INSAR DISPLACEMENTS ASSOCIATED TO THE NOVEMBER 2006 NYAMULAGIRA ERUPTION

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1. INTRODUCTION

The basaltic shield volcano of Nyamulagira (Democratic Republic of the Congo), located in the western branch of the East African rift, is Africa's most active volcano with an average of an eruption every other year. With the neighbouring stratovolcano of Nyiragongo, it is one of the two active volcanoes of the Virunga Chain. Because of the region unstable political situation, this volcano is poorly monitored. However, the SAMAAV and GORISK projects ("Study and Monitoring of Active African Volcanoes by InSAR techniques" and “A multi-approach tool for the volcanic risk management of the Goma region (North Kivu)”) permits a regular space monitoring of the volcano displacements since 2005, completing the more sporadic monitoring that has been performed since 1996. In November 2006, an unusual eruption took place on the South Eastern Flank of Nyamulagira from a fissure located halfway between Nyamulagira and Nyiragongo. A lava flow was reported extending southward toward the inhabited areas of Lake Kivu and the main supply road for Goma.

2. INSAR DATA

Because of the political situation and the bad weather condition at the time of the eruption, no field data indicate the precise location of the eruptive fissure. This eruption was covered by interferograms from 4 different view angles, three were taken when the satellite was east of the volcano (the satellite was on a descending orbit) and one was take when the satellite was west of the volcano (the satellite was on an ascending orbit). Using SAR amplitude images, the location of the lava flow was estimated [1], allowing an approximate determination of the location of the eruptive fissures. Only the interferogram from the ascending orbits had spatial and temporal baseline conditions allowing to overcome the vegetation-induced coherence loss. This interferogram shows a signal over a 200 km² area East, North and South of the presumed eruptive fissure. On the other hand, the interferograms from ascending orbits only show displacements over a 25 km² area East and North of the fissures.

3. DATA ANALYSIS

The interferograms were analyzed using a method that combines a 3D numerical modelling for elastic medium with a near neighbourhood inversion algorithm [2, 3]. The numerical method [4] takes realistic topographies into account, as well as any number and shape of fault or pressure source. Boundary conditions are stresses, they are null on the ground surface and correspond to constant pressures for dikes and constant shear stress drops for faults. The near neighbourhood inversion method takes the noise characteristics of the data into account [2]. To evaluate the data fit, data were unwrapped and subsampled at circular gridded points and the 4 interferograms were simultaneously used in the inversion.

4. RESULTS

Preliminary results show that two sources are needed to explain the measured displacements. One of the sources corresponds to a dike located between Nyamulagira and Nyiragongo, which is aligned with the axis linking the two volcanoes. The other source, which is responsible for displacements measured North of Nyamulagira, still needs to be determined. As displacements created by both sources are close in space and time, these two sources should be determined simultaneously [5].

11. REFERENCES

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