Geophysical Research Abstracts
Vol. 15, EGU2013-10097, 2013
EGU General Assembly 2013

Volcanic ground deformation due to surface loading of erupted material on Montserrat

Henry Odbert (1), Benoit Taisne (2), and Steve Tait (3)

(1) University of Bristol, UK, (2) Earth Observatory of Singapore, Singapore., (3) Institut de Physique du Globe de Paris, France.

Co-eruptive volcano ground deformation is often interpreted in terms of pressure changes at depth in the magmatic system (e.g. magma reservoirs). Measured surface displacements are typically compared to numerical models to estimate the elastic response of the crust to such pressurisation. Model inversion techniques are routinely used to infer the size, shape and volume or pressure change of pressure sources using these kinds of models. A 'best fit' solution is obtained by minimising the misfit between the modelled and observed ground displacements. This allows the system parameters of interest to be constrained. Such approaches require a number of simplifying assumptions and typically neglect the influence of complicating factors, such as compressibility of magma in the system and the crustal response to surface loading of erupted material (i.e. lava domes, pyroclastic density current deposits, etc.). Here, we explore the effects of loading by deposits erupted and emplaced on the volcano's flanks

Since 1995 the Soufrière Hills Volcano, Montserrat, has erupted over a cubic kilometre of lava. Much of this material has moved offshore but there remains a substantial subaerial and submarine deposit around the volcano's flank. We measure the distribution of deposits around the flanks of the volcano using recent topographic survey data and derive a surface load estimate assuming typical density estimates. We use finite element modelling to estimate the elastic crustal response of the deposit load across Montserrat, in terms of expected associated ground deformation. We explore the the sensitivity of loading-derived deformation to the model's elastic parameters for a range of plausible configurations. Results are compared to long-term deformation time series data recorded using continuous GPS throughout the eruption. We discuss the extent to which loading has contributed to observed ground deformation and how inversion modelling of magma reservoirs may be affected if surface loading is neglected.