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Source mechanisms of caldera earthquakes during the 2018 eruption of Sierra Negra, Galápagos: Insights from near-field and far-field displacement

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The Sierra Negra volcano, one of the most active volcanoes of the Galápagos islands in Ecuador, and one of the world's most actively deforming volcanoes, has erupted seven times in the past 70 years. In response to escalating seismic activity and caldera inflation, the IGUANA (Investigating Geophysical Unrest at Sierra Negra) array of 14 seismometers were deployed around the volcano in April 2018. The eruption commenced on 26 June 2018, 10 hours after a M5.3 earthquake, and lasted 57 days, with eruptive fissures opening on the northern rim and northwestern flank. We use seismic data from the temporary local array (14 stations) and nearby Ecuador (Instituto Geofisico de la Escuela Politecnica Nacional) and Global Seismographic Network permanent seismic stations (7 stations) to analyze the source mechanisms of M > 4 pre-eruptive and co-eruptive earthquakes from first-motion wave arrivals. Because of the shallow seismic sources (<2 km) and source-receiver distances ranging from ∼1 to 100 km, 12 of which are <10 km, the classical method for estimating fault-plane solutions (FPS), based on the far-field first arrivals, may not be well-suited for the estimation of source mechanisms. Hence we model and investigate near-, intermediate-, and far-field polarizations. The velocity model used for locating events was obtained from the local seismic database of the SIGNET (Sierra Negra Integrated Geophysical Network) seismic array deployed in the same region in 2009-2011. Our preliminary results show high sensitivity of the FPS to the inclusion of the near- and intermediate-field terms, thus emphasizing the necessity of the modelling of the complete seismic wavefield in the case of a wide range of hypocentral distances. The source mechanism solutions are interpreted in light of the eruption, concurrent cGPS findings, and past regional CMTs.