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Physical modelling to remove hydrological effects from geodynamical measurements

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Hydrological phenomena are pointed out to possibly hide geodynamical processes (e.g. Evans and Wyatt 1984, Crossley et al., 1999). Some authors (e.g. Dal Moro and Zadro, 1998) concluded that hydrological effects should be removed before any other study regarding the monitoring and the identification of tectonic deformational signals intended to be extracted.

In this work, we investigate the hydrological processes inducing geodynamical effects in order to correct time series. Two orthogonal 100-meter base hydrostatic inclinometers were set up in an old mine in the Vosges mountains (France) in Decembre 2004. They record tilt variations with a temporal sampling of 30 seconds and a resolution better than 10ˆ(-10) radians. In the same time, an hydrometeorological monitoring system of the 100-km^2 hydrological unit around the inclinometer has been installed.

Two physical processes of deformation induced by water are significant in generating geodynamical undesirable effects: pressure fluctuations in nearby fractures and redistribution of water masses on the earth crust (surface loading) at regional scale. Hydrological models are used to model both amount and distribution of water masses. Finally, we emphasize the necessity to physically model each hydrological process separately in order to correctly remove hydrological effects, since all environmental signals are correlated.