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## **GRACE gravity approach in estimating changes in Total Water Storage in the Vaal River Basin, South Africa.**



Masindi, K.<sup>1</sup>, Kramers, G.<sup>1</sup> and Abiye, T.A.<sup>1</sup>

<sup>1</sup>University of the Witwatersrand, School of Geosciences, Private Bag 3, Wits 2050.  
khulmsnd@gmail.com

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Understanding total water storage (TWS) in a certain basin is an important aspect of water resource management in a changing environment, where climate variability and anthropogenic activities threatens the quantity of available water. In this study gravity data derived from the Gravity Recovery and Climate Experiment (GRACE) are used to estimate changes in total water storage in the Vaal River Basin, in order to quantify different components of the hydrologic cycle. A lot has been achieved with respect to monitoring and collection of hydrological data in South Africa, however, the available data is inadequate for basin-scale water resource assessment studies. Therefore, GRACE satellite observations provide an opportunity to study large-scale hydrological process in data sparse regions like in South Africa. GRACE satellites sense gravity anomalies in the earth, which are then processed to produce estimates of mass changes at and below the earth [1]. TWS values for the study period, from March to January 2014 were used to estimate changes in storage. Smoothing radii of 700, 300, 175 and 25 km are used. It was observed that by comparing the TWS changes and the ground based data, the TWS changes mimics major hydrological events such as dry and wet periods. Preliminary results indicate that the changes in TWS anomaly for smoothing radii of 175 and 300 km are -25.65 and -12.89 mm of equivalent water thickness, which suggests the accuracy of the results is dependent on the selection of an appropriate smoothing radius for a given area [2]. In order to estimate other components of the hydrological cycle (evaporation, soil moisture, groundwater and precipitation), other satellite techniques will be used. This exercise demonstrates the ability of GRACE satellites to recover TWS storage changes in the Vaal River basin where inter-basin water transfer is taking place. Moreover, it demonstrates the usefulness of satellite-based techniques for studying large scale hydrological processes, which can inform water management practices.

### *References:*

- [1] Wahr et al.(1998) J. Geophys. Res 103 (B12): 30205-30229
- [2] Swenson S and Wahr J (2002) J. Geophys. Res 107 (B9): 2193

