



Operational Forecast of Runoff from Large Scale Basins using Satellite-Gravimetry and Remote Sensing

Johannes Riegger (1) and Mohammad Tourian (2)

(1) Institut für Wasser- und Umweltsystemmodellierung, Lehrstuhl Hydrologie und Geohydrologie, Universität Stuttgart, Deutschland (riegger@iws.uni-stuttgart.de), (2) Geodätisches Institut, Universität Stuttgart, Deutschland (tourian@gis.uni-stuttgart.de)

The forecast of river runoff is a major issue in hydrology and of considerable economic importance with respect to the management of floods and droughts. However an accurate and reliable forecast is a major challenge as runoff depends on climatic and physiographic conditions and on different driving forces such as present recharge, water storage in liquid and solid form, etc. Specifically the quantification of the solid and liquid water storage components and their transition has a major impact on the accuracy of runoff forecasts especially during melting periods. As groundbased measurements of groundwater levels, snow water equivalent and soil moisture are point measurements the determination of water storage is still quite inaccurate and unreliable on large spatial scales.

GRACE gravimetry provides a direct measure of water storage anomalies and thus a determination of runoff – storage (R-S) relationships on large scales catchments. For fully humid tropic regions the system behaviour can be described as a linear time invariant (LTI) system between runoff and total mass with a phase shift due to runoff routing time lag. For boreal regions runoff and liquid mass quantified on the basis of GRACE and MODIS snow coverage also behave as a LTI system. This allows for a direct determination of runoff from GRACE gravity measurements and remote sensing based on an adaption of the parameters time lag, hydraulic time constant and mass offset between the time series of runoff and liquid mass (Riegger & Tourian, 2014).

Even though there are no operational GRACE measurements available at the moment, an approach for short term runoff forecasts using operational data is investigated here in order to explore the prediction potential of operational data. The approach is based on the R-S relationship for liquid storage components with the respective parameters taken from previous runoff, recharge, mass and snow coverage time series in a training period. These are used to predict runoff for the subsequent month based on the values of present recharge, snow coverage and liquid mass. The forecast results are compared to measured runoff during the prediction period.

Our investigations on large scale catchments emphasize the considerable potential for the use of operational GRACE and remote sensing data in runoff predictions. Future improvements in spatial and temporal resolution will tremendously increase the number of catchments for which this method can be applied.

References: Riegger, J., and M. J. Tourian (2014), Characterization of runoff-storage relationships by satellite gravimetry and remote sensing. *Water Resour. Res.*, 50, doi:10.1002/2013WR013847.