THE WATER CYCLE IN SAHELIAN AFRICA:

MULTIDISCIPINARY APPROACH AND CONTRIBUTION OF SPATIAL AND TERRESTRIAL GRAVIMETRY

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In regard with climate variability and human activities, recent advances in water resources observation, quantification and prediction have led to a growing interest in the geophysical community. Geodetic techniques allow measuring the shape and the gravity field of the Earth. These measurements are sensitive to the water mass distribution at the Earth's surface over a wide range of time and space scales. Such techniques may thus provide valuable information about continental water storage changes. In the framework of the AMMA[1] and GHYRAF[2] projects, a bunch of actions have been set up in gravimetry, geodesy, geophysics and hydrology on a pilot site located in south-west Niger, at 70 km of the city of Niamey. The seasonal water cycle, in link with the West African monsoon, is studied at local scale by *in situ* measurements and at continental scale by satellite data. The observed gravity signal is analysed to retrieve local hydrogeological parameters, such as the drainage porosity. The uncertainties due to the presence of water in the first meters of soil are evaluated with *in situ* measurements. Porosity values estimated by gravimetry are compared to values of the aquifer water content derived from magnetic resonance soundings. The good agreement between these two independent geophysical methods, displaying different sensitivity as well as spatial and temporal resolutions, shows their potential to constrain local hydrogeological parameters. The spatial heterogeneity of the water storage is investigated at the small catchment scale (~ 2.5 km^2) by an intensive microgravity field campaign. Dynamic variations of the gravity are measured with small to medium amplitudes (≤ 220 nm s^{-2}) and carefully analysed to evaluate the intraseasonal variability of the water storage. The heterogeneity of the water storage in the vadose zone appears as the main reason for the spatial variability of the gravimetric signal at local scale (<1 km).

Keywords: Hydrology, Gravimetry, Sahelian Africa

[1] African Monsoon Multidisciplinary Analysis

[2] Gravity and Hydrology in Africa