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Different mechanisms of the pre- and co-eruptive tremor during the 2018 eruption at Sierra Negra volcano, Galapagos

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Volcanic tremor are persistent seismic signals observed near active volcanoes. They are often associated with eruptions, although the exact relationships are not well constrained. To gain a better insight into the generation mechanisms of volcanic tremor, we study tremor that occurred during the 2018 eruption at Sierra Negra volcano, Galapagos. Located 1000 km west of continental Ecuador, Sierra Negra is a shield volcano with a large summit caldera and is one of the most active volcanoes in the Galapagos archipelago. The 2018 eruption started at about 19:55 UTC on 26th June and lasted about two months. Two tremor phases with very different frequency characteristics are identified before and after the eruption onset. The pre-eruptive phase is characterized by a narrow frequency band (2.5 – 4 Hz) and the co-eruptive phase has a broad frequency band (1 – 15 Hz). Location of the two phases by a seismic amplitude ratio method suggests that they are likely to be generated by different physical processes. The pre-eruptive phase is likely generated by dike opening while the co-eruptive phase is associated with lava flow. This interpretation is consistent with a time-lapse P-wave velocity structure of the volcano imaged by local-earthquake travel-time tomography.