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The water storage change anomaly and its causes in the middle-lower reaches of Yangtze River basin

Taoyong Jin, Xiaolong Li, and Zuansi Cai
Wuhan University, School of Geodesy and Geomatics, China (tyjin@sgg.whu.edu.cn)

The three gorges dam (TGD) is always thought to have a significant impact on hydrological and climatic change in the middle-lower reaches of the Yangtze River basin (MLYRB), which can be regarded as human driven factor. The El Nino/Southern Oscillation (ENSO) events are also considered have large effect in the MLYRB, which can be regarded as climate driven factor. In the study, using terrestrial water storage change anomalies (TWSA) from Gravity Recovery and Climate Experiment (GRACE) mission and hydrological data, we investigate the effect of TGD and ENSO on the TWSA in MLYRB and its sub-basins. From the routinely impoundment of TGD since October 2010, the TWSA and ENSO show high correlation greater than 0.75 with a 5-month time lag, except for the upper Han River basin which is large affected by the Danjiangkou reservoir, and during two extreme flood and drought events, the TWSA and ENSO are almost consistent. It is concluded that the TWSA in the MLYRB is mainly affected by the climate driven factor, but the impoundment of TGD has limited effect. Since the relationship between TWSA and ENSO is stable during the routinely impoundment of TGD, the extreme events occurred in the MLYRB can be early warned by the ENSO index.