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Investigation of active volcanic areas through oceanographic data collected by the NEMO-SN1 multiparametric seafloor observatory

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In the framework of the European Research Infrastructure EMSO (European Multidisciplinary Seafloor and water-column Observatory, www.emso-eu.org), the cabled multidisciplinary seafloor observatory node NEMO–SN1 was deployed in the Western Ionian Sea (Southern Italy) at a depth of 2100 m, about 25 km off-shore Eastern Sicily, close to the Mt. Etna volcano system.

The oceanographic payload mounted on this observatory was originally designed to monitor possible variations of the local hydrodynamic playing a crucial role on the redistribution of deep water in the Eastern Mediterranean Sea. In particular the Acoustic Doppler Current Profiler (ADCP RDI WorkHorse 600 kHz) was configured with the main aim to record the bottom dynamics, watching few meters of water column above the station (about 30 m). Surprisingly, this sensor offered a spectacular recording of the Mt.Etna pyroclastic activity occurred on 2013 which affected the ESE sector of the volcano.
Although the ADCP sensor is commonly used to measure speed and direction of sea currents, it is more often used to monitor concentration suspended matter of controlled areas, such as rivers or coastal marine environments, by the analysis of the acoustic backscatter intensity. This standard condition entails some a-priori knowledge (i.e. suspended sediment concentration, particle size, echo intensity calibration) useful to well configure the sensors before starting its acquisition. However, in the case of Mt. Etna pyroclastic activity, due to the unexpected recording, these information were not available and it was necessary to work in a post-processing mode considering all acquired data. In fact, several different parameters contribute to complete the comprehension of the observed phenomenon: the ADCP acoustic wavelength able to indirectly provide information on the detectable particle size, the intensity of the explosive activity useful to define the starting energy of the volcanic system, the oceanographic local dynamics indispensable to know possible ash dispersion in seawater.

This work aims to present a new perspective of observation for pyroclastic fallout in benthic seafloor areas using alternative sensors normally designed for other investigation such as the ADCP. Also, it highlights the possibility to optimize the instrumental resources used within the benthic observatories and opens new possibilities for the study of benthic processes, as volcanic ash sedimentation, through multiparametric analysis.