



Towards seismic and volcanic hazard assessment with distributed acoustic sensing in fibre optic cable

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Volcanic and seismic activities produce a variety of phenomena that put population at risk. In order to assess the seismic and volcanic hazard, many instruments are deployed around active volcanoes and seismic fault zones. Their records are useful to observe the activity of the volcanoes and faults in order to understand better their behaviour and issue warnings to authorities in charge of the public security.

In this study, we used optical cables around Etna volcano to observe seismic and pressure signals associated with volcanic activity. The 2018 expedition consisted of three experiments. Firstly, we used a 4-km long telecom line in Zafferana and recorded all geodynamic and other activities for about 20 days. At this site, the fibre is known to cross active faults that are linked to the eastern volcano flank slowly sliding towards the sea. Secondly, we tested a 40 km-long cable from an internet provider at the western side of the volcano. Thirdly, we used a fibre cable deployed at the summit area of the volcano to test its ability to detect small volcanic events.

In each of the three parts, a DAS system (iDASTM interrogator provided by Silixa) sent repeatedly coherent light pulses with a gauge length of 10 m and deduced the strain rate from interferometric measurements of the back-scattered light. We were able to measure every 2 metres the strain rate associated with several volcanic event types, earthquakes and many other signals from human activity. We validated the optical records with records from additional sensors such as seismic broadband stations, geophones and infrasound sensors. We present results from all experiments.