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Geodesic and hydrogeophysic long term observations in the Durzon karstic aquifer (Larzac, France)

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Karsts are generally characterized by high heterogeneity at all scales for both the water storage properties and the mode of water transport. The Durzon karst system is located in south of France and is characterized by a unsaturated zone of 100-150 m width. The water input is exclusively rainfall and draining occurs at the Durzon perennial spring in a karstic valley. The Durzon aquifer has been monitored by our group by different geophysical methods (gravimetry, tiltmetry, more details below) for several years. The present-day stage of the project is to setup long term observations to assess hydrological properties of the karst in a small area of 500m*500m with numerous caves (up to 100 m deep and more than 2 km of development).

The observations are of four major types:
- Continuous high frequency and high accuracy gravimetry: Gravimetric observations can be directly linked to the variations of water masses in the unsaturated zone. The iGrav™ Superconducting Gravity Meter from GWR (San Diego, USA) will be used to record continuous gravity variations and track water mass variations at a few millimeters level. The iGrav™ is a new SG model from GWR that has been simplified for portable and field operation, but retains the stability and precision of previous SGs. With a drift rate of less than 0.5 microGal/month and a virtually constant scale factory, the iGrav™ will provide a much higher stability and precision than can be achieved with mechanical spring-type gravity meters.
- Water flux measurements (atmospheric and in-situ): A flux tower provides evapo-transpiration measurements (output) allowing complete budget calculation with the help of gravity (storage variations) and rainfall (input). An original measurement corresponds to the measure of the in-situ flow inside karstic caves (stalactites and underground river).
- Tiltmetry: In situ (in caves) measurements are completed by long base silica tiltmeters. Tiltmeters are sensible to water storage in fractures and provide another type of transfer observation with long term measurements recording.
- Repeated hydro-geophysical methods (Resonance Magnetic Protonic, electric resistivity, seismic reflection): Repeated ground and boreholes electric resistivity measurements can be interpreted as a function of water saturation in the unsaturated zone and is perfectly complementary with Resonance Magnetic Protonic (RMP) which measures vertical profiles of water content.

All the observations are used to constrained simple physical models of water transfer in the unsaturated zone of the karst. New observations as gravimetry, RMP or in-situ flow measurements are crucial to distinguish between different physical models and establish the level of heterogeneity of the water transfer. The observatory will be fully operational for the winter 2010 and welcomes collaborations. All data will be made publically available through the OREME and ORE H+ web services.