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# Multiparameter monitoring of fluid expulsion and seismic activity by the SN4 seafloor observatory at the Izmit Gulf

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## Abstract

Episodic gas seepage occurs at the seafloor in the Gulf of Izmit (Sea of Marmara) along the submerged segment of the North Anatolian Fault (NAF) which ruptured during the 1999 Mw7.4 Izmit earthquake. An autonomous multiparametric benthic observatory (SN4) operated at 166m water depth in the gulf to study gas seepage and seismic energy release along this segment of the NAF in the framework of two EC projects, ESONET NoE (Marmara Demo Mission, 2009-2010) and MARsite (2013-2014). A multiparametric approach were adopted to study the methane emission and to understand the detection mechanism at the seafloor. Methane concentration time series reveals large number of abrupt increases of measured concentration (Methane Peak Events, MPEs) over time intervals from minutes to one hour. A large quantity of short duration high-frequency signals (SDEs) were detected by the seismometer. MPEs and SDEs documented recurrent methane emission in the vicinity of the installation site with different behaviour. The oceanographic parameters (mainly sea bottom currents) appeared essential in understanding the conditions that favoured the detection of methane emission. The availability of long-term time series of chemical, oceanographic and seismic data, analysed with a multiparametric approach, revealed essential in documenting the behaviour of recurrent fluid emission from the seafloor and in understanding how the marine environment may drive the detection mechanism. A similar approach in a permanent installation at the seafloor in the Sea of Marmara, as EMSO location (Marmara Regional Facility), takes advantage of a very long-term data availability and supplies a stable procedure to monitor seafloor gas emission over years. This will allow to understand the evolution of the seismogenic processes, helping to assess the seismic hazard of the area.

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