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The new Hamburg Ocean Bottom Tiltmeter: A First Deployment at Columbo Seamount (Aegean Sea, Greece)

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Assessing the state of volcanic activity of seamounts is quite more complicated than for onshore volcanoes, due to the difficulty of deploying instruments. At land, various techniques are applied (seismic networks, deformation studies, gas measurements etc.). At sea, mainly seismological observations are used. However, especially onshore deformation studies using INSAR have proven to be valuable in determining recharge of magmatic systems.

We therefore developed a free fall, self leveling Ocean Bottom Tiltmeter (OBT) to observe deformation on the seafloor, using a two component high resolution tilt sensor with a resolution of about 1nrad (0.15µ°) and a maximum signal of about 0.045rad (0.5°). It is mounted inside a 17" glass sphere on a levelling stage, which relevels the instrument between ± 5° down to an accuracy of 0.006°. During the measurement this leveling stage is standing on the bottom of the glass sphere. For releveling, the instrument is pulled up by thin nylon strings and then locked to a gimbal system in order to compensate for tilt >5°. This releveling procedure is done once every 48 hours. Data is recorded on an 18bit data logger at 50Hz sampling rate.

Additionally to tilt and seismic signals (using a hydrophone), temperature, absolute pressure to measure uplift or subsidence, and orientation (electronic compass) are monitored.

4 OBT systems were deployed between June 2006 and March 2007 at Columbo seamount, a submarine volcano north-east of Santorini island, Aegean Sea, Greece, on a 3 km long profile perpendicular to the first principal stress axis of the regional stressfield. Three of the instruments operated the whole time, one shut down due to a short circuit. First data processing indicates that small regional earthquakes as well as major tectonic earthquakes are properly recorded by the system. We find small, but permanent short-period deformations associated with local earthquakes and also observe long-period deformation processes occurring over a period of days. Additionally, subsidence of two stations relative to a third is observed with the absolute pressure gauges.

The implications of these findings and the general operational principle of these instruments will be discussed in detail in the presentation.