Hydrological Variability of Lake Chad using Satellite Gravimetry, Altimetry and Global Hydrological Models

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Abstract

Sustainable water resource management requires the assessment of hydrological variability in response to climate fluctuations and anthropogenic activities. Determining quantitative estimates of water balance and total basin discharge are of utmost importance to understand the variations within a basin. Hard-to-reach areas with few infrastructures, coupled with lengthy administrative procedures makes in-situ data collection and water management processes very difficult and unreliable.

In this study, the hydrological behavior of Lake Chad whose extent, extreme climatic and environmental conditions make it difficult to collect field observations was examined. During a 10 year period [January 2003 to December 2013], dataset from space-borne and global hydrological models observations were analyzed.

Terrestial water storage (TWS) data retrieved from Gravity Recovery and Climate Experiment (GRACE), lake level variations from Satellite altimetry, water fluxes and soil moisture from Global Land Data Assimilation System (GLDAS) were used for this study. Furthermore, we combined altimetry lake volume with TWS over the lake drainage basin to estimate groundwater and soil moisture variations. This will be validated with groundwater estimates from WaterGAP Global Hydrology Model (WGHM) outputs.

TWS showed similar variation patterns Lake water level as expected. The TWS in the basin area is governed by the lake's surface water. As expected, rainfall from GLDAS precedes GRACE TWS with a phase lag of about 1 month. Estimates of groundwater and soil moisture content volume changes derived by combining altimetric Lake Volume with TWS over the drainage basin are ongoing. Results obtained shall be compared with WaterGap Hydrology Model (WGHM) groundwater estimate outputs.

Keywords : GRACE, Lake Chad, Satellite Altimetry, GLDAS

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