Geodynamics

Interferometric water level tilt meter at Conrad Observatory

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The prototype of a one end interferometric water level tilt meter has been operated at Conrad observatory (COBS) since 2014. The instrument records a broad band of geophysical tilt signals with 15 Hz sampling rate e.g. microseisms, free oscillation of the Earth surface and internal structure, Earth tide tilt, ocean loading, atmospheric loading and secular land tilting. Preliminary earth tide analysis based on the recorded tilt data at COBS and comparisons of ocean loading model tilts were already presented in2015.

A modern 5.5 m long one end Michelson-Gale type water level tilt meter (iWT)prototype was built by the Finnish Geodetic Institute and bought by the Geodetic and Geophysical Institute of the MTA CSFK, Hungary. The instrument was installed in August 2014 at the Conrad Geophysical Observatory of the Central Institute for Meteorology and Geodynamics, in Muggendorf, Thal, Austria. Interferometric fluid level sensing is carried out by the principles described e.g. in Ruotsalainen (2015). This Fizeau type interferometer consists of a HeNe-laser with fiber-optics, a convex-plane lens, a digital CMOS camera and the images of which can be accessed through a remote fiber-optic firewire connection by a computer. Instrument parameters were fitted e.g. to station temperature and local gravity. Fig 1. shows the level interferometer installed at the seismological tunnel of COBS.

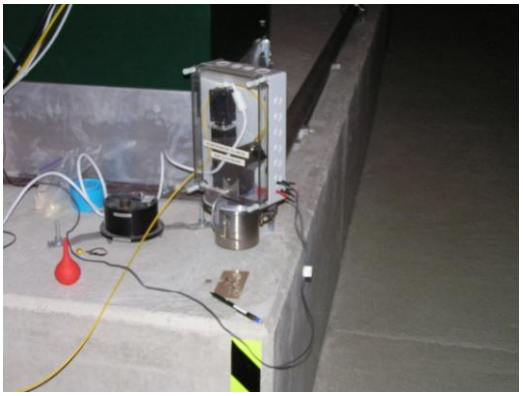

Figure 1: The current setup of iWT on the pier #2. End pot looks to west

Microseisms is often disturbing the recording eventhough the recording station is far from oceans. Global deformation of the rigid Earth by planetary masses (earth tides) causes a small bulges to the surface of the earth and due to the rotation of the masses in their positions. This tidal effect is registered by the tiltmeter and the signal peak to peak has a observational maximum of about 0.7 x 250 nanoradians. Fig. 2 shows east-west tidal tilt and microseisms. When artificial jumps and peaks are corrected and microseisms is filtered away, hourly values for earth tide analysis are estimated. Standard tidal analysis is carried out with the Eterna3.4 program developed by H.G. Wenzel (1996). Beyond this e.g. core–mantle resonance can also be investigated. Earth tide observations are also influenced by ocean and atmospheric loading, global models of which can be used to correct observations. After removal of known effects, the tilt residual may indicate local tendencies of tectonic motion. By comparing it with seismological observations, it may reflect pre- and postseismic activity in the area close to Conrad observatory such as the Mur-Mürz tectonic zone between Austria and Hungary.

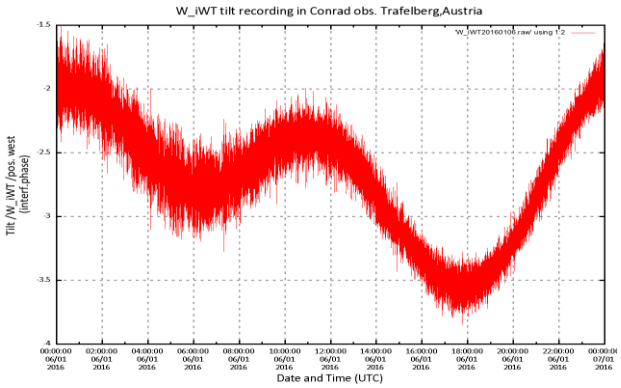

Figure 2:Tilt time series recorded by iWT at COBS, 2016-01-06. Peak to peak tilt amplitude is 125 nanoradian.

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