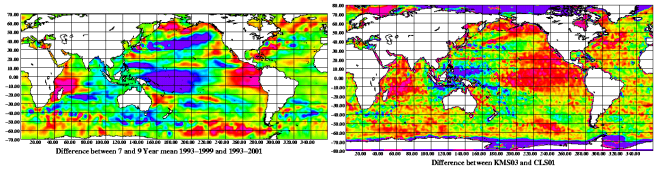
The derived mean sea surface can subsequently be tailored to include the inter-annual variability for a specific period (creating a quasi-stationary MSS over the selected period).

This way the KMS03 mean sea surface can be corrected to fit any sub-period in the (1993-2001 period for the comparison with hydrodynamically computed Mean Dynamic Topography Models



Annual sea level deviation from 9 year mean value computed from T/P altimetry computed over 1993-2001. The scale ranges in all pictures between +/- 5 cm.

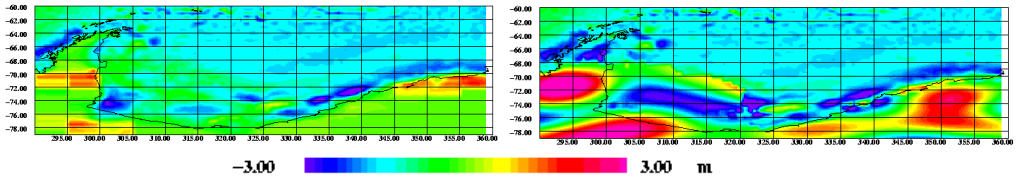
THE CLS01 AND KMS03 MSS AND INTER-ANNUAL OCEAN VARIABILITY.



The difference in interannual ocean variability computed over the 1993-1999 (CLS period) and 1993-2001 (KMS03 period is shown to the left. To the right is the slightly smoothed difference between CLS01 and KMS03 shown. Again the colorscale ranges +/- 5 cm.

The large discrepancies at high latitudes are errors in the CLS01 MSS. These are a combination of EGM96 errors and lack of altimetry in the CLS01 MSS.

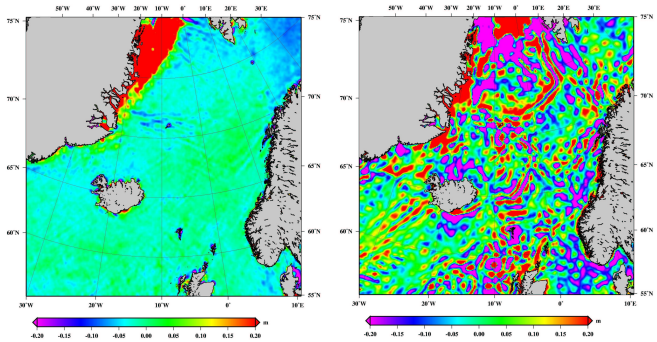
The Weddel Sea.



ITHE KMS03 MSS – GGM01EGM96 Geoid

CLS01 MSS – GGM01EGM Geoid

KMS03, CLS01 AND GSFC00 MSS IN GOCINA STUDY REGION IN THE NORTHERN ATLANTIC REGION.



IKMS01-CLS01 MSS

KMS01-GSFC00.1 MSS

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