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# The GHYRAF (Gravity and Hydrology in Africa) project using ground and space geodesy to constrain water storage changes: latest results in West Africa

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Underground hydrological processes (soil moisture, aquifers) redistribute water and alter the gravity and shape of the Earth at various time and length scales (from very local catchment size to continental size) because of both Newtonian attraction and elastic loading. GHYRAF (Gravity and Hydrology in Africa) is a 4 year project (2008-2011) aiming to better characterize the water storage changes in West Africa and to assess the predictions of global hydrology models for this region. We present here the results from 3 specific sites, two of them in the Sahelian zone and one in the equatorial monsoon region. The first one is Wankama in Southwest Niger where gravity measurements were repeated four times a year with a FG5 absolute gravimeter and modeled using local piezometric and soil moisture observations. We will show that there is a nice agreement between the measured and modeled surface gravity changes during the 2008 monsoon, inferring porosity values very close to the aquifer water content derived from magnetic resonance sounding (MRS). In Diffa, close to the Chad-Niger frontier, there is a fair agreement between the amplitude of the gravimetric signal and the groundwater level. However there is a still unexplained offset between both signals. The observed gravity changes allow us to propose a water storage budget at the Djougou site with heavy rainfall in North Benin compatible with in situ hydrological measurements. We finally present the annual signature in GPS and space gravimetry (GRACE) observations of large scale continental loading from the West African monsoon.

**Keywords**: field gravimetry, water storage, monsoon, porosity

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