



## **Improved drought indicators based on Gravity Recovery and Climate Experiment (GRACE), water balance components and soil moisture**

Peyman Saemian, Mohammad J. Tourian, and Nico Sneeuw

Institute of Geodesy - GIS, Stuttgart, Germany (peyman.saemian@gis.uni-stuttgart.de)

Drought, as a natural recurring hazard, can occur in virtually all climate zones. In recent years, severe large scale droughts have been detected in all continents including large areas in Europe. A change in water storage, which is the combination of groundwater, snow, and soil moisture, can indicate deficiencies in water storage in general. Such deficiencies may be related to any of its components or even a combination of them.

We present here a new water storage deficiency index that has been developed using the terrestrial water storage (TWS) change from the Gravity Recovery and Climate Experiment (GRACE) and global water balance components data (Precipitation, Evapotranspiration and Runoff). First, for each monthly time series of TWS we calculate differences of water storage from a climatology that has been obtained from the long term water balance components time series. We then turn the differences into meaningful indices with the help of soil moisture data that characterizes agricultural drought.

Our indexes identifies variation in water storage in general and characterizes groundwater drought including onset, severity, and duration of drought periods. Our results highlight the ability of GRACE TWS in combination with global water balance fluxes as an invaluable source to detect and monitor groundwater and groundwater drought which is a vital step for the planning and management of water resources both at local and global scales.