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Observatoire volcanologique du Piton de la Fournaise

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

Piton de la Fournaise is a basaltic hot spot volcano located in the southeastern part of La Réunion Island (Indian Ocean). The volcano first erupted about 500,000 years ago. Its volcanic activity is characterized by frequent effusive eruptions (with emissions of lava fountains and lava flows) that occur on average twice a year since 1998. More rarely, larger explosive eruptions (with blocks covering the summit area and ash emissions that can disperse over long distances) have happened in the past with a centennial recurrence rate.
Most of the current eruptive activity (97% during the last 300 years) occurs from vents inside the Enclos Fouqué caldera. A few eruptions, however, have occurred from vents outside the caldera (most recently in 1977, 1986, and 1998). Such eruptions can potentially threaten communities that live in the surrounding areas.
Since late 1979, the activity of Piton de la Fournaise is monitored by the Piton de la Fournaise Volcanological Observatory (Observatoire Volcanologique du Piton de la Fournaise - OVPF), which belongs to the Institut de Physique du Globe de Paris (IPGP).

Since August 2023, no eruptions have been reported at Piton de la Fournaise. Periods of inactivity are common in the recent history of Piton de la Fournaise. Volcanic activity is not continuous, but fluctuates significantly over decades, with eruption cycles interrupted by several years without eruptions.

Alert level: No alert
(Since June 20, 2025)

(cf. table in the appendix)

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A. Piton de la Fournaise activity

Seismicity

The seismological network of the Piton de la Fournaise Volcanological Observatory consists of 41 seismological stations currently in operation, representing a total of 109 channels sampled at 100 Hz and transmitted in real time to the observatory. This network includes 32 three-component broadband stations, 2 three-component short-period stations and 7 analogue stations with one vertical component.
Earthquakes are located based on the arrival times of P and S waves, which are manually plotted in the SeisComP software (www.seiscomp.de) using automatic or visual detections. The earthquakes are then located using NonLinLoc software (Lomax et al., 2000), using a three-dimensional velocity model. This model takes into account a velocity gradient according to the topography and assumes a constant VP/VS ratio of 1.7. The P-wave velocity is 3.3 km/s at the free surface and increases linearly with depth at a gradient of 0.3 s^{-1}.

Observations

In September 2025, the OVPF-IPGP recorded at Piton de La Fournaise:

- 14 shallow volcano-tectonic earthquakes (0 to 2.5 km above sea level) below the summit craters;
- 2 deep earthquakes (below sea level);
- 2 long-period earthquakes;
- 63 rockfalls.

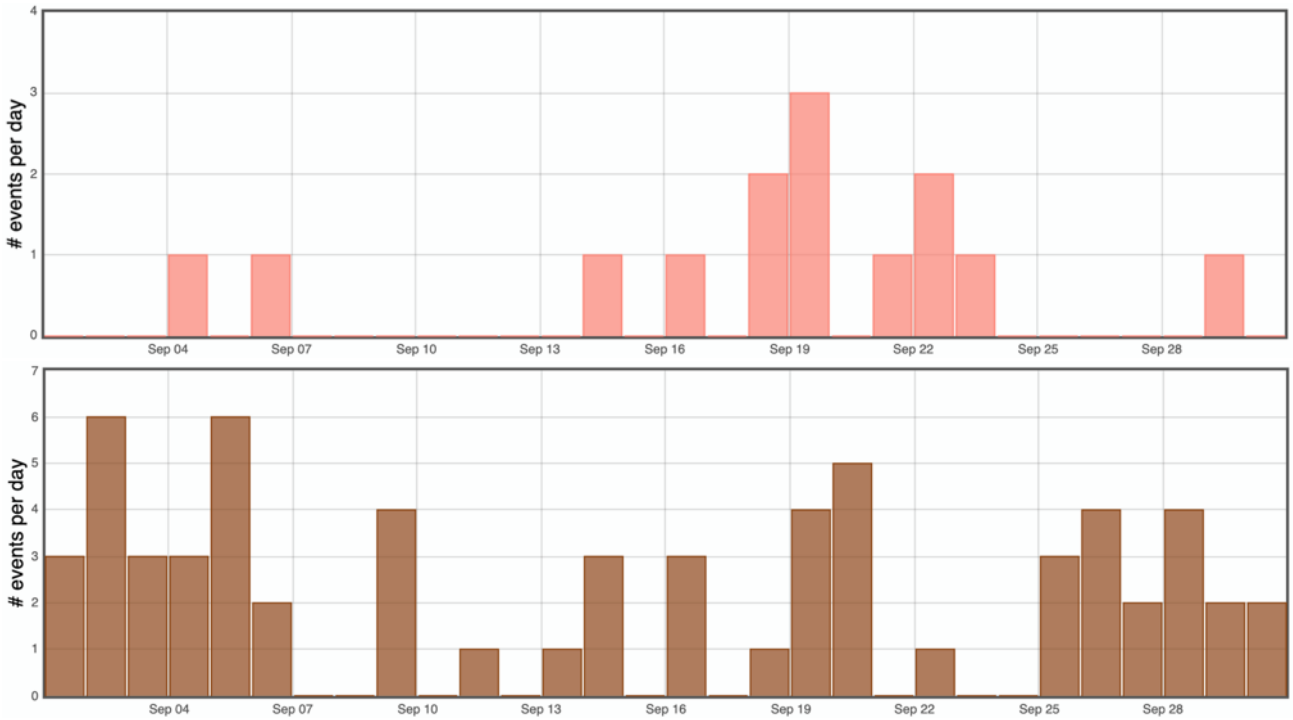

Figure 1: Number of (top) shallow volcano-tectonic earthquakes and (bottom) rockfalls per day recorded in September 2025 (© OVPF-IPGP).

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The seismic activity in September 2025 was low, with only 14 shallow volcano-tectonic earthquakes (Figure 1) and 2 deep earthquakes.

Only 4 shallow and 2 deep volcano-tectonic earthquakes could be located below the Dolomieu crater, and the eastern flank, respectively (Figure 2). The other ones – of lesser magnitude – could not be located.

Numerous rockfalls (63) also occurred inside the *Dolomieu* crater, along the cliffs of the *Enclos Fouqué* caldera and *Rivière de l'Est* (Figure 1).

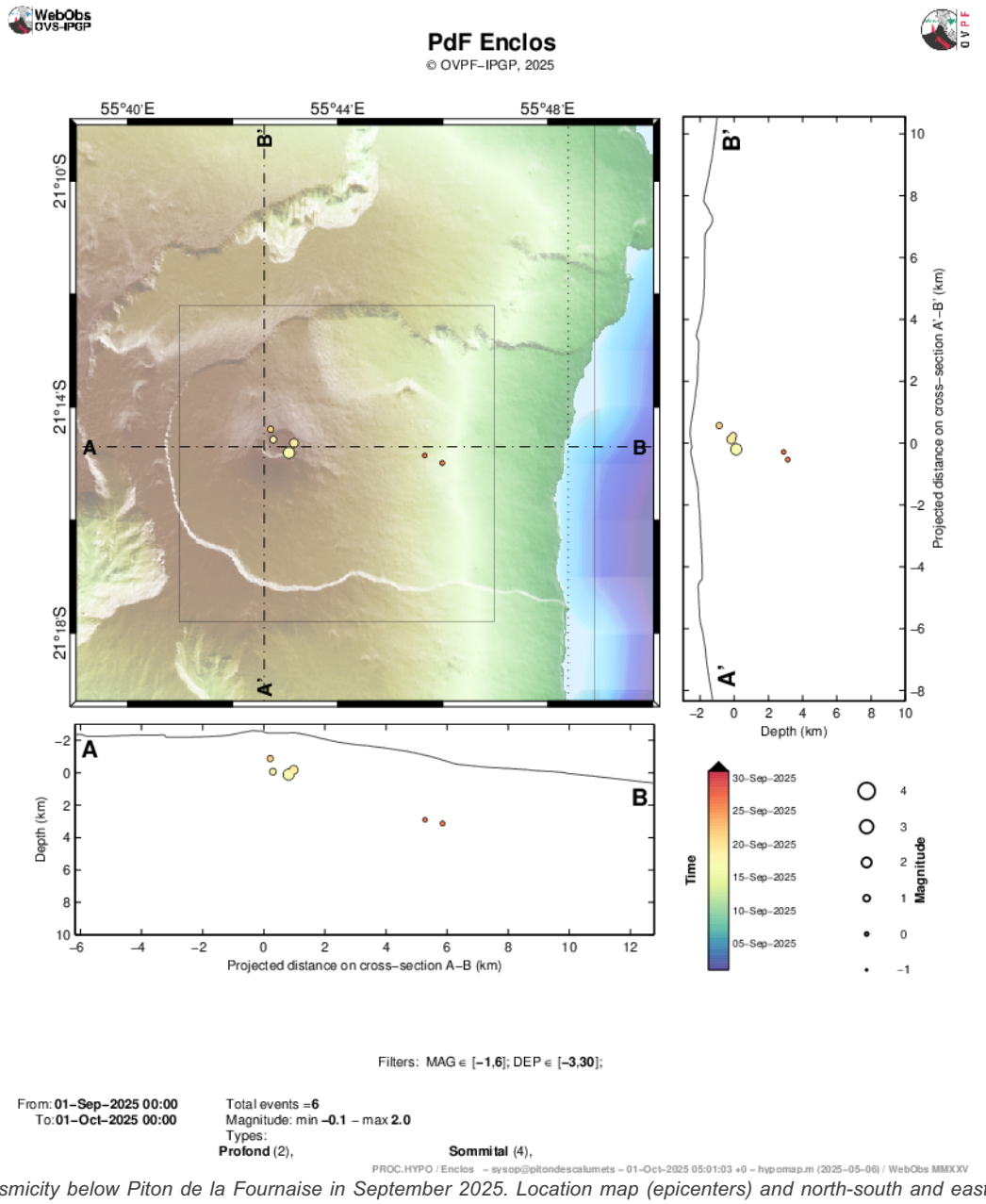

Figure 2: Seismicity below Piton de la Fournaise in September 2025. Location map (epicenters) and north-south and east-west cross-sections (hypocenters) of earthquakes as recorded by OVPF-IPGP. Only manually located earthquakes are shown on the map (© OVPF-IPGP).

Deformation

The permanent network for monitoring deformation at Piton de la Fournaise currently comprises:
- 27 GNSS (Global Navigation Satellite System) stations,
- 11 pairs of tiltmeters at 10 different sites,
- 3 three-component extensometers.
Once the data have been retrieved (every 15 min to every day depending on the stations), they are automatically processed by two software programs (GAMIT/GLOBK and GipsyX, which replaced Gipsy in mid-2019). The GAMIT/GLOBK (Herring et al., 2010) and GipsyX (Bertiger et al., 2020) calculation chains, which complement each other (GipsyX is faster and GAMIT/GLOBK is more accurate), run in parallel.
It should be noted that all GNSS time series were updated in June 2025. They consist of a homogeneous reprocessing of all GNSS data, now available in RINEX3 format for the most recent data (since the end of May 2025 and retrospectively from January, 1 2019). The calculation is performed using the GipsyX software in version 2.3 (Murphy et al., 2024). These calculations incorporate the new JPL products in ITRF2020 (Altamimi et al., 2023, Rebischung et al., 2024) released since August, 25 2024 and made available retrospectively from January, 1 2002 (Murphy et al., 2024). The calculated coordinates are expressed relative to the Figure Centre (FC). The Figure Centre/Centre of Mass (CM) dichotomy is a concept introduced by ITRF2020, and GipsyX 2.3 works by default in CM, so we chose to perform a CM > FC transformation, which is more suitable for projects in small areas.

Observations

After its resumption in February 2024, the edifice inflation stopped at the beginning of April 2024.

Since then, a slight deflation is recorded in the long-term, particularly well visible at the summit stations (Figures 3 et 4).

It should be noted that the two summit stations (DERG and DSRG) destroyed during *Cyclone Garance* on February 28, 2025, were reinstalled on September 24, 2025. The reinstallation of these two stations, which also serve as relays for the PVDG (south-east of the terminal cone) and PRAG (Puys Ramond) stations, enabled the recovery of data from these two stations.

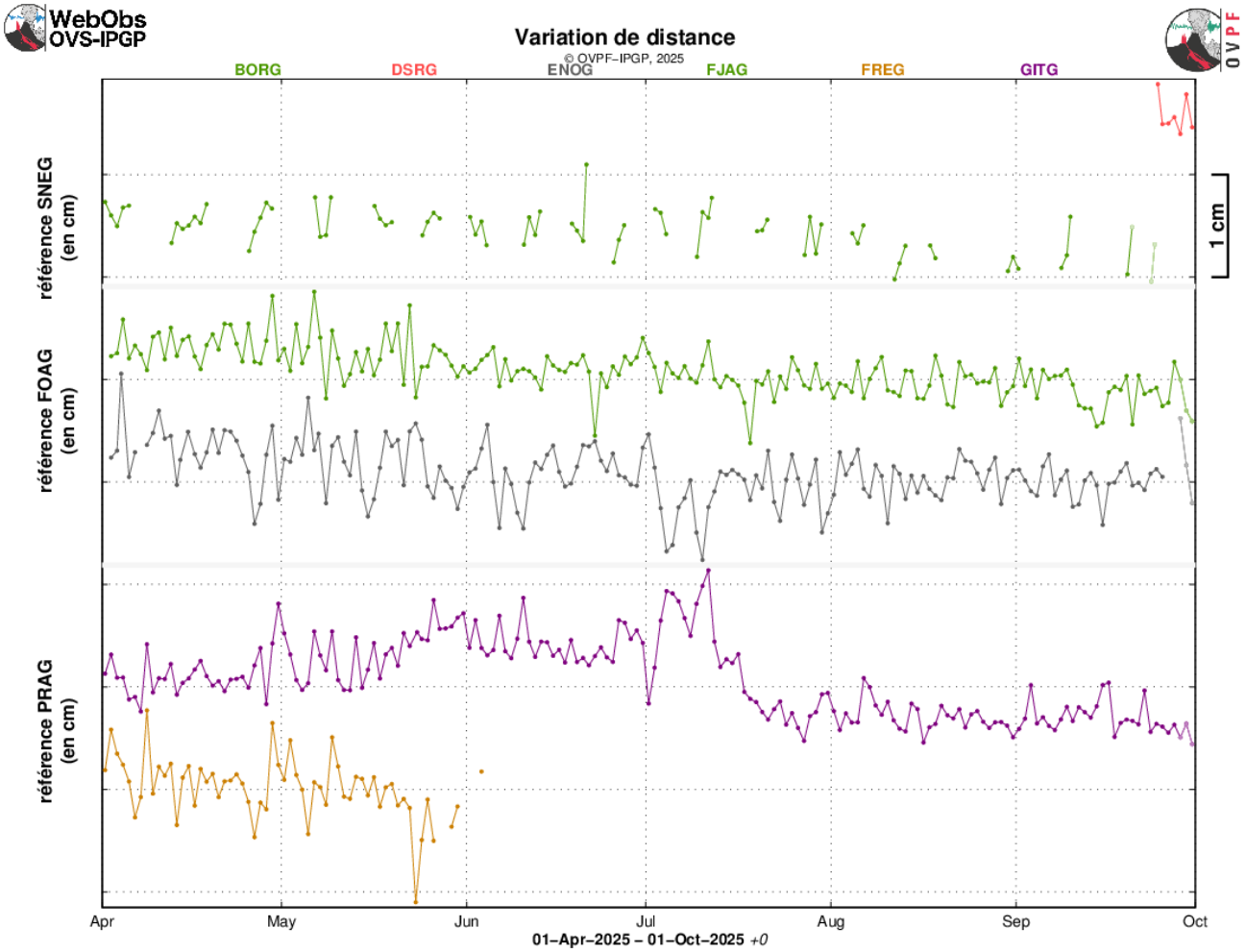

Figure 3: Ground deformation records over the past six months (in case of eruptive or intrusive periods, red and green bars represent eruptions and intrusions, respectively). The time series plots show the changes in distance between pairs of GPS stations located around the Dolomieu summit crater (reference: SNEG; top graph), the terminal cone (reference: FOAG; middle graph) and the Enclos Fouqué caldera (reference: PRAG; bottom graph), from north to south (see location in Figure 5). Increasing distances (or baseline elongation) indicate volcano inflation, while decreasing distances (or baseline contraction) reflect edifice deflation (© OVPF-IPGP).

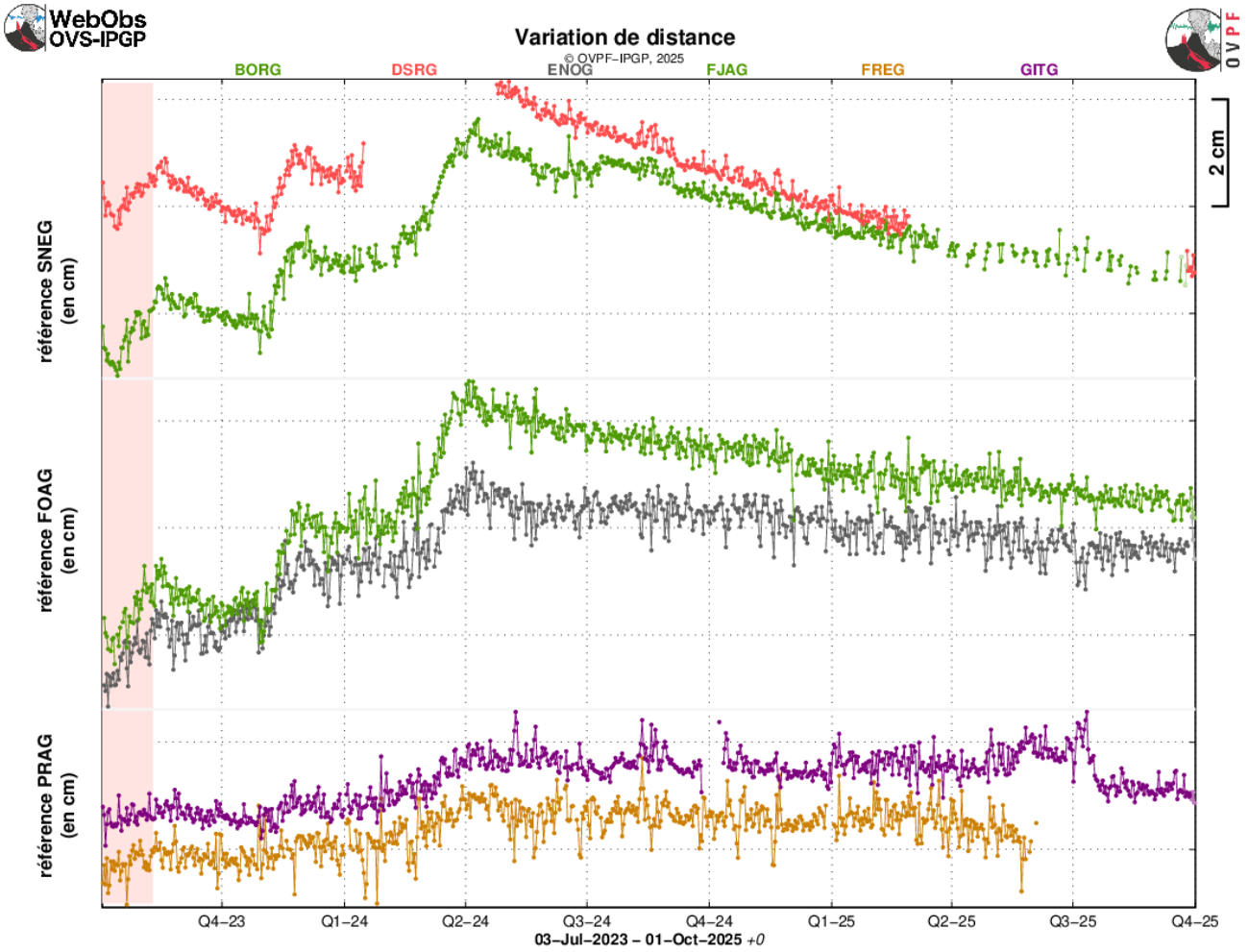

Figure 4: Ground deformation records since the last eruption in July-August 2023 (the eruptive period of July-August 2023 is shown in red). The time series plots show the changes in distance between pairs of GPS stations located around the Dolomieu summit crater (reference: SNEG; top graph), the terminal cone (reference: FOAG; middle graph) and the Enclos Fouqué caldera (reference: PRAG; bottom graph), from north to south (see location in Figure 5). Increasing distances (or baseline elongation) indicate volcano inflation, while decreasing distances (or baseline contraction) reflect edifice deflation (© OVPF-IPGP).

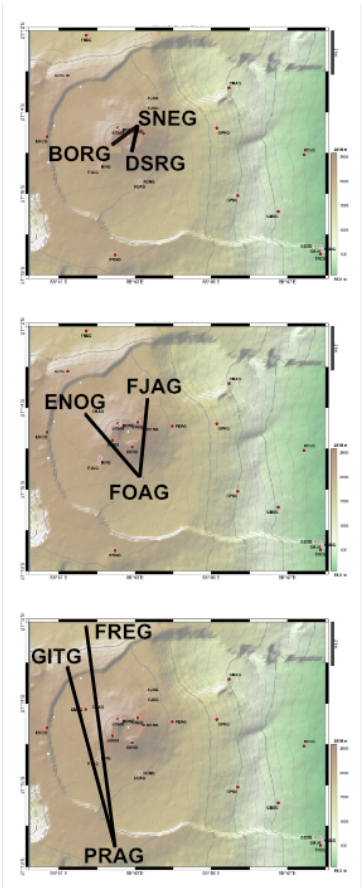

Figure 5: Location map of GPS stations and baselines as discussed in the text and shown in Figures 3 and 4 (© OVPF-IPGP).

** Glossary: The summit GPS signals indicate the influence of a shallow pressure source below the volcano, while distant GPS signals indicate the influence of a deep pressure source below the volcano. Inflation usually means pressurization; and conversely deflation usually means depressurization.*

Gas geochemistry

The permanent geochemical network for monitoring gas emissions from Piton de la Fournaise currently comprises:
- 3 MAX-DOAS stations measuring the optical thickness of SO2 (ppm.m) in the atmosphere. Measurements are taken every 10 to 15 minutes during the day when weather conditions are favorable (Arellano et al., 2020).
- 1 MultiGaS station measuring excess H2O, CO2, SO2 and H2S relative to the atmosphere, with measurements taken every 6 hours.
- 4 stations measuring CO2 flux through the soil. At these stations, meteorological parameters (temperature, pressure, humidity, wind speed and direction) are also recorded in order to correct signals from environmental disturbances (Boudoire, 2017; Bénard et al., 2023). Measurements are taken every hour.

Observations

CO_2 concentration in the soil

Since the last Piton de la Fournaise eruption (July, 2 – August 10, 2023), an overall trend of decrease in soil CO_2 emissions is recorded, associated by moderate positive pulses (Figure 6).

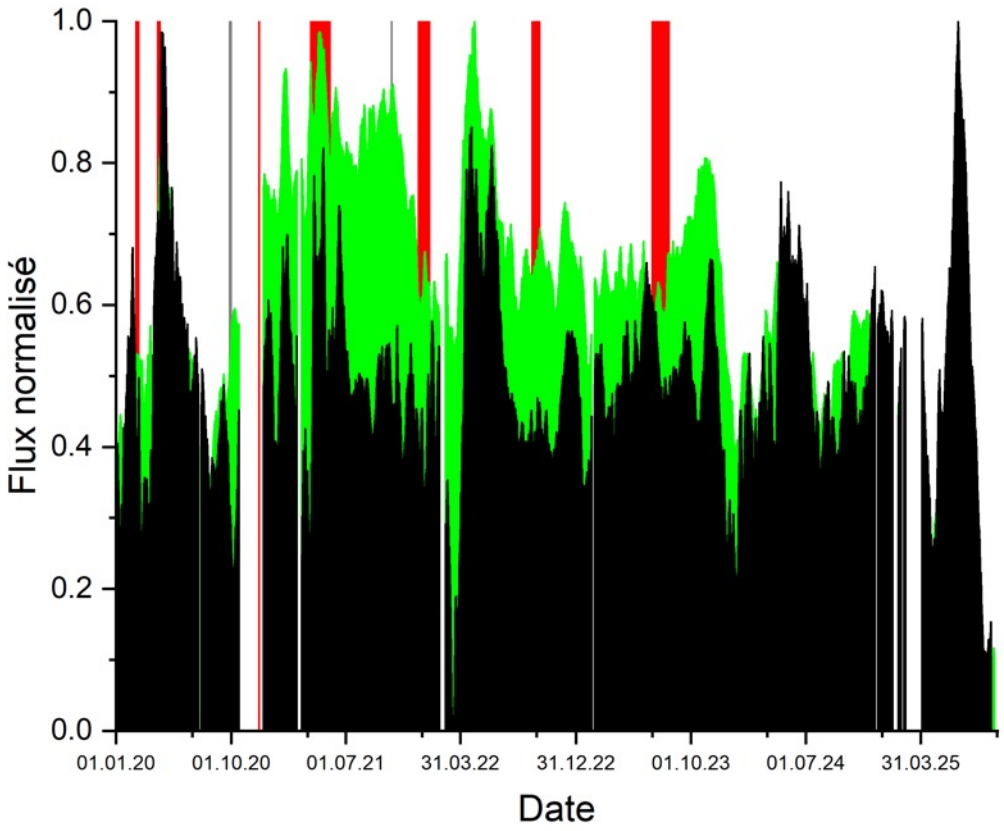

Figure 6: Comparison between the normalized average of corrected for short (OVPF-model; 15 days moving average; in green) and long-term influence of environmental parameters (INGV MALFIT model; in black) soil CO_2 flux from all distal stations (last station set). Red bars: eruptions; Gray bars: intrusions (© OVPF-IPGP).

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A first positive pulse was recorded from mid-October 2023 and it stopped in mid-November 2023.

Following the cyclonic event of January 15th 2024, a rapid increase in soil CO_2 fluxes was observed from January 19th in both proximal and distal locations on the western flank of Piton de la Fournaise. This second phase of slow progressive increase lasted till May 2024 and attained unusually high values in the proximal GITN site. Isotopic fluid compositions did not show an increase of the magmatic component in the fluids during this phase (Figure 7).

A third phase of moderate increase in soil CO_2 emissions, recorded mostly by the distal stations, was detected between November and December 2024, when concentrations started to decrease again (Figure 6). A new minor pulse in soil CO_2 emissions in the distal sites has been recorded between June and July 2025.

As a whole, August and September 2025 data confirm the overall trend of decrease in soil CO_2 emissions recorded since the last Piton de la Fournaise eruption.

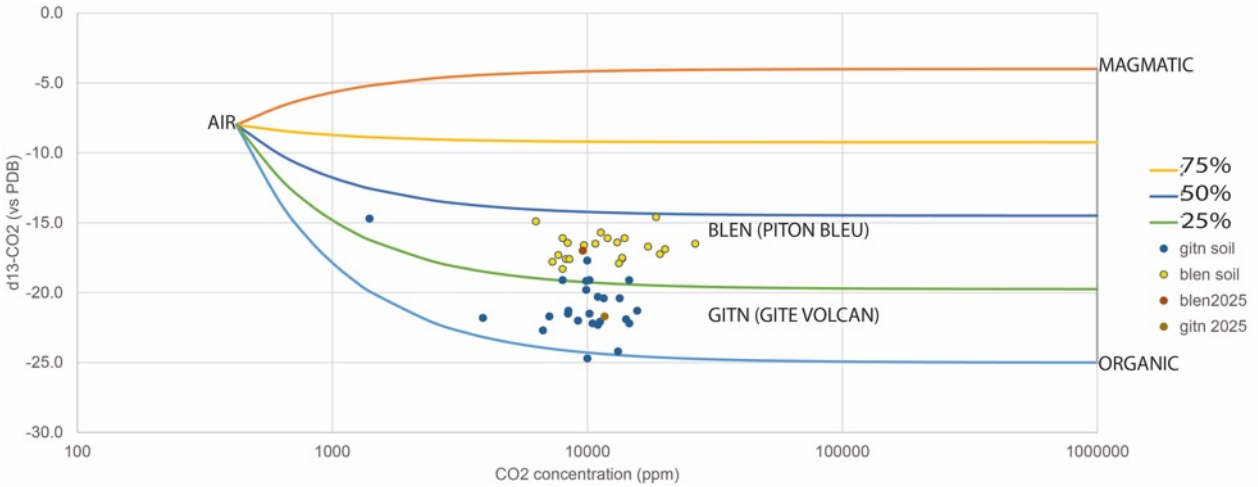

Figure 7: Carbon isotope (δ13C) variations in CO_2 from soil gas emitted from a proximal (GITN) and distal (BLEN) station. Measurements performed at the beginning (March 2024) of the peak phase in CO_2 emissions do not show a strong increase in the percentage of magmatic contribution.

** Glossary: CO_2 is the first gas to be released from deep magma (rising 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 the surface).*

Summit fumaroles composition obtained by the MultiGas method

- Since the installation of the new MultiGaS station at the summit in June 2024, SO_2 and H_2S concentrations at the volcano summit remain below detection levels.

Weak concentrations of SO_2 (<0.3 ppmv, Figure 8) and H_2S, associated with H_2O pulses recorded between November 2024 and March 2025 - showing a potential weak regain in activity of the hydrothermal system - have reverted to lower levels, close to the detection limit.

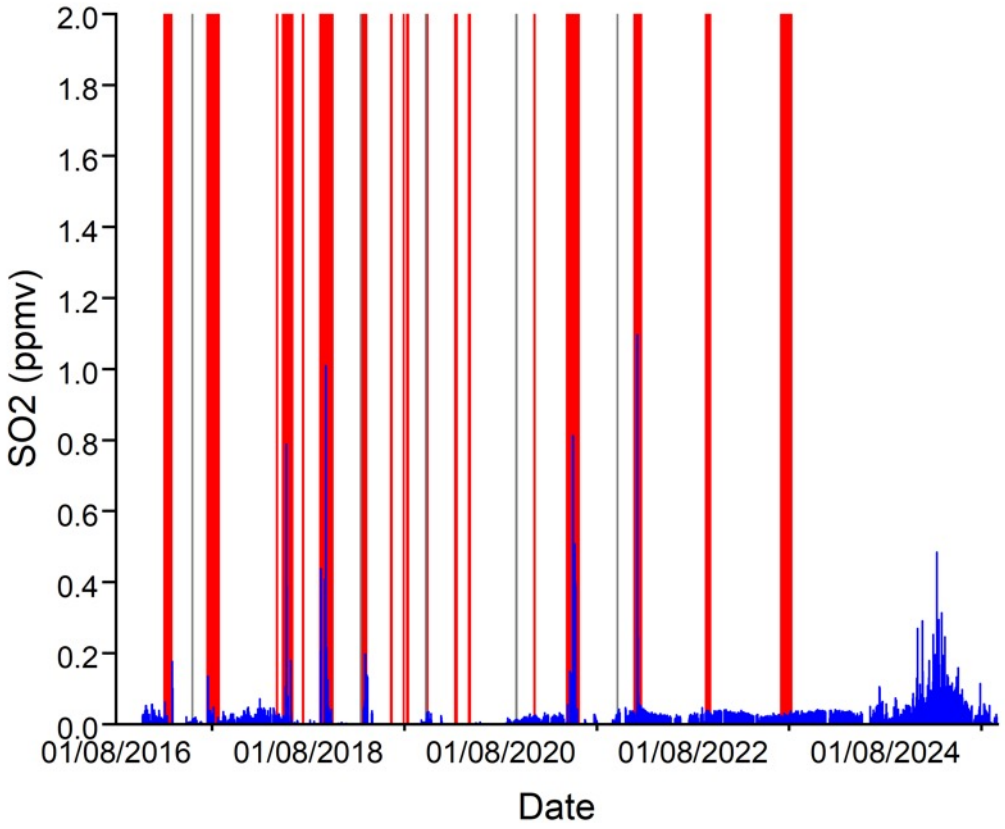

Figure 8: Raw (in blue) concentrations of SO_2 in the atmosphere at the summit of Piton de la Fournaise (MultiGaS station) Red bars: eruptions; Gray bars: intrusions.

** Glossary: The MultiGaS method allows measuring the concentrations of H_2O, H_2S, SO_2 and CO_2 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 SO_2 concentrations and in the C/S ratio (carbon/sulfur).*

SO_2 flux in the air obtained by DOAS method

The SO_2 fluxes in the air were low; close or below the detection threshold.

** Glossary: During rest periods, SO_2 flux at Piton de la Fournaise is below the detection threshold. The SO_2 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 at the surface.*

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Phenomenology

No eruptive activity reported in September 2025.

Summary

Since April 2024, magma recharge and pressurization of the shallow magma reservoir stopped.

In September 2025, seismicity remained low with only 14 shallow volcano-tectonic earthquakes and 2 deep earthquakes. A slight summit deflation is still observed, and the September 2025 data confirm the overall trend of decrease in CO_2 emissions recorded since the last Piton de la Fournaise eruption.

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

Local and regional seismicity

In September 2025, the OVPF-IPGP recorded:

- 87 local earthquakes (below the island, within a radius of 200 km around the island, Figures 9 and 10);
- 0 regional earthquake (in the Indian Ocean basin).

In September 2025, the OVPF-IPGP recorded 87 local earthquakes located mainly below the *Plaines area* (Figure 10). Most of these earthquakes have magnitude less than 1 and are difficult to locate.
These earthquakes were located between 10 km and 25 km depth in oceanic lithosphere on which was built the volcanic edifice at the origin of La Réunion island.

A slight increase in seismic activity beneath the *Plaine* area, particularly beneath *Plaine des Palmistes*, occurred during the second half of September, with an average of one to two earthquakes per day. Located between 15 and 25 km below sea level, this seismicity does not correspond to a main shock-aftershock sequence, but could reflect a transient loading episode linked to pressurization in the deep parts of the Piton de la Fournaise magmatic system, located below this region. The mechanisms indicate reverse faults oriented N120°, similar to those observed further north on the island.

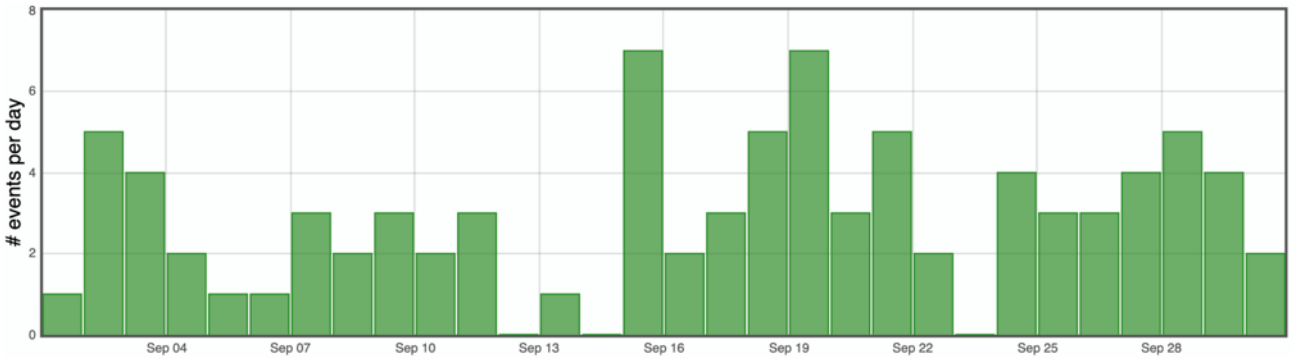

Figure 9: Number of local earthquakes (La Réunion island) per day recorded in September 2025 (© OVPF-IPGP).

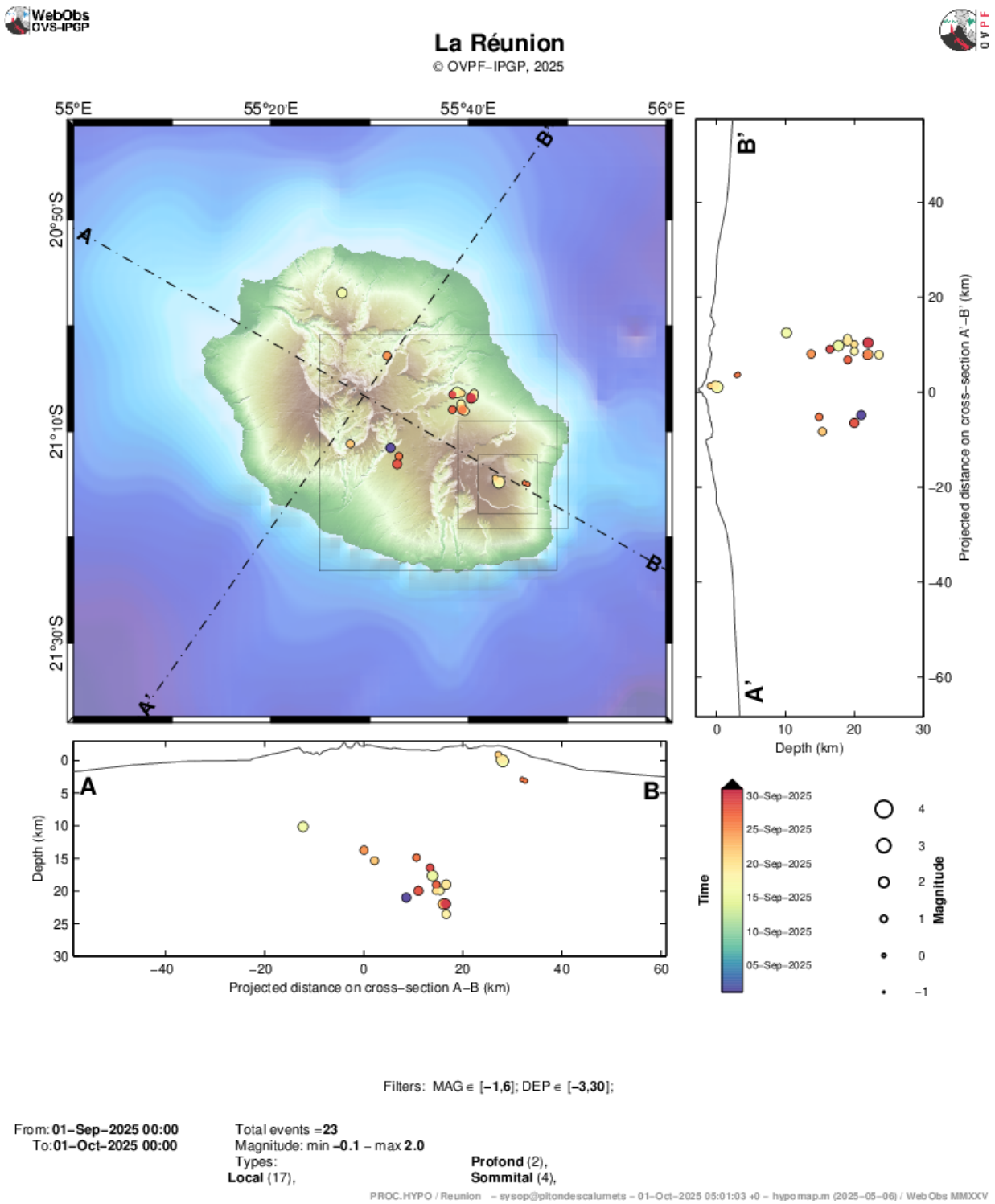

Figure 10: Seismicity below La Réunion in September 2025. Location map (epicenters) and north-west – south-east and south-west – north-east cross-sections (hypocenters) of earthquakes as recorded by OVPF-IPGP. Only localizable earthquakes are shown on the map (© OVPF-IPGP).

Seismic-volcano activity in Mayotte

The « REseau de surveillance VOlcanologique et SIsmologique de MAyotte (REVOSIMA) » is the structure in charge of the volcano and seismic monitoring of Mayotte. IPGP and BRGM coordinate and manage REVOSIMA. Operational monitoring of seismo-volcanic activity is carried out by IPGP (OVPF), under the joint responsibility of BRGM and in close association with IFREMER and CNRS. REVOSIMA is supported by a scientific and technical partnership. The REVOSIMA consortium: IPGP and Université Paris Cité, BRGM, IFREMER, CNRS, BCSF-RéNaSS, ITES and Université de Strasbourg, IGN, ENS, SHOM, TAAF, Météo France, CNES, Université Grenoble Alpes and ISTerre, Université Clermont Auvergne, LMV and OPGC, Université de La Réunion, Université Paul Sabatier, Toulouse and GET-OMP, Université de la Rochelle, Université de Bretagne Occidentale, IRD and collaborators.

All information on the REVOSIMA and the activity in Mayotte can be found on the dedicated webpages:
- https://www.ipgp.fr/observation/infrastructures-nationales-hebergees/revosima/
- https://www.ipgp.fr/actualites-du-revosima/
- https://www.facebook.com/ReseauVolcanoSismoMayotte/
- https://bsky.app/profile/revosima.bsky.social

October, 2 2025
OVPF-IPGP Director

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C. Appendix

Definition of Volcanic Alert Levels for Piton de la Fournaise

from *disposition spécifique « Volcan Piton de la Fournaise » - arrêté n°2242-* 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 inside the Enclos Fouqué caldera without threat to the safety of people, property or the environment

Alert 2-2: ongoing eruption inside the Enclos Fouqué caldera with direct or indirect threat to the safety of people, property or the environment.

Access to the Enclos Fouqué caldera and to the summit are closed and prohibited. For Alert 2-2, evacuation of the people and vehicles depending on the issues.

• **"Alert 2-3"**: ongoing eruption outside the Enclos Fouqué caldera with threat to the safety of people, property or the environment.

Access to the Enclos Fouqué caldera and to the summit are closed and prohibited. Evacuation of the people and vehicles depending on the issues.

• **"Sauvegarde"**: end of eruption.

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

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Acknowledgments

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

Information

All information on the Piton de la Fournaise activity can be found on the OVPF-IPGP media:
- Internet website : ipgp.fr/fr/ovpf/actualites-ovpf
- Bluesky : @ovpf.bsky.social
- Facebook : facebook.com/ObsVolcanoPitonFournaise

A preliminary automatic daily bulletin of the OVPF-IPGP, relating to the activities of the day before, validated by an analyst, is published daily. It can be accessed directly at this link:
http://volcano.ipgp.fr/reunion/Bulletin_quotidien/bulletin.html

The seismicity validated in continuous by OVPF-IPGP can also be followed on the RENASS portal: https://renass.unistra.fr/fr/zones/la-reunion

The OVPF-IPGP data are distributed by the IPGP data centre - Volobsis - and are also available on the EPOS and Epos-France websites (doi:10.18715/REUNION.OVPF).