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Long-term variations in explosion dynamics at Santiaguito volcano

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Here we present two years of seismic and infrasound observations of ash-and-gas explosions recorded during an ongoing multi-disciplinary experiment at the Santiaguito lava dome complex, Guatemala. Due to the occurrence of regular explosive activity since the early 1970's, the volcano is an ideal laboratory for the study of the eruption dynamics of long-lived silicic eruptions. The instrument network, deployed between 0.5 and 7 km from the active vent, includes 5 broadband and 6 short-period seismometers, as well as 5 infrasound sensors. Seismo-acoustic data are complemented by thermal infrared imagery, visual observations from an unmanned aerial vehicle, and geochemical measurements of eruptive products.

In mid-2015, a major shift in activity took place at Santiaguito. Vulcanian explosions became more energetic and less regular, and were often accompanied by pyroclastic density currents. Important morphological changes were observed at the active El Caliente dome, as the lava-filled crater was excavated by a sequence of vigorous explosions to a depth of at least 150 m. Variations in the relative arrival times of seismic and infrasound signals suggest a significant deepening of the explosion initiation point inside the conduit. This shift in behaviour likely represents a change in the eruptive mechanism in the upper conduit beneath El Caliente, possibly triggered by disequilibrium at a greater depth in the volcanic system. Our observations suggest a reactivation of the deep magmatic system at Santiaguito, with little precursory activity. The results of this multi-parameteric monitoring experiment have specific implications for hazard assessment at Santiaguito, and contributes to understanding the processes that control changes in eruptive regime at lava dome volcanoes.