



A set of alternative explanations to account for the deformation field at Montserrat, West Indies

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For almost 20 years, Soufrière Hills Volcano, Montserrat, has been in a state of volcanic unrest. Intermittent periods of dome building have been punctuated by explosive eruptions and dome collapse events, endangering the lives of the inhabitants of the island. To date, there have been numerous phases to the activity, with the current activity designated Pause 5. There has not been any active magma extrusion since February 2010, and the last significant explosive (ash-venting) event occurred in March 2012. However, the volcano continues to emit an average of 374t/d SO₂ and shows signs of deformation.

Current observations indicate a line lengthening between several pairs of GPS stations across the island, suggesting an overall inflation of Montserrat. Through the use of three-dimensional numerical modelling using a finite element method, we explore the potential sources of this deformation, ranging from an inflating magma chamber or dyke - suggesting ongoing volcanic activity, to the existence of an active left-lateral strike-slip fault - which may indicate cessation of volcanic activity.

We show the effect of different dyke sources (shapes, characters and depths) on the surface displacement. Furthermore, through the inclusion of topographic data, we investigate how the topography may affect the displacement pattern at the surface.

Alternatively, we determine how much fault slip would be required in order to derive the deformation observed.