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Explosion volume flux comparison using seismically derived tilt, infrasound, and gas data at Stromboli Volcano, Italy

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Basaltic volcanoes are characterized by low-level explosions and lava fountaining, but are capable of violent subplinian to plinian eruptions. Stromboli Volcano has been observed with seismometers and tiltmeters to deform prior to explosion [Genco and Ripepe, 2010]. Quantitatively linking this precursory deformation, often interpreted as inflation due to an influx of magma and gas, with the volume of subsequent erupted material (gas and tephra) will be helpful for understanding eruption dynamics and in hazard mitigation, as we can better constrain expected volatile output from monitored volume input.

To these aims, we temporarily deployed 7 seismometers, 7 infrasonic microphones, an FTIR, FLIR, gravimeter, and MultiGAS at Stromboli Volcano, Italy in May 2018. We use these data in combination with data from permanently installed seismometers, infrasound sensors, tiltmeters, and a UV camera to examine the volatile budget of Stromboli by comparing shallow volume input derived from broadband, tilt-affected seismic and tilt data with volume output from infrasound and gas data. First, we characterize and locate the seismically-derived tilt source using a nonlinear moment tensor inversion method [Tape and Tape, 2012; Waite and Lanza, 2016] and use the result to quantify the volatile volume input. Initial inversion results place the tilt-affected source ∼300 m below the active craters. We will attempt to characterize the input volume density using gravity data. Independently, we characterize and locate the infrasonic explosion source and quantify the output volume using an infrasonic waveform inversion technique that accounts for the influence of topography by computing numerical Green's functions by way of a 3-D finite difference time domain method [Kim et al., 2015]. The seismically estimated volume input and infrasonically estimated volume output will then be validated with volume output estimated from gas observations. This quantitative examination of tilt, infrasound and gas data aims to advance our ability to determine the size of eruption prior to its occurrence.