The mean dynamic topography model DTU26MDT

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Abstract

A new global geodetic mean dynamic topography model DTU26MDT is derived using the new SWOT based DTU25MSS mean sea surface. The DTU25MSS model has been derived using nadir and interferometric data including two years of SWOT altimetry. The resolution is 1 km (1/100 degree). The MSS is referenced to the 1993-2012 period (center time 2003.01.0) in agreement with older MSS and MDT models.

The geoid model was XGM2019e complete to d/o 2160 which was transformed into the mean-tide system to include the indirect effect of the permanent tide.

The processing scheme used for deriving the new geodetic MDT is similar to the one used for the previous geodetic DTU MDT models. However, the filtering was re-evaluated by adjusting the quasi-gaussian filter width to optimize the fit to drifter velocities. Also, optimal filtering was introduced to enhance MDT in the coastal areas. Furthermore, the filtering was re-evaluated at the western boundary currents to enhance the estimation of the geostrophic surface currents in those areas.

The Geodetic MDT

Since the previous geodetic model, the DTU22MDT, was derived a newer model for the Mean Sea Surface and has become available. Hence, the following models are used:

- New Mean Sea Surface DTU25MSS, and
- XGM2019e geoid complete to d/o 2160 based on the GOCO06S and terrestrial data including marine gravity anomalies derived from satellite altimetry.

When deriving the new geodetic MDT DTU26MDT the filtering scheme was re-assessed to enhance the western boundary currents. In earlier models the western boundary currents came out too weak due to filtering in combination with missing values on land.

For DTU26MDT an additional step were introduced to recover the finer details of the western boundary currents. Also, the re-gridding of values in the coastal areas were fine tuned.

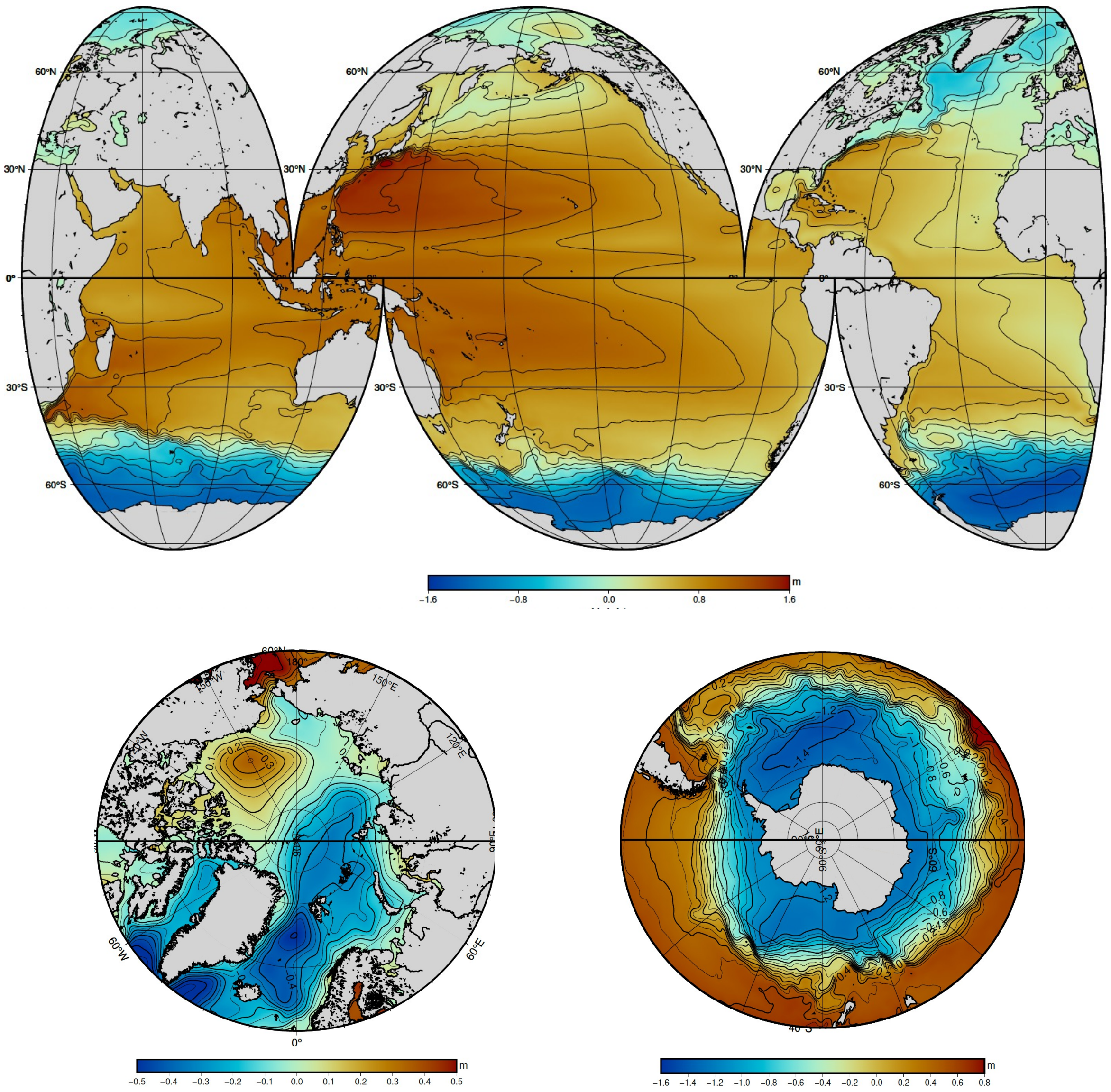

Figure 1. Mean dynamic topography from the geodetic DTU26MDT.

Developments in the DTU MDT modelling is shown in the table:

	Mean Sea Surface	Geoid
DTU15MDT	DTU15MSS	GOCO05S-EIGEN-6C4 hybrid
DTU16MDT	DTU15MSS	GOCO05C-EIGEN-6C4 hybrid
DTU17MDT	DTU15MSS	OGMOC hybrid
DTU19MDT	DTU18MSS	OGMOC hybrid
DTU22MDT	DTU21MSS	XGM2019e
DTU25MDT	DTU24MSS	XGM2019e
DTU26MDT	DTU25MSS	XGM2019e

Comparison with drifters:

During the process of optimizing the filtering the derived geostrophic surface currents were compared with drifter velocities.

The drifter velocities had been corrected for Ekman flows empirically and for geostrophic current anomalies obtained from AVISO. Only bins (1/4x1/4 deg) where the mean flow may be computed from at least 20 observations were used. The data set is displayed in Figure 3 below.

The results of the comparison of the models are shown in the table below:

	lat 10-30		lat 30-50	
[cm/s]	u	v	u	v
DTU15MDT	5	5.9	5	4.9
DTU17MDT	4.9	5.5	4.7	4.7
DTU19MDT	4.8	5.5	4.7	4.6
DTU22MDT	4.7	5.3	4.7	4.5
DTU25MDT	4.7	5.1	4.5	4.5
DTU26MDT	4.7	5.1	4.5	4.4

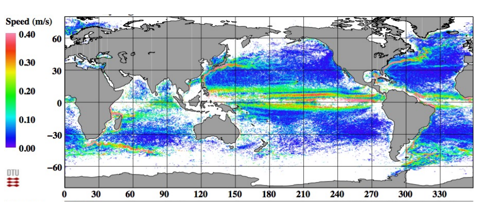

Figure 3. Mean drifter velocities used for the assessment of the geodetic models.

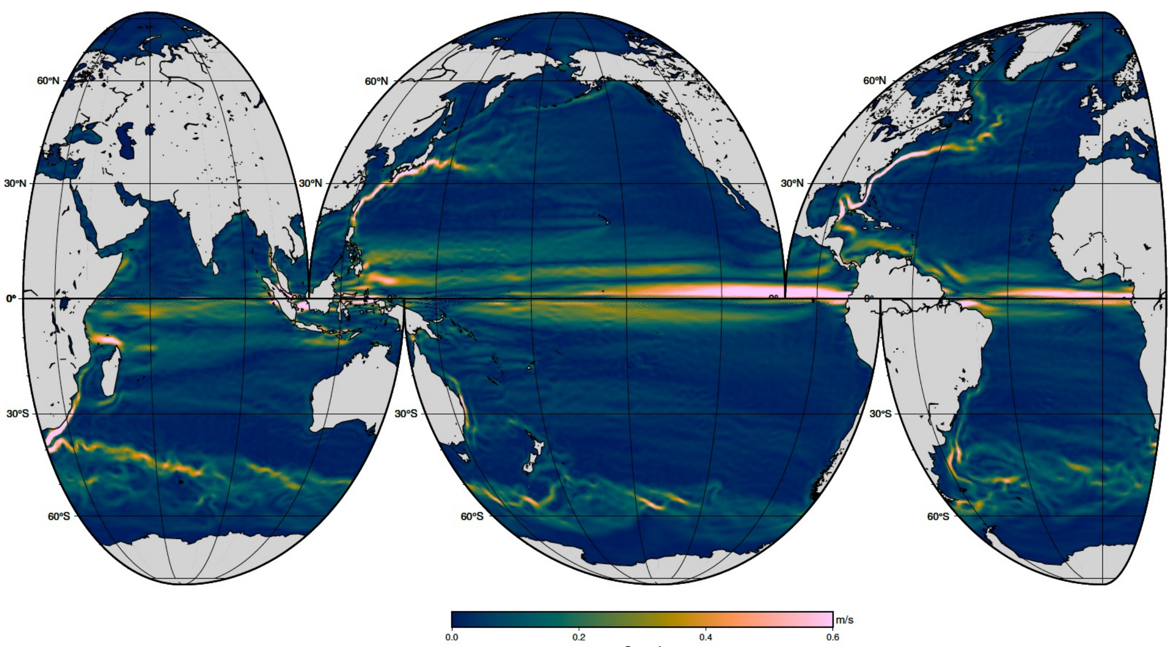

Figure 2a. Geostrophic surface current speed associated with the DTU26MDT model.

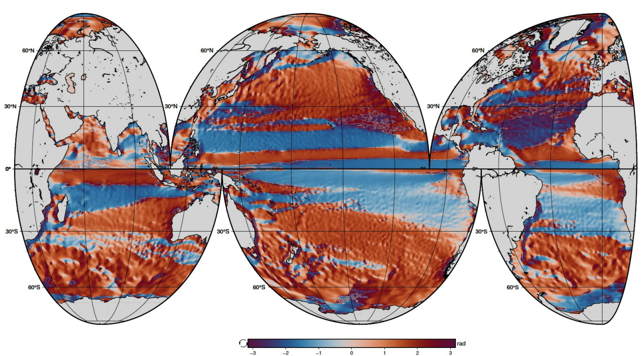

Figure 2b. Geostrophic surface current speed directions associated with the DTU26MDT model.

Summary

An update of the geodetic MDT has been carried out to utilize the enhanced MSS based on SWOT.

Subsequently, an integration of the geodetic MDT with drifter velocities is in process. Since the release of the previous model DTUUH22MDT the processing of the drifter data has been revised to enhance the correction for wind driven flows and to enhance the filtering of noise.