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Constraints on sources of pressure and magma flux from displacements data at Piton de La Fournaise during 2003

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During 2003, Piton de La Fournaise had known a period of strong activity with four eruptions (May, August, September, and December) and one intrusion (November) within eight months. During this period, the deformation networks of the Volcanological Observatory of Piton de la Fournaise recorded large deformations due to magmatic intrusions, and slight and continuous inflations in the summit area between each event, accompanied by a strong seismicity beneath the summit. The combination of the extensive set of deformation and seismicity signals recorded during this period allows us to provide new insights into the volcanic feeding system. We use a three-dimensional elastostatic boundary elements code, which calculate the deformation fields, to constrain with an inversion method the shape, and location of the pressure source at the origin of the displacements recorded between eruptions, but also to constrain the geometry and the dynamics of dyke propagations feeding the lateral eruption of August and September 2003. Field data combined with these models suggest that the four eruptions and the intrusion were triggered by a continuous over pressurization in a shallow magma chamber located above sea level under the Dolomieu crater and reveal a strong structural control in the lateral dyke emplacements.