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A kilohertz approach to Strombolian-style eruptions

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Accessible volcanoes characterized by persistent, relatively mild Strombolian-style explosive activity have historically hosted multidisciplinary studies of eruptions. These studies, focused on geophysical signals preceding, accompanying, and following the eruptions, have provided key insights on the physical processes driving the eruptions. However, the dynamic development of the single explosions that characterize this style of activity remained somewhat elusive, due to the timescales involved (order of 0.001 seconds). Recent technological advances now allow recording and synchronizing different data sources on time scales relevant to the short timescales involved in the explosions. In the last several years we developed and implemented a field setup that integrates visual and thermal imaging with acoustic and seismic recordings, all synchronized and acquired at timescales of 100-10000 Hz. This setup has been developed at several active volcanoes.
On the one hand, the combination of these different techniques provides unique information on the dynamics and energetics of the explosions, including the parameterization of individual ejection pulses within the explosions, the ejection and emplacement of pyroclasts and their coupling-decoupling with the gas phases, the different stages of development of the eruption jets, and their reflection in the associated acoustic and seismic signals. On the other hand, the gained information provides foundation for better understanding and interpreting the signals acquired, at lower sampling rates but routinely, from volcano monitoring networks. Perhaps even more important, our approach allows parameterizing differences and commonalities in the explosions from different volcanoes and settings.