EGU21-7517
https://doi.org/10.5194/egusphere-egu21-7517
EGU General Assembly 2021

Modelling the Soufrière Hills Volcano; Investigating the Montserrat magmatic system with co-analysis of EDM and GPS data

Alexander Johnson[1], James Hickey[1], Karen Pascal[2,3], Ben Williamson[1], and Racquel Syers[2]
[1]University of Exeter, Camborne School of Mines, United Kingdom of Great Britain – England, Scotland, Wales (aj401@exeter.ac.uk)
[2]Montserrat Volcano Observatory, Montserrat
[3]Seismic Research Centre, University of the West Indies, St. Augustine, Trinidad and Tobago

Ground deformation offers vital insight into the activity of volcanoes, as well as the characteristics of the magmatic systems that feed them. The extended eruption of the Soufrière Hills Volcano (SHV) has allowed for the development of a comprehensive multi-disciplinary monitoring network, which has aided extensive research into the magmatic system underlying the volcano. The modern network comprises GPS, strainmeters, and cheaper Electronic Distance Measurement (EDM). However, the island's EDM network has to date only being used for monitoring the SHV. Here, for the first time, we co-analyse the EDM dataset from 2010-19 with the GPS data from the same period. This study aims to delineate the modern magmatic system conditions by building 3D Finite Element Models, as well as assessing the best use of EDM data in modelling the SHV.

The island-wide deformation recorded over the past decade at the GPS network is broadly radial relative to the SHV dome, with a decreasing deformation rate. The EDM data shows line lengthening on the west and east flanks of the volcano, but minor line length shortening on the northern flank. We utilise Finite Element Modelling to model the SHV magmatic system as a single elongated prolate with 3D topography incorporated. We systematically test a wide range of parameters to explore how both EDM and GPS record perturbations to the magmatic system. Our preliminary results show that variations of certain parameters to the deeper magmatic system have an impact on both EDM and GPS timeseries, while some parameters (e.g., source pressure, source depth, and source location) have a more significant effect on EDM measurements than others (e.g., source shape).