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Seismological constraints on the intrusive mechanism during the December 2018 Mt. Etna flank eruption

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On December 24, 2018 at 08:30 (UTC), an intense seismic swarm preceded and accompanied the beginning of a flank eruption at Mt. Etna. Simultaneously, a strong increase in the volcanic tremor amplitude was recorded. The eruption started with a fracture, about 2 km long and with a NNW-SSE direction, located between 3000 and 2400 m a.s.l (Internal Report N° 01/2019, INGV-OE). Strombolian activity and lava emission accompanied this eruption. In few days more than 3000 events were recorded by the INGV-OE permanent seismic network, most of them in the first 24 hours. In the early stages, the swarm affected the summit area, then it moved towards the Valle del Bove, with shocks located in a depth range between 0 and 3 km below sea level Subsequently, the seismic activity affected the eastern and the south-western flanks of the volcanic edifice. The most energetic event (Ml=4.8), recorded on December 26th at 02:19 UTC, was located just at the sea level and is a consequence of the activation of the Fiandaca Fault, a seismogenic structure which is part of the Timpe tectonic system. The earthquake was widely felt in many urban centres, producing important damages in the epicentral area. Noteworthy, the Ml=4.8 earthquake was followed by a drastic decrement of the volcanic tremor amplitude and, in general, of the volcanic activity.
A detailed analysis of seismicity recorded between December 24, 2018 and January 6, 2019 was performed in order to better constrain the intrusive mechanism feeding the eruption itself. A total of 400 seismic events with Ml$\geq$1.5 were used as data source for this study. Specifically, we calculated 3D locations of the events, and we computed about 50 fault plane solutions (FPSs) of the most energetic events (Ml$\geq$2.7).
Seismic data strongly support the hypothesis that the repeated activation of fault systems in different sectors of the volcano may be considered as a response to accommodate deformations induced by the injection of volumes of magma approximately located in the southern rim of the Valle del Bove.