



Quantifying and locating water stored within a catchment thanks to ground geodesy

L. Longuevergne (1), L. Oudin (1), F. Boudin (2), N. Florsch (1), T. Vincent (3), M. Kammenthaler (3)

(1) UMR Sisyphe, Université Pierre et Marie Curie, Paris, (2) IPGP Université Denis Diderot, Paris, (3) Volunteers (laurent.longuevergne@ccr.jussieu.fr)

In this work, we explore the possibility of using ground geodesy measurements as a tool to improve our knowledge of the hydrological behaviour of a catchment. In fact, geodetic measurements are direct estimations of the water mass variations on the earth crust, they therefore bring complementary information on the hydric state of river basins. With similar goals but different methods, GRACE data have recently proved to be of great interest for continental-scale hydrological modelling (see e.g. Schmidt et al., 2006).

A new observatory was been set up in a 100-km² catchment in the Vosges mountains (France). A 100-meter base hydrostatic inclinometer monitors crust tilting due to stored water variations since December 2004 with a temporal sampling of 30 seconds and a resolution better than 10⁻⁹ degrees. The physical modelling of the inclinometric deformation induced by water mass variations requires the investigation of the mass balance equation, that is calculated using simple lumped rainfall-runoff models.

Results show that modelled short term fluctuations of stored water are in good agreement with inclinometer measurements during winter time, when the spatial distribution of water within the catchment can be considered as "uniform" (i.e. stable precipitation field). Conversely, large discrepancies exist during storms and snow accumulation periods because the inclinometer is also sensible to the position of water masses. As a consequence, we believe that geodesy could bring interesting information on both the quantification and the distribution of water within the catchment, and thus better calibrate hydrological models.