Asymmetrical deformation of the Piton de la Fournaise (Réunion Island) summit cone *Poster*

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Piton de la Fournaise (Réunion Island) is an active basaltic shield volcano in the south-western part of the Indian Ocean. The activity consists essentially of lava being issued from two rift zones close to the summit cone. The summit cone has been monitored since 1980 by the OVPF (Volcanological Observatory of Piton de la Fournaise). Geodetic data and radar interferometry show a systematic asymmetric pattern of deformation associated with all the N–S trending eruptive fissures (Briole et al. 1998, Sigmundsson et al. 1999).

The asymmetric deformation has been interpreted in various ways. The two main models proposed are (1) eastward dip of the dykes, based on inversion of data provided by radar interferometry (Sigmundsson et al 1999), and (2) the existence of a free boundary in the east part of the volcano. The second model allows the accommodation of dykes by eastward displacements, whilst the western part of the volcano is supported by the existing Piton des Neiges (Lénat et al., 1989). However, no displacements occur along the eastern coastline of Piton de la Fournaise. The only parts of the volcano affected by deformation are the rift zones and the summit cone. Moreover, geodetic data provided by the new real-time GPS network show that there is an asymmetric deformation of the summit cone prior to eruption (Staudacher 2005). The deformation itself seems to be related to pressure increase in the magma chamber. Absence of permanent displacements during periods of rest (such as 1992–1998) (Briole et al. 1998) support this link between magmatic pressure and deformation.

Here we complement previous deformation studies by the results of several numerical models that aim at understanding the internal processes resulting in deformation of the volcano. We investigate the influence of different parameters such as the topography and the lateral mechanical heterogeneity revealed by gravimetric data and seismic data. We are able to obtain an asymmetric deformation as resulting from (1) the asymmetric topography of the volcano, and (2) the existence of a pluton under the Plaine des Sables area. The asymmetric topography can explain the major part of the asymmetric deformation, whilst the existence of pluton beneath the Plaine des Sables area arrests the propagation of deformation in the western part of the volcano.

Our models explain the large features of the asymmetric deformation observed during eruptions at Piton de la Fournaise Volcano. Vertical and lateral heterogeneities are very important for understanding the deformation. In the case of Piton de la Fournaise Volcano, absence of deformation on the other parts of the volcano, especially the lower eastern part, whilst the upper part shows much deformation, implies that stresses concentrate primarily in the eastern flank.

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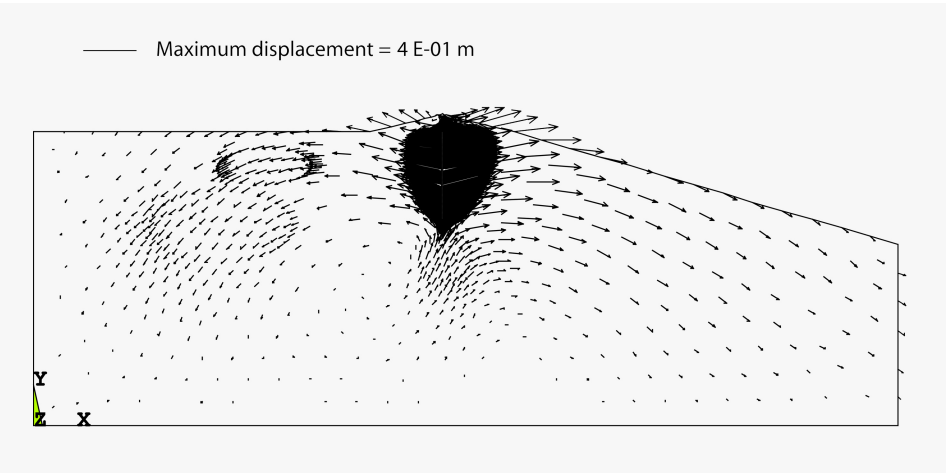

Figure 1: Numerical model showing the displacement triggered by the injection of an overpressured dyke (1 MPa) in the summit cone of an asymmetric volcano. Unit = 1 km

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