



The GNSS network at Piton de la Fournaise

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The Piton de la Fournaise volcano at La Réunion Island in the western Indian Ocean is amongst the most active volcanoes in the world with a mean over 2 centuries of one eruption every 9 month. Since 1998 up to 4 eruptions occurred per year. The volcanological observatory, which is a branch of the Institut de Physique du Globe de Paris, is in charge of the monitoring of the volcanic activity and the prediction of eruptions by means of several networks: deformation, seismicity and gas emission. We will focus here on the GNSS network.

The permanent GNSS network consist in 25 stations, 5 stations around the summit craters “Bory” and “Dolomieu”, 5 stations at the base of the central cone at about 2 km away from the summit, 6 stations on the eastern flank in the Grandes Pentes and Grand Brûlé area. Two stations are situated north and south outside of the Enclos Fouqué Caldera. Four basis stations are situated farther away outside of the caldera Fouqué at high and low elevation. Very first GPS measurements at Piton de la Fournaise were attempted since 1994 between Bory (BORG) and “Enclos Zéro” (ENCG). The present permanent network was built up since 2004; the central network, covering the volcanic cone was upgraded till 2006. Between end 2009 and early 2010 the eastern flank, which is difficult to access, was equipped in the frame of the “Undervolc program”. Data acquisition is usually done every 30 seconds, but can be incremented to 1Hz and even to 20 Hz for the most recent NetR9 receivers. Data files were transmitted by radio every day and evaluated. Presently we move the daily evaluation of the data from Winprism to Gamit, which shows in some cases more precise results, in particular when we compare stations at low and high elevation. The cinematic GPS network consist today in 78 sites, equipped with stainless steel rods cemented in the rock or fixed on metallic tripods. These sites are measured routinely one or two times per year, or more often in case of eruptions or particular events.

Finally 3 stations are situated on the 60 meter thick exceptional April 2007 lava flow and record the subsidence of the thick lava flow.

The GNSS data, and in particular the base line changes, which are much more precise than DGPS, indicate a general increase between several days and several weeks before each eruption. These increases correspond to an inflation of the massif and allow precise forecasting. It also shows a systematic change after the 2007 collapse of the Dolomieu crater. After eliminating quick deformations due to eruptive and pre-eruptive events, the base lines indicate a general increase (or inflation) of Piton de la Fournaise central cone before 2007, while after the summit collapse in 2007 the base lines changes indicates a still ongoing deflation of the massif.

More recent data from the Grandes Pentes and the Grand Brûlé area reveal a continuous shift of the east flank of Piton de la Fournaise to the east with a rate of up to 3 cm per year and a subsidence of up to 4 cm per year, most probably due to a large sill injected beneath the east flank end March 2007 just before the April eruption.