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One for all and all for one: The visual, thermal, geochemical, acoustic, and seismic signature of a single Strombolian explosion.

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Technological advancements in volcano observation parallels multiparametric studies to understand and monitor eruptive processes. However, data collection, comparison, and cross-validation between new and different techniques is seldom straightforward. Here we present the results of a rare combination of state-of-the-art volcanological observations on the same eruption, namely, one Strombolian explosion occurred at Stromboli volcano in 2013.
During a limited period of time in May 2013 the volcano hosted several different instruments, including: one high-speed camera, filming the explosions in the visible and near-infrared spectral regions at 500 frames per second (fps); one FLIR camera, filming in the thermal infrared at 50 to 200 fps; a dual UV camera system filming at 16 fps; two microphones recording from the infrasonic to the audible range; and one broadband, vertical component seismometer, both the microphones and the seismometer being acquired at 2 kHz frequency in synch with the high-speed and thermal videos. The information from this temporal deployment was complemented by that from part of the permanent monitoring system, including an infrasonic array, broad-band seismometers, and ground tiltmeters. Instrument synchronization was either via datalogger, via GPS timing, or, in lack of the above, visual, after field of view overlapping by tie points. After screening weather and volcanic activity conditions, our attention focused on one single Strombolian explosion characterized by decent visibility and a very characteristic double-burst feature clearly identified by all instruments. The selected explosion consists in the ejection of molten, bomb- to lapilli-sized pyroclasts without a significant ash component.
Besides allowing a comparison of the response of the instruments, the cross-correlation of the different time-series enlighten the dynamics of both gas liberation and magma fragmentation/pyroclast acceleration during the selected, complex explosion. Our integrate approach also provides a unique chance to estimate the different components of the energy dissipation, addressing the overall energy partition of a Strombolian explosion. Finally, comparison with routinely acquired monitoring data potentially allows framing the insights gained from a single explosion into a more general perspective.