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Editorial: Application of satellite gravimetry in terrestrial water storage change

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Editorial on the Research Topic
Application of satellite gravimetry in terrestrial water storage change

Water resource is important to human development and environment. With the warming climate and human activities, water resource has been experiencing dramatic changes, e.g., glacier retreat, decreasing groundwater due to irrigation and industrial consumption. It is difficult to monitor water resource changes at the regional and/or global scales by using traditional *in situ* observational methods. With the great success of Gravity Recovery and Climate Experiment (GRACE)/GRACE-Follow on (GRACE-FO) mission, satellite gravimetry has been used to analyze the terrestrial water storage change (TWSC) at the global and regional scales (Rodell et al., 2018; Wang et al., 2018; Tapley et al., 2019; Rodell and Reager, 2023b), which could monitor the total water resource changes as the summation of its potential components, e.g., mass change from lake water, glaciers, soil moisture, permafrost, and groundwater. Accurate estimation and attribution of TWSC is essential for sustainability and conservation of water resources.

Previous studies reported the difference of TWSC from satellite gravity model solutions, the separation of TWSC components, bridging the gap between GRACE and GRACE-FO, analyzing spatiotemporal patterns of TWSC and corresponding mechanism (Li et al., 2022; Liu et al., 2022; Rodell and Li, 2023a). Most of them were implemented with the combination of hydrological models, while potentially limited by the accuracy of satellite data and hydrological models. Therefore, there are still certain challenges to be resolved, e.g., the method of data processing with current GRACE/GRACE-FO solutions for improving estimation accuracy, precise separation of objective components, detailed and accurate analysis of physical mechanism, and the corresponding driving causes.

In this Research Topic, we have collected four research articles with gravity satellite application. Dannouf et al. used the method of boosted regression trees (BRT) and artificial neural network (ANN) to reconstruct the past terrestrial water storage anomaly (TWSA) during 1982–2014 over the Yangtze River basin, combined with hydro-climatic variables. The results suggested that this method of BRT during the test stage is capable to reconstruct the past TWSA with low RMSE (18.9 mm), which is better than ANN. For the actual GRACE data, the method of BRT is also better than ANN. This research provides a new perspective to reconstruct the past TWSA. Fok et al. used the satellite hydrological data to reconstruct the daily runoff over the Mekong basin, found that the accuracy of reconstructed daily runoff had been increased compared with *in situ* streamflow data, but the method of neural network-based model did not improve the accuracy. The best method of reconstructed daily runoff was reconstructed with upstream standardized water storage index with lowest relative error of 8.6%. Wang et al. developed a regional mascon method to squeeze more mass change signal, and used the Tongji-Grace2018 model to derive a series of mascon solutions with $1^{\circ} \times 1^{\circ}$ equal-area resolution during 2002–2016, and the results suggested that this method could effectively suppress the strips and improve the spatial resolution over Antarctic Ice Sheet, and the signal had improved with 116.86%. This paper also analyzed the spatial and temporal difference of mass change overt the Antarctic Ice Sheet. Huan et al. used the method of ensemble empirical mode (EEMD) decomposition with the empirical model decomposition (EMD) to filter the GRACE data, and divided those gravity field solutions into two parts (degrees 2–28 and 29–60). The results suggested that the fitting errors of EEMD method were much smaller than those of the EMD method with a low mean RMS (3.45), and this method could extract the geophysical signal much more accurately.

Author contributions

Manuscript evaluate and review: BQ, NM, and YM; Potential author invitation: YM and LX; Contact with Corresponding author: BQ and HW. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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