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A New Source Model of Non-Tidal Mass Variability in Atmosphere, Oceans, Terrestrial Hydrosphere, and the Solid Earth for Simulation Studies of Future Satellite Gravity Missions

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The ability of any satellite gravity mission concept to monitor mass transport processes in the Earth system is typically tested well ahead of its implementation by means of various simulation studies. Those studies often extend from the simulation of realistic orbits and instrumental data all the way down to the retrieval of global gravity field solution time-series. Basic requirement for all these simulations are realistic representations of the spatio-temporal mass variability in the different sub-systems of the Earth, as a source model for the orbit computations and assess the performance of the gravity field retrieval.

For such simulations, a suitable source model is required to represent (i) high-frequency ($\sim$ daily) redistribution, for example, in the atmosphere and oceans, in order to realistically include the effects of temporal aliasing due to non-tidal high-frequency mass variability into the retrieved gravity fields. In parallel, (ii) low-frequency (weekly to monthly) variability needs to be modelled with realistic amplitudes, particularly at small spatial scales, in order to assess to what extent a new mission concept might provide further insight into physical processes currently not observable.

The new source model presented in this study attempts to fulfil both requirements: Based on ECMWF's recent atmospheric reanalysis ERA Interim and corresponding simulations from numerical models of the other Earth system components, it offers spherical harmonic (SH) coefficients of the mass variability in atmosphere, oceans, the terrestrial hydrosphere including the ice-sheets and glaciers,as well as the solid Earth. Simulated features range from high temporal (6 hours) to long-term (inter-annual) with a spatial resolution of SH degree and order 180, encompassing a a period of 12 years. Associated with the source model, a de-aliasing model for atmospheric and oceanic high-frequency variability is available with augmented errors for a more realistic description of the process of the gravity field retrieval. Several features of this new dataset will be highlighted in this presentation in order to provide guidance for its application in upcoming future mission simulation studies.