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Monitoring volcanic activity with fibre-optic Distributed Acoustic Sensing – first experiments at the Etna volcano

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Distributed acoustic sensing (DAS) technology has been for the first time tested as a new tool for monitoring volcanic activity. We installed an "intelligent" Distributed Acoustic Sensing (iDAS) interrogator, based on Rayleigh Optical Time-Domain Reflectometry (OTDR), inside the Observatory Pizzi Deneri to record strain rate signals along a 1.3 km-long fibre optic cable deployed in the Etna summit area. The iDAS system recorded the strain rate induced by volcanic sources with 2 m spatial resolution at a sampling frequency of 1 kHz. The cable is radially oriented with respect to the summit craters. The main objective of the experiment was to test the capability of the DAS technology to contribute to the monitoring of Etna volcano. To validate the iDAS signal we collocated along the fibre cable a multi-parametric array composed of: 15 three-component geophones, 5 seismic broadband sensors, and 2 arrays of three infrasonic sensors. The system was in acquisition from 29 August to 16 September 2018, when volcano Etna activity was mainly characterized by moderate but frequent explosive activity from the NSEC (New South East Crater) and the NEC (North East Crater), the latter being very near to the installation site (1.8 km distant). Volcanic events such as explosions from the summit craters were recognized in the iDAS signal. Our preliminary observations suggests that DAS technology can record volcano-related strain rate signals with unprecedented spatial and temporal scales, which may have an important impact on the understanding of volcanic processes.