



Consistent estimate of ocean warming, land ice melt and sea level rise from Observations

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Based on the sea level budget closure approach, this study investigates the consistency of observed Global Mean Sea Level (GMSL) estimates from satellite altimetry, observed Ocean Thermal Expansion (OTE) estimates from in-situ hydrographic data (based on Argo for depth above 2000m and oceanic cruises below) and GRACE observations of land water storage and land ice melt for the period January 2004 to December 2014.

The consistency between these datasets is a key issue if we want to constrain missing contributions to sea level rise such as the deep ocean contribution. Numerous previous studies have addressed this question by summing up the different contributions to sea level rise and comparing it to satellite altimetry observations (see for example Llovel et al. 2015, Dieng et al. 2015). Here we propose a novel approach which consists in correcting GRACE solutions over the ocean (essentially corrections of stripes and leakage from ice caps) with mass observations deduced from the difference between satellite altimetry GMSL and in-situ hydrographic data OTE estimates. We check that the resulting GRACE corrected solutions are consistent with original GRACE estimates of the geoid spherical harmonic coefficients within error bars and we compare the resulting GRACE estimates of land water storage and land ice melt with independent results from the literature.

This method provides a new mass redistribution from GRACE consistent with observations from Altimetry and OTE. We test the sensibility of this method to the deep ocean contribution and the GIA models and propose best estimates.