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Estimating geocenter motion and barystatic sea-level variability from GRACE observations with explicit consideration of self-attraction and loading effects

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Estimating global barystatic sea-level variations from monthly mean gravity fields delivered by the Gravity Recovery and Climate Experiment (GRACE) satellite mission requires additional information about geocenter motion. These variations are not available directly due to the mission implementation in the CM-frame and are represented by the degree-1 terms of the spherical harmonics expansion. Global degree-1 estimates can be determined with the method of Swenson et al. (2008) from ocean mass variability, the geometry of the global land-sea distribution, and GRACE data of higher degrees and orders. Consequently, a recursive relation between the derivation of ocean mass variations from GRACE data and the introduction of geocenter motion into GRACE data exists.

In this contribution, we will present a recent improvement to the processing strategy described in Bergmann-Wolf et al. (2014) by introducing a non-homogeneous distribution of global ocean mass variations in the geocenter motion determination strategy, which is due to the effects of loading and self-attraction induced by mass redistributions at the surface. A comparison of different GRACE-based oceanographic products (barystatic signal for both the global oceans and individual basins; barotropic transport variations of major ocean currents) with degree-1 terms estimated with a homogeneous and non-homogeneous ocean mass representation will be discussed, and differences in noise levels in most recent GRACE solutions from GFZ (RL05a), CSR, and JPL (both RL05) and their consequences for the application of this method will be discussed.

Swenson, S., D. Chambers and J. Wahr (2008), Estimating geocenter variations from a combination of GRACE and ocean model output, J. Geophys. Res., 113, B08410

Bergmann-Wolf, I., L. Zhang and H. Dobslaw (2014), Global Eustatic Sea-Level Variations for the Approximation of Geocenter Motion from GRACE, J. Geod. Sci., 4, 37-48