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Real-time estimation of distributed volcanic source for the 3 December 2015 eruption on Mt. Etna

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On the early hours of 3 December 2015 Mt Etna (Italy) abruptly showed intense strombolian activity rapidly increased into violent lava fountains, reaching more than 1 km in height over the volcano with an accompanying ash plume that topped 3 kilometers above the summit. The short but very violent paroxysm was over in only 60 minutes reaching the peak phase between 02:20 - 03:20 UTC. As for past eruptions (Cannavò et al., 2015), an open challenge is to localize and track in real-time the evolution of the magma source beneath the volcano. In this work we apply a recent methodology (Camacho et al., 2011) to rapidly estimate the magmatic source from surface geodetic data and track its evolution in time without any a priori assumption about source geometry. To this aim the high-rate GPS data, coming from the continuous GPS network deployed on Mt. Etna, are processed in real-time to obtain sub-daily solutions, then the obtained time series are filtered to reduce the noise, and subsequently they are fed to the inversion algorithm for source estimations. Here, we present the processing scheme and the achieved results, highlighting the pros and cons of the adopted approach.

Camacho, A. G., González, P. J., Fernández, J. & Berrino, G. (2011) Simultaneous inversion of surface deformation and gravity changes by means of extended bodies with a free geometry: Application to deforming calderas. J. Geophys. Res. 116.

Cannavò F., Camacho A.G., González P.J., Mattia M., Puglisi G., Fernández J. (2015) Real Time Tracking of Magmatic Intrusions by means of Ground Deformation Modeling during Volcanic Crises, Scientific Reports, 5 (10970) doi:10.1038/srep10970