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Integrated, multi-parameter, investigation of eruptive dynamics at Santiaguito lava dome, Guatemala

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Understanding the nature of the signals generated at volcanoes is central to hazard mitigation efforts. Systematic identification and understanding of the processes responsible for the signals associated with volcanic activity are only possible when high-resolution data are available over relatively long periods of time. For this reason, in November 2014, the Liverpool Earth Observatory (LEO), UK, in collaboration with colleagues of the Instituto Nacional de Sismologia, Meteorologia e Hidrologia (INSIVUMEH), Guatemala, installed a large multi-parameter geophysical monitoring network at Santiaguito – the most active volcano in Guatemala. The network, which is to date the largest temporary deployment on Santiaguito, includes nine three-component broadband seismometers, three tiltmeters, and five infrasound microphones. Further, during the initial installation campaign we conducted visual and thermal infrared measurements of surface explosive activity and collected numerous rock samples for geochemical, geophysical and rheological characterisation.

Activity at Santiaguito began in 1922, with the extrusion of a series of lava domes. In recent years, persistent dome extrusion has yielded spectacularly episodic piston-like motion displayed by characteristic tilt/seismic patterns (Johnson et al, 2014). This cyclicity episodically concludes with gas emissions or gas-and-ash explosions, observed to progress along a complex fault system in the dome. The explosive activity is associated with distinct geophysical signals characterised by the presence of very-long period earthquakes as well as more rapid inflation/deflation cycles; the erupted ash further evidences partial melting and thermal vesiculation resulting from fault processes (Lavallée et al., 2015). One year of data demonstrates the regularity of the periodicity and intensity of the explosions; analysis of infrasound data suggests that each explosion expulses on the order of 10,000-100,000 kg of gas and ash. We conclude that near-field monitoring of this volcanic system promises to greatly advance our understanding of shallow volcanic processes.

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Reference

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