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Toward real-time monitoring of dyke propagation from shallow low-amplitude seismicity at Piton de la Fournaise volcano.

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At shallow depth beneath Earth's surface, magmas propagate through cold host rocks that may be less dense than them. Inversion of buoyancy and/or solidification have strong impacts on the dynamics of propagation without any change of magma supply. Numerical and experimental studies are used to document how the ascent of the dyke tip is affected depending on several parameters including the input rate of magma. Calculation of dyke-induced stress perturbations indicates that most of the seismicity occurs in the vicinity of the dyke tip. The time evolution of the stress field and of the induced seismicity provides information on the control variables for dyke propagation. We have developed a simple method that allows the precise tracking of the dyke during a volcanic crisis. Correlations between the amplitudes of seismic events at different stations demonstrate that seismic events occur in a small number of discrete zones in response to dyke intrusion. This simple analysis can be used on many volcanoes. The presentation will be focussed on seismic crises that precede eruptions at Piton de la Fournaise volcano, Reunion Island.
This analysis may give in real time the information on the azimuth of propagation as well as on the input flux of magma within the dyke.