



Monthly bulletin of the Piton de la Fournaise Volcanological Observatory



A - Piton de la Fournaise activity

PITON DE LA FOURNAISE (VNUM #233020)
Latitude: 21.244°S
Longitude: 55.708°E
Summit elevation: 2632 m

Piton de la Fournaise is a hot spot basaltic volcano located in the southeast of La Réunion Island (Indian Ocean).

Piton de la Fournaise first erupted about 500 000 years ago. Its volcanic activity is characterized by frequent effusive eruptions (with emissions of lava fountains and lava flows) with mean of two eruptions per year since 1998. More rarely, explosive eruptions have occurred in the past (with blocks covering the summit area and ash emissions that can disperse over long distances) with a centennial recurrence rate.

Most of the current eruptive activity (97% during the last 300 years) occurred inside the Enclos Fouqué caldera, with the exception of a few eruptions that opened outside (1977, 1986, 1998 for the most recent ones).

Since end-1979, the Piton de la Fournaise activity is monitored by the Piton de la Fournaise Volcanological Observatory (Observatoire Volcanologique du Piton de la Fournaise - OVPF), from Institut de Physique du Globe de Paris (IPGP).

Volcano Alert level: VIGILANCE

(see table in annex)

Seismicity

In June 2018, the OVPF recorded on Piton de La Fournaise:

- 23 shallow volcano-tectonic earthquakes (0 to 2 km depth) below the summit craters;
- 2 deep earthquakes (>2 km depth) ;
- 336 rockfalls (inside the Cratère Dolomieu or along the cliff of the Enclos Fouqué caldera).

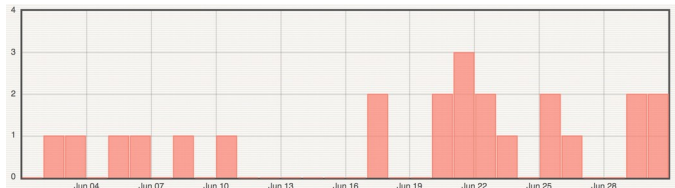


Figure 1: Daily number of the shallow volcano-tectonic earthquakes recorded below the summit craters in June 2018 (© OVPF-IPGP).

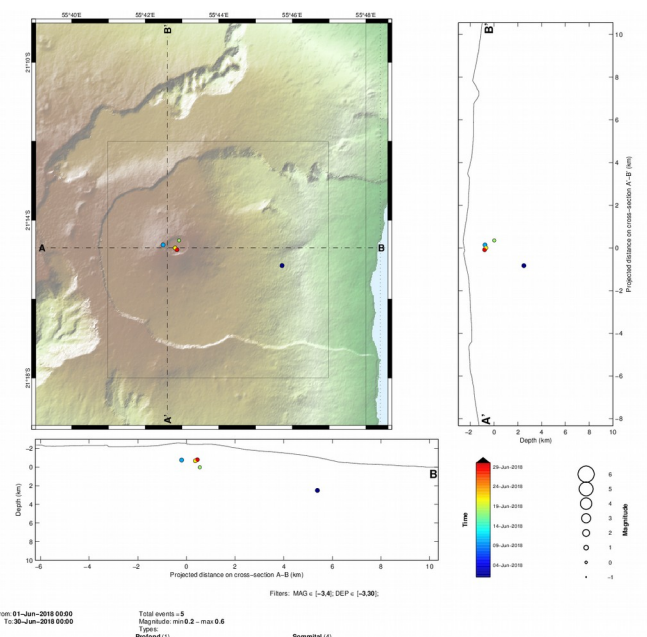


Figure 2: Location map (epicentre) and North-South and East-West cross-sections (hypocentre) of earthquakes recorded by the OVPF-IPGP.

OVPF-IPGP in June 2018 below Piton de la Fournaise. Only localizable earthquakes have been shown on the map. The observatory records seismic events not shown on this map because they are not localizable due to their low magnitude (© OVPF-IPGP).

Following the end of the eruption of April 27-June 1, 2018, the volcano-tectonic activity below the Piton de la Fournaise summit remained low (23 summit volcano-tectonic earthquakes and 2 deep earthquakes in one month, Figure 1).

Deformation

Following the end of the eruption of April 27-June 1, 2018, the OVPF deformation networks did not record any significant deformation in June 2018 (Figures 3 and 4).

* Glossary: The summit GPS signals evidence the influence of shallow pressure sources below the volcano, while distant GPS signals evidence the influence of deep pressure sources below the volcano. Inflation often means pressurization; and conversely deflation often means depressurization.

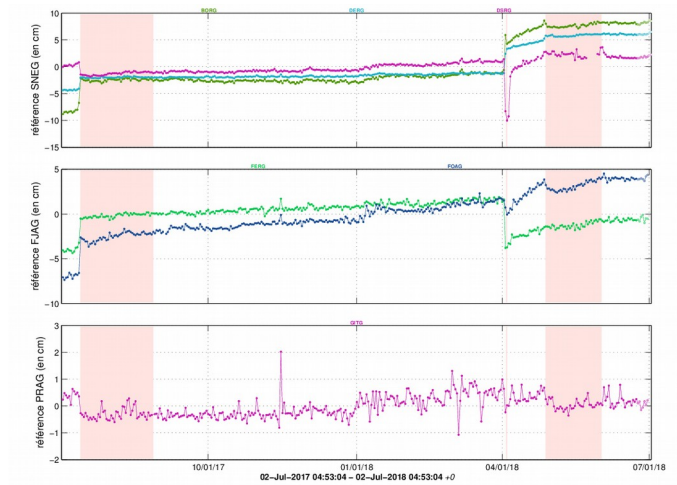


Figure 4: Illustration of the deformation over the last twelve months (Red shaded areas represent the eruptive periods of July 14-August 28, 2017, April 3, 2018 and April 27-June 1, 2018). The time series plot shows the distance changes between pairs of GNSS stations crossing the Dolomieu crater, the terminal cone and the Enclos Fouqué caldera, from the north to the south (see location in Figure 5). An increase and a decrease of the signal mean an elongation (volcano inflation) and a contraction (volcano deflation), respectively (© OVPF-IPGP).

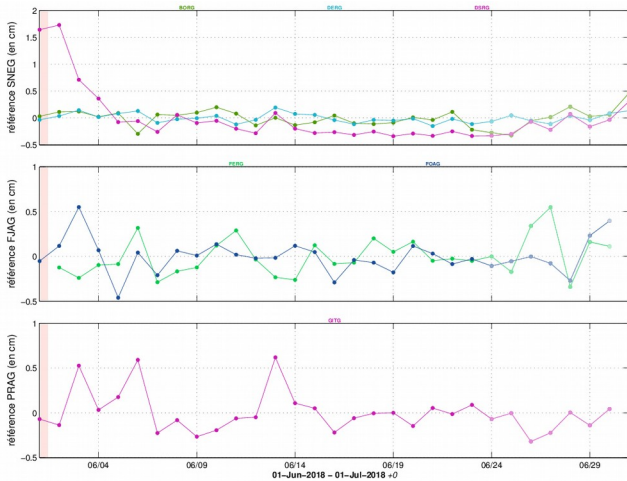


Figure 3: Illustration of the deformation in June 2018 (Red shaded areas represent the end of the April 27-June 1, 2018 eruption). The time series plot shows the distance changes between pairs of GNSS stations crossing the Dolomieu crater, the terminal cone and the Enclos Fouqué caldera, from the north to the south (see location in Figure 5). An increase and a decrease of the signal mean an elongation (volcano inflation) and a contraction (volcano deflation), respectively (© OVPF-IPGP).

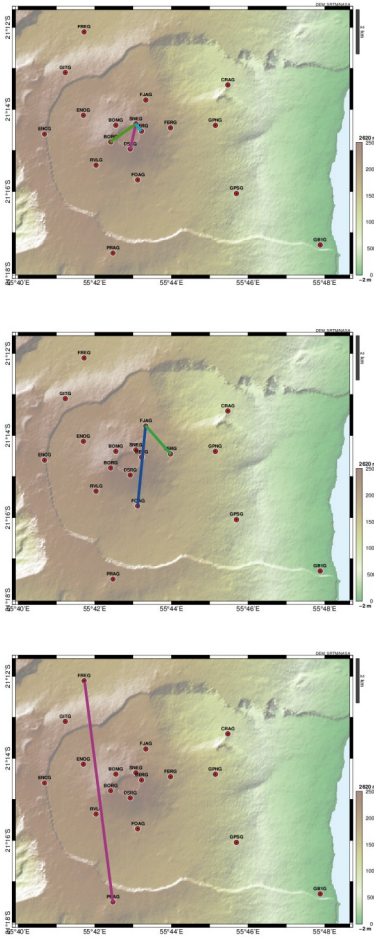


Figure 5: Location of baselines shown in Figures 3 and 4 (© OVPF-IPGP).

last twelve months (Red shaded areas represent the eruptive periods of July 14-August 28, 2017, April 3, 2018 and April 27-June 1, 2018) (© OVPF-IPGP).

* *Glossary:* CO₂ is the first gas to be released from deep magma (from the mantle), so its detection in the far field often means a deep rise of magma. Its near-field evolution may be related to magmatic transfer in the shallowest part of the feeding system (< 2-4 km below surface).

Summit fumaroles composition by MultiGas method

- SO₂ content: below the detection threshold;
 - H₂S content: low concentrations;
 Since June 10, 2018, a new increase of CO₂ is recorded in the background; but there is no evidence of emissions enriched in both CO₂ and SO₂.

* *Glossary:* The MultiGaS method allows to measure the concentrations of H₂O, H₂S, SO₂ and CO₂ in the atmosphere at the summit of the Piton de la Fournaise volcano. Magmatic transfer in the Piton de la Fournaise feeding system can result in an increase in SO₂ concentrations and a C / S ratio (carbon / sulfur).

SO₂ flux in the air by DOAS method

Below the detection threshold.

* *Glossary:* During rest periods, SO₂ flux at Piton de la Fournaise is below the detection threshold; SO₂ flux may increase during magma transfer in the shallowest part of the feeding system; during eruptions, it is directly proportional to the amount of lava emitted in surface.

Gas geochemistry

CO₂ concentration in the soil

- In the far field (Plaine des Cafres and Plaine des Palmistes sectors): CO₂ concentrations in the soil are stable at high values;
 - In the near field (« Gîte du volcan » sector): the CO₂ concentrations in the soil are stable at intermediate / low values.

Phenomenology

No eruptive activity reported in June 2018.

Summary

The month of June 2018 was marked by a low seismicity below the summit craters and a stop in the edifice inflation.

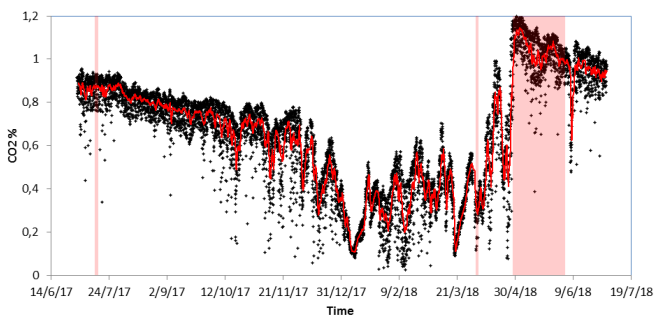


Figure 6: Concentration of CO₂ in the soil recorded on the Plaine des Cafres station, located at the observatory, over the

B -Seismic activity on La Réunion and in the Indian Ocean basin

Seismicity

In June 2018, the OVPF recorded:

- 53 local earthquakes (below the island, on the Piton des Neiges area, Figure 7 ;
- 38 regional earthquakes (in the Indian Ocean basin).

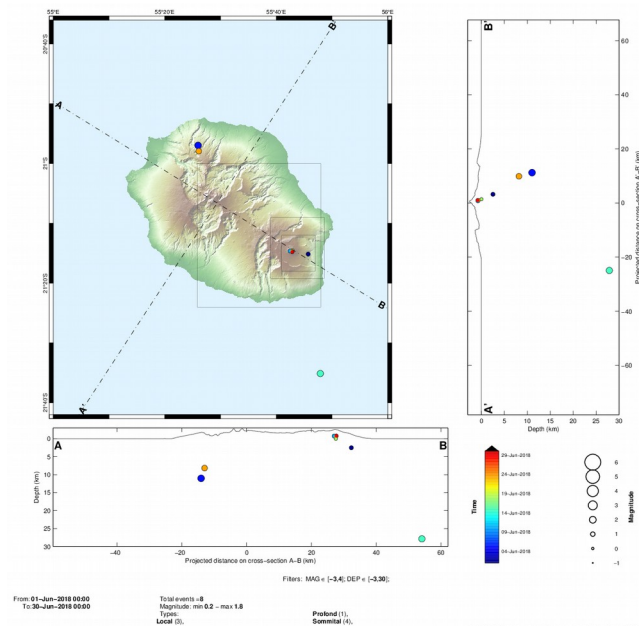


Figure 7: Location map (epicentre) and North-South and East-West cross-sections (hypocentre) of earthquakes recorded by OVPF-IPGP in June 2018 below La Réunion Island. Only localizable earthquakes have been shown on the map. The observatory records seismic events not shown on this map because they are not localizable due to their low magnitude (© OVPF-IPGP).

Seismic crisis in Mayotte

The 38 regional earthquakes recorded by the OVPF seismic network are related to the seismic crisis of Mayotte started on May 10, 2018 (about 50 km offshore, east of Mayotte), whose strongest earthquakes were recorded in La Réunion.

A strong seismic activity is recorded off shore the island of Mayotte since the beginning of May 2018. These earthquakes form a swarm located at sea 50 to 60km east of the coast of Mayotte. Majority of these earthquakes are of low magnitude, but several events of moderate magnitude (maximum 5.9) were felt by the population and damaged some buildings.

More information:

- Dedicated webpage on the IPGP website : <http://www.ipgp.fr/fr/essaim-simique-a-lest-de-mayotte-mai-juin-2018>
- BRGM website : www.brgm.fr/fr/essaim-simique-a-lest-de-mayotte-mai-juin-2018
- BCSF website : <http://www.franceseisme.fr/>
- “Préfecture de Mayotte” website : <http://www.mayotte.pref.gouv.fr/>
- http://www.brgm.fr/content/essaim-seismes-mayotte-faq-scientifique?pk_campaign=twitter&pk_kwd=2018-06_seismes-mayotte-faq

July, 2 2018
OVPF-IPGP Director

C - Annex

Definition of Volcanic Alert Levels for Piton de la Fournaise

from : *dispositif ORSEC974 - D.S « Volcan du Piton de la Fournaise »*

Emergency plan set up by the department responsible for the protection of the population in the event of unrest or activity of the Piton de la Fournaise

□ **“Vigilance”**: possible eruption in medium term (a few days or weeks) **or** presence of risks on the sector (rockfalls, increase of gas emissions, still hot lava flows...).

Access to the Enclos Fouqué caldera and to the summit volcano are allowed with restrictions.

□ **“Alert 1”**: probable or imminent.

Access to the Enclos Fouqué caldera and to the summit are closed and prohibited.

□ **“Alert 2”**: ongoing eruption.

Alert 2-1: ongoing eruption in the Dolomieu crater.

Alert 2-2: ongoing eruption inside the Enclos Fouqué caldera.

Alert 2-3: ongoing eruption outside the Enclos Fouqué caldera.

Access to the Enclos Fouqué caldera and to the summit are closed and prohibited.

□ **“Sauvegarde”**: end of eruption or eruption stabilized.

Evaluation of a partial reopening of the Enclos Fouqué caldera access.

Thank you to organizations, communities and associations for publicly posting this report for the widest dissemination.

All information on the Piton de la Fournaise activity can be found on the OVPF-IPGP website (<http://www.ipgp.fr/fr/ovpf/actualites-ovpf>) and twitter (<https://twitter.com/obsfournaise?lang=fr>).

The information in this document may not be used without explicit reference.
