Groundwater Storage Changes In The Major African Basins 2003-2011

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Résumé/*Abstract*

This study uses terrestrial water storage (TWS) data from the GRACE satellites from 2003-2011 to characterise seasonal variations in the major groundwater basins in Africa, and identify any long-term, regional scale trends in groundwater storage. TWS variation was analysed statistically with rainfall data (TRMM) and soil moisture data (GLDAS) to give insight into changes in soil moisture and groundwater storage. The analysis indicates the only significant long-term trend during 2003-2011 is accumulation of groundwater within the North Kalahari and Iullemmeden Basins, amounting to 10km^3 per year and 2.1km^3 per year respectively. There is no observed long-term depletion in groundwater storage for any basin from 2003-2011. Several basins show no statistically significant periodicity in TWS: the north African Basins and the Somali and Karoo basins. Groundwater storage changes throughout the period are negligible in these basins, and only in the Karoo and the Somali basins is there any evidence for observable widespread groundwater recharge. The remainder of the basins have statistically significant annual periodicity in TWS, which is correlated to rainfall lagged by 1-2 months. For the Sahelian Basins (Senegal, Taoudeni, Iullemmeden, Chad) soil moisture variations above the ZFP account for less than 50% of the TWS variation indicating that groundwater recharge is relatively high (55-78% of TWS variation). For the central and southern African basins (Kalahari, North Kalahari and Congo) soil moisture changes above the ZFP account for a much larger proportion of TWS variability and groundwater storage is estimated to be 24-45% of the TWS variation most likely as a result of denser vegetation and high evapotranspiration.