Geophysical Research Abstracts
Vol. 20, EGU2018-6452-1, 2018
EGU General Assembly 2018

Improved geophysical excitation of length-of-day constrained by Earth orientation parameters and satellite gravimetry products

Nan Yu (1,2), Jiancheng Li (2), Wei Chen (2), Jim Ray (3), and Maik Thomas (1)

(1) GFZ German Research Centre for Geosciences, section 1.3 Earth System Modelling, Germany (nanyu@gfz-potsdam.de), (2) School of Geodesy and Geomatics, Wuhan University, Wuhan, China, (3) National Oceanic and Atmospheric Administration, Silver Spring, Maryland, USA (retired)

At time scales shorter than about two years, LOD variations are mainly excited by zonal tides and by angular momentum exchanges between the nontidal atmospheric, nontidal oceanic, and continental hydrological fluid envelopes and the underlying solid Earth. But neither agreement among different geophysical models for the fluid dynamics nor consistency with geodetic observations of LOD has reached satisfactory levels. This is mainly ascribed to significant discrepancies and uncertainties in the theories and assumptions adopted by different modeling groups, in their numerical methods, and in the accuracy and coverage of global input data fields. Based on careful comparisons with more accurate geodetic measurements and satellite gravimetry products from satellite laser ranging (SLR), LOD variations observations and C20 series can provide a strong constraint to validate or even form improved geophysical model combinations. In this study, wavelet decomposition is used to extract several narrow-band components to compare in addition to considering the total signals. We then make refinements to the least difference combination (LDC) method proposed by Chen et al. (2013) to form multi-model geophysical excitations. Two other combination variants, called the weighted mean combination (WMC2 and WMC4), are also evaluated. All the multi-model methods attempt to extract the best modeled frequency components from each geophysical model by relying on geodetic excitation and C20 series as references. The comparative performances of the three combinations LDC, WMC2 and WMC4 and the original single models are determined. We find that: (1) C20 series from SLR can provide a rigorous constraint for the total matter excitation of the geophysical fluids, especially for broadband parts; (2) the SLAM correction term for sea level variations (global mass balance) put forward by the new ESMGFZ version can significantly improve the HE matter terms; the LSDM continental hydrology model without this corrections formerly used by ECMWF performs poorly; (3) the LDC/WMC combinations are much better than simple combinations of the original individual geophysical model excitations, reducing the magnitude of unexplained excitations to tens of microseconds. The improved geophysical model combinations are recommended to replace the original ones as they present overwhelming advantages.