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Downhole Seismic Monitoring in the Istanbul/Eastern Sea of Marmara Region: Recent Results from the ICDP-GONAF Project

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As part of the ICDP-GONAF project (Geophysical Observatory at the North Anatolian Fault) geophone arrays are being installed in 300 m deep boreholes around the eastern Sea of Marmara. The objectives of GONAF are to (1) monitor the NAFZ transition from the 1999 Izmit rupture to the Princes Islands offshore Istanbul, where a M $\sim$ 7 earthquake can reasonably be expected to occur and (2) to determine ground-motion amplification and near-surface properties at the GONAF sites.
Five geophone arrays are fully operational while two more are being completed in Spring 2015. The vertical arrays consist of one 1 Hz 3C Mark Products L4 seismometer at the surface, three 1 Hz vertical Mark Products L4 seismometers at 75 m depth-spacings, and 1 Hz, 2 Hz and 15 Hz 3C seismometers at 288 m depth. The 1Hz MARK 3C seismometer has been redesigned, gimble-mounted and deployed downhole to operate under low-noise conditions for the first time.
During April-May 2013 the GONAF-Tuzla array in eastern Istanbul recorded a microearthquake swarm located $\sim$ 3.5 km epicentral distance east of the site. By cross-correlating the continuous Tuzla data with the only swarm event detected by the regional network (20th of April 2013, Md 1.6) we retrieved an additional of 113 events confirming the expectations of a substantially lowered magnitude-detection threshold allowing for unprecedented fault-zone characterization along the Princes island fault segment offshore of Istanbul.