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The use of recent GOCE geoid models together with an altimeter Mean Sea Surface significantly improves the estimate of the ocean Mean Dynamic Topography at 100 km resolution compared to the use of previous GRACE geoid models. However, at scales shorter than 100km, the combined effect of geoid omission and commission errors prevents from directly using such models to estimate the ocean MDT and additional information is needed.
In this study, the methodology used by (Rio et al, 2012) to estimate the CNES-CLS09 MDT is applied to compute a new, high resolution Mean Dynamic Topography for the global ocean.
First a GOCE geoid model from the fourth official ESA release is subtracted from the CNES-CLS11 altimeter Mean Sea Surface. An optimal filtering technique is applied on the obtained noisy raw MDT to remove the noise due to the geoid omission error and the commission MSS and geoid errors. A ~100km resolution Mean Dynamic Topography is obtained. Then synthetic estimates of the mean heights and corresponding geostrophic velocities are built from in-situ measurements of the ocean state (heights and surface velocities) from which the temporal variability as measured by altimetry is removed. The in-situ measurements dataset consist in hydrological profiles measured by ARGO floats and CTD/XBT casts as well as 15m drogued SVP drifting buoy data for the period 1993-2012. The in-situ data are processed in order to match the altimeter data physical content. In particular, the surface velocities derived from the drifting buoy trajectories are corrected from the Ekman current contribution and the direct wind slippage, that might be quite significant in case of drogue loss.
The synthetic mean heights and velocities are then used to improve the 100km resolution MDT based on GOCE data through a multivariate objective analysis. A new, high resolution, global MDT (the CNES-CLS13 MDT) is obtained that also includes the Mediterranean Sea for which specific data processing and analysis parameters are used.
Improvements over the previous CNES-CLS09 MDT are quantified through comparison to independent in-situ velocities induced from ARGO floats surface displacements. Also, the potential impact of using the new MDT for assimilating altimeter Sea Level Anomalies into the Mercator-Ocean operational forecasting system is assessed.
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