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# Analysis of five years of continuous GPS recording at Piton de La Fournaise (Réunion Island): evidences of two time scales of ground deformation

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A network of twelve permanent GPS stations has been implemented since 2004 at Piton de La Fournaise (hot spot basaltic volcano of La Réunion Island, Indian Ocean) to follow the ground deformation associated with its high eruptive activity. During the period covered by the continuous GPS recording, 12 eruptions occurred. The compilation of the data recorded between 2004 and 2008 allows us to define two time scales of ground deformation systematically associated with this eruptive activity:

(1) Large short-term displacements, reaching up to 14 mm/min, monitored a few min to hours prior each eruption during magma injections toward the surface (co-eruptive deformation);

(2) But also, small long-term ground displacements recorded during inter-eruptive periods. Between 2 weeks and 5 months before each eruption a slight summit inflation occurs (0.4-0.7 mm/day); whereas a post-eruptive summit deflation lasting 1 to 3 months is only recorded after the largest distal eruptions (0.3 - 1.3 mm/day).

These two time scales ground deformation precursors allowed us to forecast all eruptions up to five months in advance. And the follow up of the large short-term displacement in real-time allowed us to evaluated the approximate location of the eruptive fissure a few min to hours before its opening (i.e. inside the summit crater, northern flank or southern flank).

The large short-term ground displacements have been attributed to the dyke propagation toward the surface, whereas the long-term ground displacements, which were also recorded by the extensometer network since 2000, have been attributed to a continuous over pressurization of the shallow magma reservoir located at about 2300m depth. The continuous over-pressurization of the shallow magma reservoir would explain the high eruptive activity observed since 1998; 27 eruptions in 10 years.