

Pl.7.8

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

Jacques HINDERER¹, Julia PFEFFER², Basile HECTOR³, Luc SÉGUIE⁴, Marie BOUCHER⁵,
Guillaume FAVREAU⁴, Pierre GENTHON⁴, Olivier BOCK⁶,
Jean-Paul BOY⁷, Marc DESCLOITRES⁵

¹ CNRS-IPGS, Strasbourg, FRANCE

² LEGOS, Toulouse, FRANCE

³ IPGS, Strasbourg, FRANCE

⁴ IRD-HSM, Montpellier, FRANCE

⁵ IRD-LTHE, Grenoble, FRANCE

⁶ IGN, Paris, FRANCE

⁷ CNRS-IPGS, Strasbourg, FRANCE

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

Email: luc.seguis@ird.fr



**2-6 July 2012
Toulouse, France**

4th AMMA International Conference

Program and Book of Abstracts

**African Monsoon Multidisciplinary Analyses
Afrikaanse Moesson Multidisciplinaire Analyse
Afrikanske Monsun : Multidisciplinære Analyse
Analisi Multidisciplinare per il Monsone Africano
Afrikanischer Monsun : Multidisziplinäre Analysen
Análisis Multidisciplinar de los Monzones Africanos
Analyses Multidisciplinaires de la Mousson Africaine**

Programme et Livre des Résumés

**2-6 Juillet 2012
Toulouse, France**



4^{ème} Conférence Internationale AMMA

Editors

S. Janicot, O. Roussot, F. Guichard

Design and layout

C. Michaut

Type setting

S. Janicot, O. Roussot,
F. Guichard, C. Michaut

Printing and binding

COREP
125 route de Narbonne
31400 Toulouse

Back page photo

F. Guichard

Copyright © AMMA International 2012
AMMA International Project Office
Université Pierre et Marie Curie
LOCEAN/IPSL
Boite 100 - 4 Place Jussieu
75252 Paris cedex 05 - France

Web: <http://www.amma-international.org>
Email: amma.office@amma-int.org

All rights reserved.