



Monitoring water stock variations by gravimetry in Benin

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In Central Benin (wet Soudanian climate), in the frame of the AMMA (African Monsoon Multidisciplinary Analysis) program, an hydrological observatory has been set up since 2000. It is based on embedded catchments from a few to twelve thousand squared kilometers. At the local scale, 3 hillslopes with contrasted vegetation covers were selected in 2005 to study the water redistribution processes. With the aim to close the water budget at this scale, the instrumentation device was composed of instruments which monitored the 1st meter of the vadoze zone (succion, humidetric and temperature probes), the groundwater (piezometers screened at different depths) and a flux station to control evapotranspiration. Seasonal water storage changes can be monitored at this local scale but determination of the water budget at catchment scale is still difficult and needs modelling. A promising method seems to be the monitoring of the gravimetric variations. The GHYRAF French project (Gravity and Hydrology in Africa) started in 2008. It is devoted to the water storage variation assessment in sub-saharian Africa. In this aim it carries detailed comparison between models and multidisciplinary observations (ground and satellite gravity, geodesy, hydrology, meteorology). To perform this intercomparison, the main surface gravity experiment consists in periodic absolute gravity measurements at specific points along a north-south monsoonal gradient of rainfall in West Africa (Tamanrasset (20 mm annual rainfall depth) in southern Algeria, Niamey (500 mm) and a Soudanian site in Central Benin (1200 mm). In Benin, three gravity measurements have been already done on the key periods of the water cycle (July 2008 : on-set of the groundwater recharge, September 2008 : highest water table and wettest state in the vadoze zone, January 2009, low water table and dry state in the vadoze zone). We present here the preliminary comparisons of the water storage variation estimations deduced from the hydrological device or measured by gravimetry on the culture-fallow hillslope. At meso-scale, a first comparison of GRACE solutions with groundwater variations is done. The good agreement at local and meso-scale between hydrological and gravimetric data show that gravimetry appears to be a promising tool to monitor the water storage variations at different scales.