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Modeling of the Dec 24, 2018 eruptive intrusion at Etna volcano by data of multi-disciplinary continuous deformation networks (CGPS, borehole strainmeters and tiltmeters)

Marco Aloisi, **Alessandro Bonaccorso**, Flavio Cannavò, Gilda Currenti, and Salvatore Gambino
INGV - Istituto Nazionale di Geofisica e Vulcanologia , Italy (alessandro.bonaccorso@ingv.it)

In the previous EGU 2019 we presented the different data acquired by the multi-disciplinary deformation networks during the eruption of Etna on 24 December 2018, when the volcano was suddenly penetrated by a violent dyke intrusion. An eruptive fissure opened and continued to propagate southward for more than 10 hours. The situation created the fear of possible serious consequences of feeding a lava flow even at medium-low altitudes, therefore potentially hazardous for the villages and infrastructures located there. However, the propagation stopped and lava flows finished on 25 December.

In this updated study we present the effort made to model the complex eruptive process characterized by two attempts of intrusion. We inferred a first dyke starting from the sea level depth with an increasing of its dimension in the shallower part. Successively and until the early hours of 25 December, we revealed a second attempt of intrusion characterized by a dyke with a powerful opening with respect to the first dyke but that, fortunately, did not reach the free surface. We describe how different types of continuous deformation data provide complementary information on the ongoing process allowing us to model the fast intrusive process. In particular, the high-precision borehole instruments (strainmeters and tiltmeters) provided a robust early warning; the displacement field measured by high-rate GPS allowed obtaining an early but also reliable model of the source. Finally, the integration of all the continuous data constrained a more detailed and complete model and its time evolution able to represent the complex process leading to this flank eruption.