Geophysical Research Abstracts
Vol. 16, EGU2014-7939, 2014
EGU General Assembly 2014

Dynamics of the 2007 Eruptions of Piton de la Fournaise and the Related Caldera Collapse from a Single Very Broad-band Seismic Station

Fabrice R. Fontaine (1,2), Geneviève Roult (2), Laurent Michon (1,2), Guilhem Barruol (1,2), Valérie Ferrazzini (2,3), Andrea Di Muro (2,3), Dominique Reymond (4), Aline Peltier (2,3), Thomas Staudacher (2,3)

(1) Laboratoire GéoSciences Réunion, Université de La Réunion, F-97715 Saint Denis, France. fabrice.fontaine@univ-reunion.fr, (2) Institut de Physique du Globe de Paris, Sorbonne Paris Cité, CNRS (UMR 7154), 1 rue Jussieu, 75238 Paris Cedex 05, France, (3) Observatoire volcanologique du Piton de la Fournaise, 14 RN3, 97418 La Plaine des Cafres, La Réunion, (4) CEA/DASE/Laboratoire de Géophysique, Commissariat à l'Energie Atomique, BP 640 98713 Papeete, Tahiti, French Polynesia

Seismic records from the RER very broad-band seismic station (La Réunion Island) belonging to the GEOSCOPE network are investigated to understand the eruptive succession (February to May) of Piton de la Fournaise and the caldera collapse episode of April 2007. Data first indicate that the short-lived, small volume, summit eruption of February 18 occurred during a phase of continuous inflation initiated in January 2007. Inflation decelerated around 2 weeks before a second short-lived small volume eruption on March 30-31 on the SE flank, almost simultaneous with a sudden, large deflation of the edifice. Deflation rate, which had stabilized at a relatively low level, increased anew on April 1 while no magma was emitted, followed on April 2 by a more distant and one of the most voluminous eruptions of the last two centuries at La Réunion Island. The RER station shows that very long period (VLP) and ultra long period (ULP) events developed during this period. Seven ULP events preceded the caldera collapse and 48 ones occurred during the caldera collapse over 9 days, most of which during the first 30 hours. A thorough examination of the seismic signals corrected for tide effects shows that each collapse event was coeval with VLP and ULP signals. Each individual collapse showed similar ULP and VLP signals characterized by periods of $\sim$ 500 s and $\sim$ 7 s, respectively. The back-azimuth of most ULP signals related to the caldera collapse points clearly toward the Dolomieu caldera. The strikingly constant duration of the VLP signals (around 20 s) related to the collapse events and their occurrence before the collapse initiation suggest a physical control of the volcanic edifice. Waveforms and spectrograms of the various caldera collapse events show very homogeneous patterns, suggesting a similar and repeating volcano-tectonic process for the formation of the VLP signals events. Although tilt may be responsible of part of the ULP signals observed during the collapse events, we show that it cannot explain most of the records. The ULP signals occurring during the collapse and also recorded by the OVPF GNSS (Global Navigation Satellite System) permanent network likely correspond to relaxation of the volcanic edifice. This analysis allows us to propose a scenario that may explain each successive collapse event as starting with a short-period event induced by the rock failure, followed by a VLP signal induced by dip-slip motion on the caldera ring fault, and ending with a ULP signal likely related to a relaxation process of the edifice.