Session 1.3: Volcanic surveillance by remote sensing

(Conveners: Simon Carn, Ignacio Galindo, Fred Prata)

Monitoring Nyamulagira and Nyiragongo volcanoes (R.D. Congo) using Tandem-X interferometry

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Experience in developing countries with remote and/or politically unstable regions affected by natural hazards showed that remote sensing is a key technique that can address various aspects of the study and assessment of these hazards. Thanks to its high resolution and high acquisition frequency, the Tandem-X mission, launched in June 2010 by the German Space Agency (DLR), provides tools to monitor and study crustal deformation produced by geodynamical processes like earthquakes, volcanoes or mass movement (landslides and erosion). Our study focuses on two highly active volcanoes, Nyiragongo and Nyamulagira, located in the Virunga Volcanic Province (VVP), Central Africa. Since 2005, our team has been involved in the detection and the study of one decade of eruptive activity in this volcanic province using interferometry radar (InSAR). The 2004, 2006 and 2010 eruptions of Nyamulagira and the 2002 eruption in Nyiragongo have been studied. These studies were carried out with C-band (ENVISAT, ERS1-2, RADARSAT) and L-band sensors (JERS, ALOS) radar data. Our work aims now at assessing the monitoring of the volcanic area with the use of radar X-band and especially from Tandem-X data set. Pairs of images acquired from successive orbit cycles are used for classical differential InSAR (dInSAR), provided that the temporal and perpendicular baselines are small enough to preserve the coherence. These deformation maps will be incorporated in our database and used to continue the time series of ground deformation. Moreover, an interesting characteristic of the Tandem-X mission is a bistatic mode, which provides two acquisitions of the same scene at the same time. We use these bistatic images, with no temporal decorrelation, to produce a high-resolution DEM (spatial resolution around 5 meters), which is 6 times more accurate than the available DEM of the area. This product will improve the decorrelation of topographic signal, which could facilitate the detection of ground deformation signal. On the other hand, this method of calculation provides an update of all topographic features associated to the recent volcanism such as landslides, volcanic cones, fissures or lava flows, and contribute to the production of a volcano-structural map of the area.