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Oceanic mass variations from combining GPS network displacements, GRACE and Modeled Ocean bottom pressure

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Although high resolution dynamics of the ocean can be adequately modeled, the total ocean mass content is only poorly constrained by inaccurate external input. The closure of the oceans mass budget is of vital importance when for example altimetric and gravimetric measurements are compared and used for thermal expansion studies.

We demonstrate that geodetic observations, such as GPS deformations and GRACE gravimetry can effectively constrain the mass variations in ocean models. In a least-squares sense we combine a GPS IGS network solution, a GRACE solution and modeled ocean bottom pressure (OBP) from FESOM (Finite Element Sea-Ice Ocean Model) . This enables us to simultaneously estimate OBP variations and surface loading over land, together with geocenter motion and nuisance parameters such as an ocean mass bias and residual network transformations. In contrast to the standard monthly GRACE solution, we use a dedicated weekly solution enabling 7 day time resolution of our joint estimates.

We present time variations of the ocean mass and bottom pressure as well as variations of the geocenter motion. Furthermore, we identify data inconsistencies and problems which may arise due to poor data coverage. The presence of short period signal is illustrated by a comparison with in situ OBP series.