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Measuring relative ground motion across the Pernicana fault during the December 2018 - January 2019 eruption and seismic crisis of Mt. Etna, Italy, at 1 Hz sampling frequency using low-cost GNSS

Max Wilkinson (1), Fabian Wadsworth (2), Alessandro Bonforte (3), Gerald Roberts (4), Daniele Andronico (3), Richard Jones (1), and Jenny Schauroth (5)

(1) Geospatial Research Ltd., Dept. of Earth Sciences, Durham University, Durham, U.K. (info@geospatial-research.com), (2) Dept. of Earth Sciences, Durham University, Durham, U.K., (3) INGV, Osservatorio Etneo, Catania, Italy, (4) Dept. of Earth and Planetary Sciences, Birkbeck, University of London, London, U.K., (5) Dept. of Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool, U.K.

We present a 1 Hz record of relative ground motion along the Pernicana fault during the December 2018 – January 2019 eruption and seismic crisis of Etna measured using low-cost Global Navigation Satellite System (GNSS) receivers. The low-cost GNSS receivers have been used previously to measure coseismic and post-seismic displacement along active faults that have the capability to form surface ruptures during seismic events, including the 2016 Mw 6.6 Norcia and Mw 7.8 Kaikoura earthquakes in Italy and New Zealand, respectively.
In this study, eight low-cost GNSS receivers were deployed in the immediate near-field of the Pernicana fault system on the north-eastern flank of Etna in November 2018. The deployment was intended to investigate the potential existence of subtle fault displacement related to volcanic and seismic activity. The GNSS receivers record their position at 1 Hz sampling frequency and automatically transmit these measurements on an hourly basis to a server for automated data processing and visualisation of results on a web portal. Positional information of the receivers during the December - January eruption and seismic crisis was derived using differential positioning, whereby the receivers in the network are paired to calculate time series of relative motion of one receiver to another. Temporally, the differential positioning covers the pre-eruptive, eruptive and post-eruptive periods, thus providing a proof-of-concept dataset to assess the suitability of this monitoring technique in the identification of precursors to eruption, ground displacement during eruption and the identification of cessation. Validation of the results in this scenario is the first step for assessing the wider potential of this technique to monitor volcanoes with presently little or no existing instrumentation at relatively low-cost, for example in South America, Africa and elsewhere.