Investigating the relation between the geometric properties of river basins and the filtering parameters for regional land hydrology applications using GRACE models

Dimitrios Piretzidis and Michael G. Sideris

University of Calgary, Geomatics Engineering, Calgary, Alberta, Canada

This study investigates the possibilities of local hydrology signal extraction using GRACE data and conventional filtering techniques. The impact of the basin shape has also been studied in order to derive empirical rules for tuning the GRACE filter parameters. GRACE CSR Release 05 monthly solutions were used from April 2002 to August 2015 (161 monthly solutions in total). SLR data were also used to replace the GRACE C2,0 coefficient, and a de-correlation filter with optimal parameters for CSR Release 05 data was applied to attenuate the correlation errors of monthly mass differences. For basins located at higher latitudes, the effect of Glacial Isostatic Adjustment (GIA) was taken into account using the ICE-6G model.

The study focuses on three geometric properties, i.e. the area, the convexity and the width in the longitudinal direction, of 100 basins with global distribution. Two experiments have been performed. The first one deals with the determination of the Gaussian smoothing radius that minimizes the gaussianity of GRACE equivalent water height (EWH) over the selected basins. The EWH kurtosis was selected as a metric of gaussianity. The second experiment focuses on the derivation of the Gaussian smoothing radius that minimizes the RMS difference between GRACE data and a hydrology model. The GLDAS 1.0 Noah hydrology model was chosen, which shows good agreement with GRACE data according to previous studies.

Early results show that there is an apparent relation between the geometric attributes of the basins examined and the Gaussian radius derived from the two experiments. The kurtosis analysis experiment tends to underestimate the optimal Gaussian radius, which is close to 200-300 km in many cases. Empirical rules for the selection of the Gaussian radius have been also developed for sub-regional scale basins.