



## **A multi-sensor approach to monitor the desiccation of Lake Urmia in Iran**

Mohammad Javad Tourian (1,2), Omid Elmi (2), and Nico Sneeuw (2)

(1) Institute of Hydraulic Engineering , University of Stuttgart, Germany (tourian@gis.uni-stuttgart.de), (2) Institute of Geodesy, University of Stuttgart, Germany

Lake Urmia, a hypersaline lake in northwestern Iran is under the threat of drying up. The high importance of the lake's watershed for agricultural purposes demands a comprehensive monitoring of the watershed's behaviour. Spaceborne sensors provide a number of novel ways to monitor the hydrological cycle and its interannual changes. The use of GRACE gravity data allows to determine continental water storage changes and to close the water budget on short time scales. Satellite altimetry can be used as a tool for monitoring inland water surface elevations. Optical satellite imagery and Synthetic Aperture Radar (SAR) provide the opportunity to monitor the spatial change in coastline, which can serve as a way to determine the water extent repeatedly in an appropriate time interval.

In this study, water storage change from GRACE, surface water level over different parts of the lake from satellite altimetry together with surface water extent estimation from SAR and optical imagery are used and assimilated to monitor the lake's hydrological cycle. In addition to the spaceborne data, in situ observation of precipitation, groundwater level and temperature together with model based actual evapotranspiration are also employed for assimilation. A linear dynamic system consisting of a stochastic process model and observation equations is developed to assimilate the data from different sources. The dynamic system is solved by a Kalman filter to achieve an unbiased estimation with minimum variance. The results of the assimilation allow us to monitor the hydrological cycle with quantified error budgets over the lake.