InSAR characterization of lava flows at Piton de la Fournaise

Alexis Hrysiewicz*†[1], Jean-Luc Froger[1], Nicolas Villeneuve[2,3], Thierry Menand[1], Catherine Aaron[4], and Aline Peltier[3]

[1]Laboratoire Magmas et Volcans – Université Clermont Auvergne, Centre National de la Recherche Scientifique - CNRS : UMR6524, Institut de recherche pour le développement : UMR163 – Campus Universitaire des Cézeaux, 6 Avenue Blaise Pascal, 63178 Aubière Cedex, France

[2]Laboratoire GéoSciences Réunion – Université de La Réunion, Institut de Physique du Globe de Paris, Sorbonne Paris-Cité, UMR 7154 CNRS, 97715 Saint-Denis, France, Réunion

[3]Observatoire Volcanologique du Piton de la Fournaise (OVPF) – IPGP, 14 RN3-Km27, 97418, La Plaine des Cafres, La Réunion, France, Réunion

[4]Laboratoire de Mathématiques Blaise Pascal - Clermont Auvergne – Université Clermont Auvergne : UMR6620, Centre National de la Recherche Scientifique : UMR6620 – 24 avenue des Landais / 63177 Aubière Cedex, France

Abstract

At Piton de la Fournaise (La Réunion Island), the monitoring of ground displacements by InSAR is used to quantify evolutions of deep and superficial volcanic systems and to monitor the edifice over space and time. The observed ground displacements are caused by various processes sometimes difficult to discriminate. For example, it has been shown that the Eastern flank of the volcano is affected both by large wavelengths seaward sliding and by localized subsidence related to lava flow compactions and substratum flexure. Our study is a necessary step for a precise and global quantification of the displacements induced by the lava flows in order to separate them from the displacements related to the Eastern flank of the volcano.

First, we have characterized the lava flows emitted from 2010 to 2017, exploiting the InSAR product. Thanks to an acquisition before the lava emplacement and a second one during/after the eruption, the lava pixels have a bad InSAR coherence to compare to the mean coherence of the volcano. We propose to use the coherence to quantify the lava flow area. To achieve this task, we have developed an algorithm based on a statistical analysis of the pixel coherence that allows us to quantify the uncertainties on the lava flow location and area. Then we used those of the post-eruptive interferograms in order to characterize topographic changes related to the lava flow emplacement and then to obtain an estimate of the final lava flow volume and the Up-Down and East-West displacements.

The results that we present are on the July 2015, August 2015 and July 2017 eruptions at Piton de la Fournaise. These examples allow to have a precise quantification of the all displacements linked to the lava flow emplacements and are a first way to remove the lava contributions on the interferograms.

*Speaker

†Corresponding author: a.hrysiewicz@opgc.univ-bpclermont.fr