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# Mind the gap: refined acoustic characterisation of explosions at Stromboli volcano using drone-deployed sensors and near-field arrays

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Explosive volcanic eruptions are comparably short-lived events with potentially catastrophic consequences and long-term impact. The paroxysmal eruption at Stromboli volcano, Italy, on 3 July 2019 has shown that sudden shifts in eruptive activity can to date not be forecasted. This shortcoming impedes adequate volcanic hazard assessment.

In an attempt to increase our mechanistic understanding of the physical processes related to explosive activity, we have registered acoustic and pressure signals with 2 sets of different sensors: 1. Drone-deployed, custom-made sensors in the direct vicinity of the eruptive vents as well as next to a temporarily installed infrasound array; 2. Permanently installed infrasound array. The drone-deployed sensors recorded temperature, humidity, electric potential, pressure, and sound. As most eruptions took place from the SW and central vents, the temporarily deployed infrasound sensors were positioned on the Fortini ridge (150-250 m distance). The permanent infrasound array is located at Roccette at approx. 550 m distance.

The displayed explosive activity ranged in intensity, duration, and ash content. Close observations allowed for a complete correlation of time, duration, and source vent of >100 explosions. Selected Strombolian explosions were analysed for the distance-dependent acoustic and pressure signals to allow for 1) revealing the radial dissipation of signals from explosive eruptions, 2) better constraining conduit conditions (depth, open/closed), and 3) correlating these features to different types of explosive events. We find substantial differences in the values recorded for a single explosive event as a function of distance from the vent and pyroclast content. Laboratory experiments with instantaneous gas-particle jets at known source and path conditions allow for empirical relationships of source and path conditions, ash content and monitoring signal. Enhanced understanding of the spatial shift of the acoustic signal produced by explosive eruptions will increase the reliability of volcano monitoring based on long(er) distance measurements.

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