Inversion changes of terrestrial water storage of Yangzte River Upper Reaches Based on GRACE data

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The Gravity Recovery and Climate Experiment, GRACE, selected as the second mission under the NASA Earth System Science Pathfinder (ESSP) Program in May 1997, then launched in March of 2002, which delivers monthly averages of the spherical harmonic coefficients with an order and degree of 120 that describes the Earth's gravity field with a much higher accuracy than the previous ones. We expect to infer time-variable changes in the Earth's mass by this satellite based gravity recovery technology. These data is useful for examining changes in the distribution of water in the ocean, in snow and ice on polar sheets, and in the continental water and snow storage. Time-variable gravity changes are caused by a combination of reasons including mass transfer of the Earth system especially redistribution of water, snow and ice on land.

Yangtze River, the largest river in China, is divided into three reaches including the upper, middle and lower reaches. The upper reaches refer to the section above the Yichang City in Hubei Province， which have rich resources but also ecologically fragile and environmentally sensitive, especially the water resources that plays an extremely important strategic role in the economic construction and the social development.

In this paper, we choose the GRACE Level-2 product GGM02S-GSM from JPL (Jet Propulsion Laboratory, NASA) to inverse the mass changes of the upper reaches of Yangtze River. We take the data in the period of time from September 2005 to September 2008, totally 36 months; use the spherical harmonic coefficients with order and degree 2 to 100 calculating the time-variable gravity field sequence of these 36 months. The similarities are shown well by comparing the terrestrial water storage variation from GRACE based time-variable gravity field to those results from CPC (Climate Prediction Center, USA) hydrological model, and the amplitude difference is less then 1cm equivalent height of water. The groundwater storage are estimated by combining the GRACE based terrestrial water storage with the surface water, solid moisture and snow water equivalent estimated by GLDAS(Global Land Data Assimilation System) hydrological model and WGHM(The Water GAP Global Hydrology Model). The result shows that GRACE data based time-variable gravity field is valuable in water storage estimating and application for estimating changes in local area water reserves.

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