

THE IMPORTANCE OF MULTI-PARAMETRIC ANALYSIS IN LONG-TERM SUBMARINE GAS EMISSION MONITORING: THE SN4 OBSERVATORY AT THE NORTH ANATOLIAN FAULT (MARMARA SEA, TURKEY)

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Methane-rich fluid vents have been widely observed and associated to active faults in the Sea of Marmara, along the submerged portion of the North Anatolian Fault (NAF). Episodic gas seepage also occurs in the Izmit Gulf, along the NAF segment that ruptured during the 1999 Izmit earthquake. This site is thus a unique area to test the hypothesis on the relation between strike-slip deformation, seismic activity and gas expulsion within an active fault zone. A long-term multi-parametric experiment can be an effective way to study the irregular dynamics of gas emission from seafloor and to understand its possible relation with seismic activity.

A benthic seafloor observatory (SN-4) was deployed in the Izmit Gulf in 2009 using the R/V Urania as a demonstration mission in the framework of the EC ES-ONET (European Seas Observatory NETwork) project. Instrumental redundancy and specific cross-correlation of data from different sensors, proves to be fundamental to distinguish actual seepage events from other signals related to oceanographic behaviour or even sensor biases. The observatory was equipped with a three component broad-band seismometer, a CTD with turbidity meter, two methane detectors, an oxygen sensor and a current-meter. All sensors installed on the observatory were managed by dedicated low-power electronics, which can manage a wide set of data streams with quite different sampling rates. A unique reference time, set by a central high-precision clock, is used to tag each datum. After six months of continuous monitoring, SN-4 was recovered in March 2010 in order to download the data and replace the batteries for a further six month mission period and finally recovered in October 2010.

The data analysis clearly shows frequent degassing events, recorded as methane anomalies in seawater and as high-frequency short-duration signals recorded by the seismometer. The time series of other oceanographic parameters (temperature, oxygen concentration, turbidity and salinity) shows patterns that seem to be linked to both local gas seepage and to the circulation of water masses in the Gulf of Izmit. A comparative analysis of the various observables and their mutual correlation, can be a key tool to understand actual degassing events along the NAF. This analysis is first attempt in finding possible correlations between seismic activity and gas release with a significant confidence level.



Fig. 1 The SN-4 seafloor observatory

(below) Fig. 2 Six month time series, from October 2009 to March 2010; from bottom to top: methane (log. scale), turbidity, temperature and oxygen concentration.

