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Highresolution tilt observations of subsurface hydrological signals at the Geodynamic Observatory Moxa/Germany

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At the Geodynamic Observatory Moxa in Thuringia/Germany high resolution tiltmeters of the ASKANIA type are installed in boreholes of 50m and 100m depth, resp. Since November 2002 small scale deformations of the upper crust are observed for different frequency ranges. These signals are associated to free oscillations of the Earth after big earthquakes, e.g. the Sumatra-Andaman earthquake in December 2004, the tides of the solid Earth, barometric and local hydrologically induced tilt effects as well as long period drift signals. The observed tilt signals are investigated regarding the quality of data, depending on the different installation depths. The results show that on the one side a clear increase of the signal to noise ratio can be achieved by the installation of the tiltmeter in a deeper borehole. On the other side it is found that signals caused by groundwater level changes are observed simultaneously by the tiltmeters in the boreholes of different depths. This result confirms the expectation that the induced tilt effect is caused by fluid related pore pressure changes. In general, these investigations show that this type of tiltmeter is suitable for the observation of small scale deformations of the upper crust, especially if these deformations are associated to hydrological sources. The mayor target is the application of high resolution tilt observations in tectonic active areas like swarm earthquake regions, e.g. the Vogtland/NW-Bohemia area, where deformation, stress accumulation, seismicity and the local fluid situation form together the underlying coupled process.