



Constraints on the mid-crustal magma chamber of Soufrière Hills Volcano, Montserrat (W.I.), derived from cGPS data analysis

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The analysis and modelling of deformation data from active volcanic regions can provide vital information on the internal structure of a volcano and the dynamics of its magmatic system. We here present cGPS data that were recorded at Soufrière Hills Volcano, Montserrat (W.I.), during two major deformation periods including the 2003-2005 interval of ground inflation and the 2005-2007 period of ground deflation. The data are analysed using a Finite Element approach, accounting for crustal heterogeneity, surface topography, and a range of source geometries (spherical and oblate/prolate sources with differing eccentricities). Accounting for a variable crustal rigidity with depth as deduced by seismic analysis beneath Montserrat, we find the data to be best explained by pressurization and depressurization of a slightly prolate mid-crustal magma chamber that is centered between 11.5 - 13 km below sea level, about 640 m NE of the active vent. Considering source dimension and source pressure changes, we demonstrate that magma compressibility and visco-elasticity of host rocks considerably affect dynamics in the mid-crustal magmatic system of Soufrière Hills Volcano and need to be accounted for as first-order effects in geodetic data analysis and modelling.