Geophysical Research Abstracts
Vol. 18, EGU2016-15523, 2016
EGU General Assembly 2016

Eruptive Source Parameters from Near-Source Gravity Waves Induced by Large Vulcanian eruptions

Giulia Barfucci (1), Maurizio Ripepe (1), Silvio De Angelis (2), Giorgio Lacanna (1), and Emanuele Marchetti (1)

(1) Department of Earth Sciences, University of Firenze, Firenze, Italy , (2) Department of Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool, UK

The sudden ejection of hot material from volcanic vent perturbs the atmosphere generating a broad spectrum of pressure oscillations from acoustic infrasound (<10 Hz) to gravity waves (<0.03 Hz). However observations of gravity waves excited by volcanic eruptions are still rare, mostly limited to large sub-plinian eruptions and frequently at large distance from the source (>100 km).
Atmospheric Gravity waves are induced by perturbations of the hydrostatic equilibrium of the atmosphere and propagate within a medium with internal density stratification. They are initiated by mechanisms that cause the atmosphere to be displaced as for the injection of volcanic ash plume during an eruption. We use gravity waves to infer eruptive source parameters, such as mass eruption rate (MER) and duration of the eruption, which may be used as inputs in the volcanic ash transport and dispersion models.
We present the analysis of near-field observations (<7 km) of atmospheric gravity waves, with frequencies of 0.97 and 1.15 mHz, recorded by a pressure sensors network during two explosions in July and December 2008 at Soufrière Hills Volcano, Montserrat. We show that gravity waves at Soufrière Hills Volcano originate above the volcanic dome and propagate with an apparent horizontal velocities of 8-10 m/s. Assuming a single mass injection point source model, we constrain the source location at $\sim$3.5 km a.s.l., above the vent, duration of the gas thrust < 140 s and MERs of 2.6 and 5.4 x10E7 kg/s, for the two eruptive events. Source duration and MER derived by modeling Gravity Waves are fully compatible with others independent estimates from field observations.
Our work strongly supports the use of gravity waves to model eruption source parameters and can have a strong impact on our ability to monitor volcanic eruption at a large distance and may have future application in assessing the relative magnitude of volcanic explosions.