Geophysical Research Abstracts, Vol. 9, 00899, 2007
SRef-ID:

Geodetic monitoring of a karst aquifer in the Larzac region, South of France

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In this study we attempt to understand the hydrological behaviour of a karst aquifer on the Larzac Plateau (South of France) using geodetic techniques. The uppermost weathered zone of carbonate rocks, or epikarst, acts as a potential perched aquifer. Water then percolates down the infiltration zone to the saturated or vadose zone, which represents the main water reservoir and is connected to the outlet. On this studied karst aquifer (110 km^2), water input is exclusively rainfall and draining occurs at the Durzon perennial spring. The plateau therefore constitutes a significant water resource. The aim of this study is to assess the water storage variations (discharge-recharge) relative to horizontal and vertical flow between the different karst structures. We assume that temporal and spatial water storage variations affect local gravity and local deformation by Newtonian and loading effects. The karst aquifer is hence being monitored since January 2006 with monthly absolute gravity measurements at three sites, differential relative gravity measurements at the surface and at 60m depth, continuous tiltmeters at two sites, continuous rainfall recordings, pressure head variations in two boreholes and hourly Durzon spring flow. Gravity at the three measurement sites exhibits an important seasonal trend (100-150 nm.s-2 of amplitude). Heavy rainfall events are both seen by FG5 absolute gravimetry and the tiltmeters. Significant deformation in tilt (10-6 rad) is indeed correlated to precipitations. During each event, tilt azimuth remains constant and tilt amplitude rises to a maximum then slowly declines. Water storage may occur preferentially at the south of the catchment area, as shown by gravity value and tilt. A model accounting for gravity and tilt with hydrological parameters as input is herein presented.