Geophysical Research Abstracts
Vol. 18, EGU2016-12262, 2016
EGU General Assembly 2016

Regularized GRACE monthly solutions by constraining the difference between the longitudinal and latitudinal gravity variations

Qiujie Chen (1,2,3), Wu Chen (2), Yunzhong Shen (1), Xingfu Zhang (4), and Houze Hsu (5)

(1) College of Surveying and Geo-Informatics, Tongji University, Shanghai, China, (2) Department of Land Surveying and Geo-Informatics, Hong Kong Polytechnic University, Hong Kong, (3) Center for Spatial Information Science and Sustainable Development, Shanghai, China, (4) Departments of Surveying and Mapping, Guangdong University of Technology, Guangzhou, China, (5) State Key Laboratory of Geodesy and Earth's Dynamics, Institute of Geodesy and Geophysics, CAS, Wuhan, China

The existing unconstrained Gravity Recovery and Climate Experiment (GRACE) monthly solutions i.e. CSR RL05 from Center for Space Research (CSR), GFZ RL05a from GeoForschungsZentrum (GFZ), JPL RL05 from Jet Propulsion Laboratory (JPL), DMT-1 from Delft Institute of Earth Observation and Space Systems (DEOS), AIUB from Bern University, and Tongji-GRACE01 as well as Tongji-GRACE02 from Tongji University, are dominated by correlated noise (such as north-south stripe errors) in high degree coefficients. To suppress the correlated noise of the unconstrained GRACE solutions, one typical option is to use post-processing filters such as decorrelation filtering and Gaussian smoothing , which are quite effective to reduce the noise and convenient to be implemented. Unlike these post-processing methods, the CNES/GRGS monthly GRACE solutions from Centre National d'Etudes Spatiales (CNES) were developed by using regularization with Kaula rule, whose correlated noise are reduced to such a great extent that no decorrelation filtering is required. Actually, the previous studies demonstrated that the north–south stripes in the GRACE solutions are due to the poor sensitivity of gravity variation in east-west direction. In other words, the longitudinal sampling of GRACE mission is very sparse but the latitudinal sampling of GRACE mission is quite dense, indicating that the recoverability of the longitudinal gravity variation is poor or unstable, leading to the ill-conditioned monthly GRACE solutions. To stabilize the monthly solutions, we constructed the regularization matrices by minimizing the difference between the longitudinal and latitudinal gravity variations and applied them to derive a time series of regularized GRACE monthly solutions named RegTongji RL01 for the period Jan. 2003 to Aug. 2011 in this paper. The signal powers and noise level of RegTongji RL01 were analyzed in this paper, which shows that: (1) No smoothing or decorrelation filtering is required for RegTongji RL01 anymore. (2) The signal powers of RegTongji RL01 are obviously stronger than those of the filtered solutions but the noise levels of the regularized and filtered solutions are consistent, suggesting that RegTongji RL01 has the higher signal-to-noise ratio.