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On the interrelation of fluid-induced seismicity and crustal deformation at Columbo Seamount (Aegean Sea, Greece)

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The Columbo submarine volcano is part of the Santorini volcanic complex, located in the center of the Hellenic volcanic arc, Aegean Sea, approximately 8km north-east of Santorini island.

The Columbo seamount has attracted attention since island based monitoring indicated high seismicity rate and crustal deformation which both might be related to fluid migration in the subsurface. In addition to the island-based seismic network, 4 Ocean-Bottom-Seismometers (OBS) and 4 newly developed -Tiltmeters (OBT) have been deployed on top and in the vicinity of the seamount during the Columbo experiment between June 2006 and March 2007. Aim of the local experiment was to reduce the azimuthal gap between the islands, to get precise depth locations of the events and measuring tilt signals directly in the epicentral region. OBTs were additionally equipped with hydrophones to measure seismic signals and absolute pressure gauges to observe possible uplift or subsidence.

A STA/LTA trigger applied to the seismic data delivered over 14.000 triggers for local and regional events over the whole deployment. At least 8 earthquake swarms with event rates of up to 230 events per day occurred during the experiment. First relocation results estimate a depth range between 5 and 15km for the seismic swarms. Centroids of these earthquake clusters are distributed beneath and in the vicinity of the Columbo caldera and SW of Columbo, in direction of Santorini volcano. Parallel to these sequences of seismic unrest, we observe long-period tilt signals occurring over several days or weeks, which might reflect slow, but permanent deformation at the seamount.

Purpose of the study is to find evidences for swarm triggers, such as fluid migration, by precisely relocating the events by means of multiple event methods in order to investigate the migration behavior of the seismic clusters and by studying focal mechanisms of the events. In a second step, we compare observed tilt signals with the behavior of the earthquake swarms to find possible relations between crustal deformation and seismicity.