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Reduction of ocean tide aliasing in the context of a next generation gravity field mission

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Ocean tide aliasing is currently one of the main limiting factors for temporal gravity field determination and the derivation of mass transport processes in the Earth system. This will be true even more for future gravity field missions with improved measurement technology, which cannot be fully exploited due to this dominant systematic error source. In several previous studies it has been shown that temporal aliasing, related to tidal and non-tidal sources, can be significantly reduced by double-pair formations, e.g., in a so-called Bender configuration, and its effects can be migrated to higher frequencies by an optimum orbit choice, especially the orbit altitude (Murböck et al. 2014). Improved processing strategies and extended parameter models should be able to further reduce the problem. Concerning non-tidal aliasing, it could be shown that the parameterization of short-period long-wavelength gravity field signals, the so-called Wiese approach, is a powerful method for aliasing reduction (Wiese et al. 2011), but it does not really work for the very short-period signals of ocean tides with mainly semi-diurnal and diurnal periods (Daras 2015).

In this contribution, several methods dealing with the reduction of ocean tide aliasing are investigated both from a methodological and a numerical point of view. One of the promising strategies is the co-estimation of selected tidal constituents over long time periods, also considering the basic orbit frequencies of the satellites. These improved estimates for ocean tide signals can then be used in a second step as an enhanced de-aliasing product for the computation of short-period temporal gravity fields.

From a number of theoretical considerations and numerical case-studies, recommendations for an optimum orbit selection with respect to reduction of ocean tide aliasing shall be derived for two main mission scenarios. The first one is a classical Bender configuration being composed of a (near-)polar and an inclined in-line satellite pair. The second one follows the so-called GETRIS concept, assuming a high-precision inter-satellite link between high-flying GEO and/or GNSS satellites and an ensemble of low Earth orbiters (LEOs).

As a further aspect of this work, possible correlations between a dedicated ocean tide co-parameterization with other parameters (Wiese, empirical accelerations, etc.) and their impact on the gravity solution shall be analysed in detail.