



Area of Interest: Erta Ale and Hayli Gubbi Volcanoes, Ethiopia

Dates Covered: Sept – 24 November 2025

Plain language summary:

- An eruption occurred at Hayli Gubbi between 07.56 UTC and 08:31 on 23 November 2025 and the plume had formed an umbrella cloud at a height of 10-14 km by 10:56 UTC.
- There has been low-level activity at Hayli Gubbi since 25th July, following a 30 km long dyke intrusion between Erta Ale and Afdera (see COMET Event Response Reports 2.1-2.3). Since then, there have been quasi continuous observations of low-lying white clouds within the crater (likely water vapour and CO₂) and SO₂ emissions at 1-2 km. There was about 5 cm of uplift at Hayli Gubbi in late July.
- Ground deformation at Erta Ale began in late Sept/early Oct and has been accelerating - the signal is consistent with a contracting dyke. There was minor uplift at Hayli Gubbi (a few cm at most) between 13-19th Nov.
- The first co-eruptive deformation image will be acquired on 25 November.

Purpose/Caveats: This event response report was produced to assist situational awareness and rapid response efforts. It represents best endeavours at the time of issue. Analysis and interpretation of the data is preliminary, which may not reflect the most up-to-date or complete information due to the evolving situation.

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Optical Imagery

Planet imagery from 23 November 2025 at 08:31 UTC shows the start of an explosive eruption at Hayli Gubbi (Fig 1). The eruption is not visible in the Sentinel-2 imagery acquired ~35 minutes earlier (Fig 2). Thermal anomalies were observed at Hayli Gubbi throughout on the 23

November (Fig. 3). Most recent from the 24 November, currently shows no anomaly (Fig. 3D). Prior to the eruption, Sentinel-2 and Planet imagery show a quasi-continuous white cloud confined to Hayli Gubbi crater (Fig. 1,2). These plumes have been frequently observed at Hayli Gubbi since their first appearance on 25 July 2025 (see COMET event response 2.3)

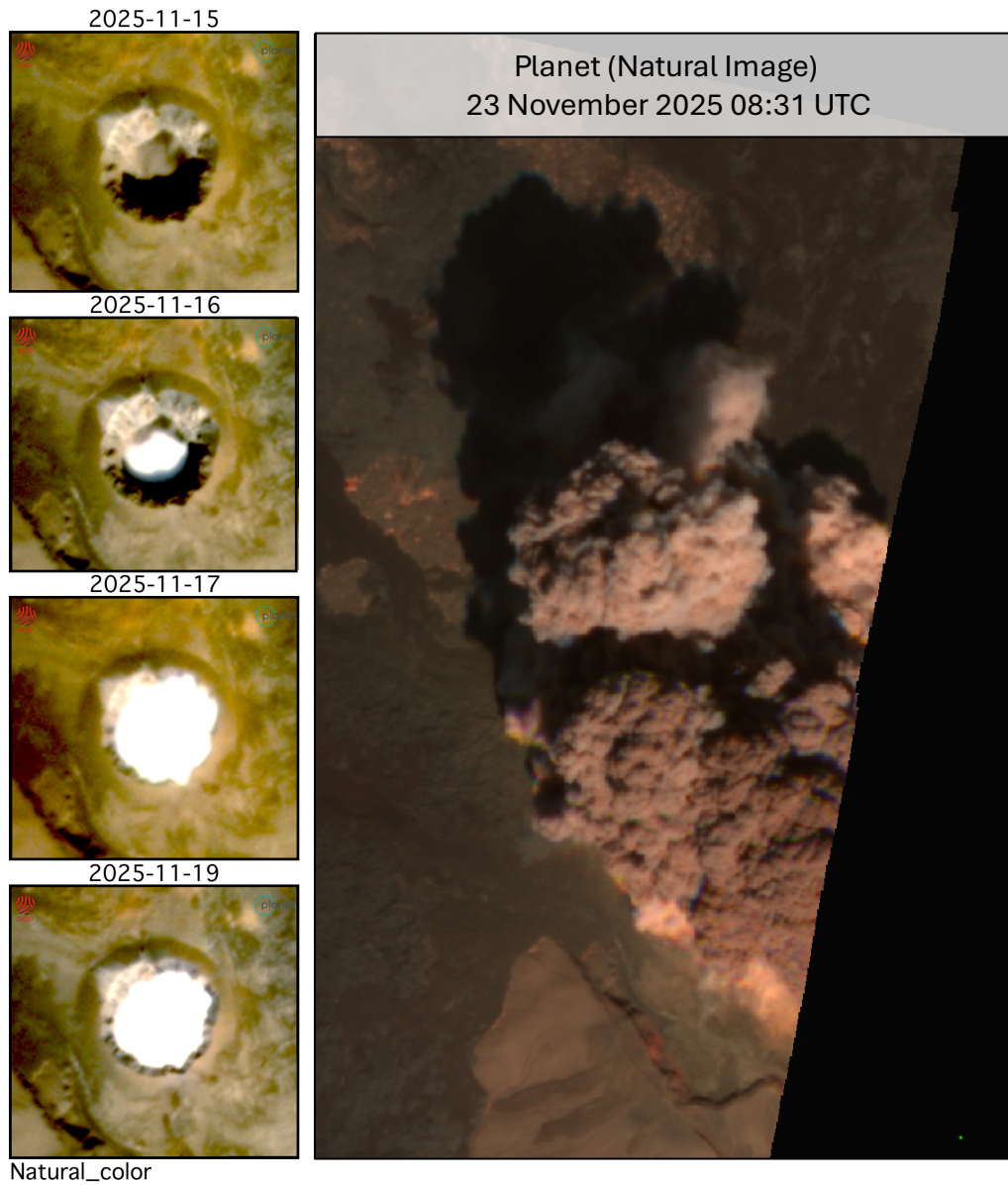


Fig 1. Planet images showing the evolution of the crater confined plume in November 2025 and the explosive eruption on 23 November 2025 08:31 UTC

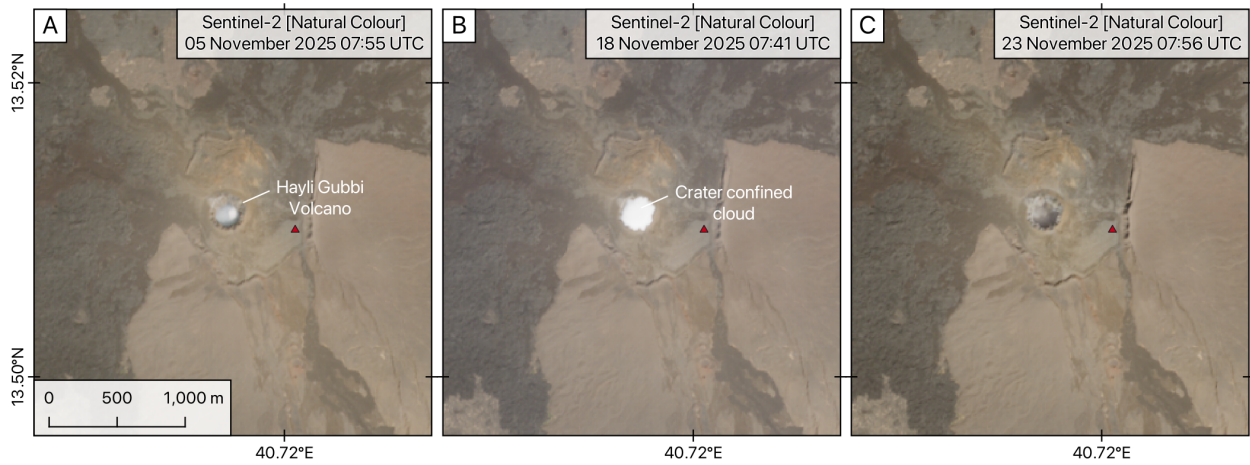


Fig. 2. Sentinel-2 natural colour images showing the plume confined to Hayli Gubbi crater prior to the 23 November eruption.

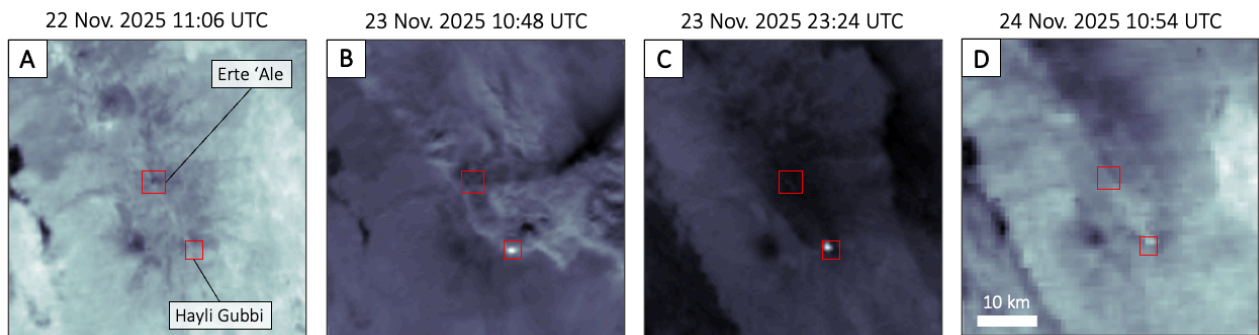


Fig. 3. Thermal anomalies observed with VIIRS 375 product on MIROVA associated with the eruption at Hayli Gubbi.

SO₂ Emissions:

SO₂ emissions were visible in the weeks leading up to the eruption (Fig. 4). Because of the proximity to Erta Ale, it is not possible to definitively say that these are from Hayli Gubbi, though the fact that they increase in the lead up to the activity would suggest that these are linked to this activity.

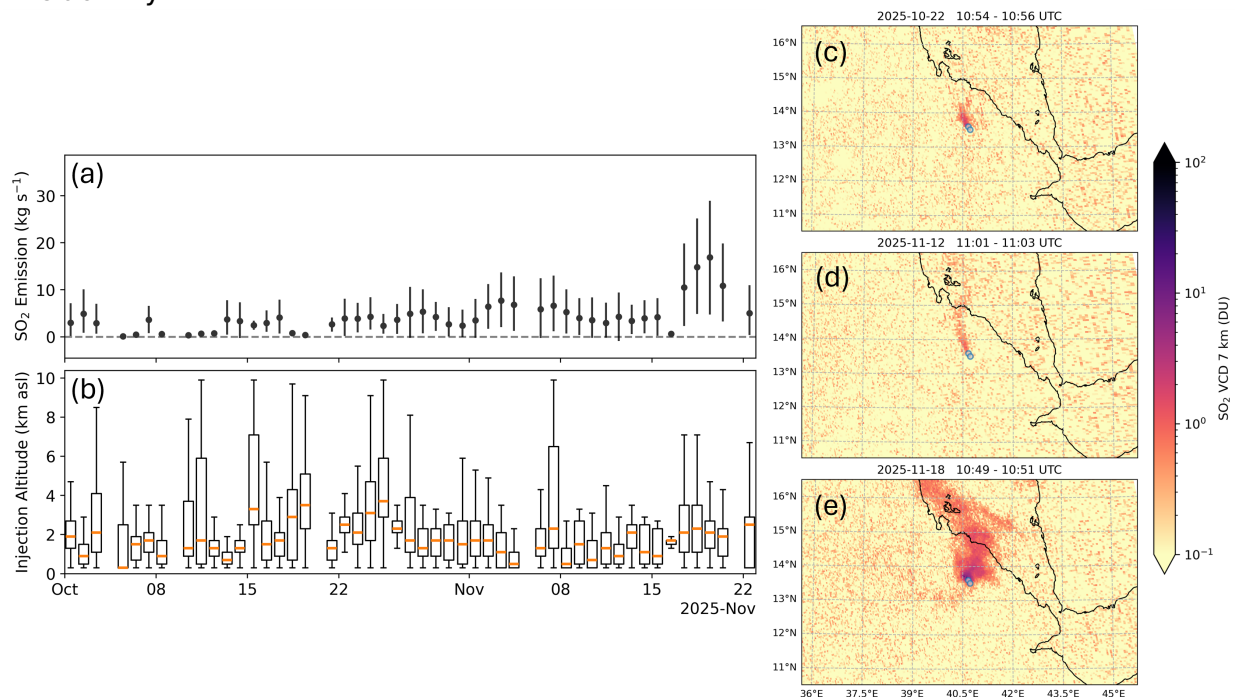


Fig. 4. Overview of SO₂ emissions in the run up to the 23 November eruption, using SO₂ imagery from TROPOMI and analysed with PlumeTraj. (a) mean emission rate for each satellite orbit, (b) box plots of injection altitudes of SO₂, (c-e) example SO₂ images from 22 October, 12 November and 18th November

The main eruption plume was captured by TROPOMI on 23 November at roughly 10:56 (UTC). Analysing this image with PlumeTraj shows that the bulk of the emission was at 10-14 km asl (Fig. 5). Some artefacts can be seen at higher altitude and at earlier times, likely because of an umbrella cloud pushing the plume against the background wind field. The total mass of SO₂ contained within this plume is 51 (±18) kt, though this may be an underestimate if significant volcanic ash is also present.

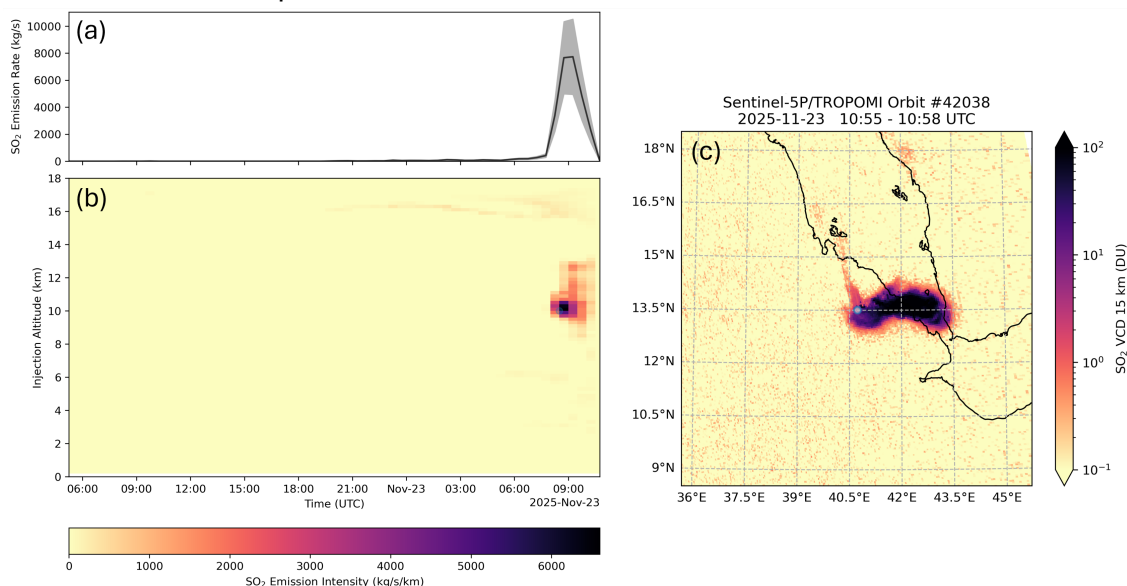


Fig. 5. SO₂ emissions from the 23 Nov eruption, showing (a) total emission rate, (b) altitude-resolved emissions and (c) TROPOMI 15 km SO₂ image.

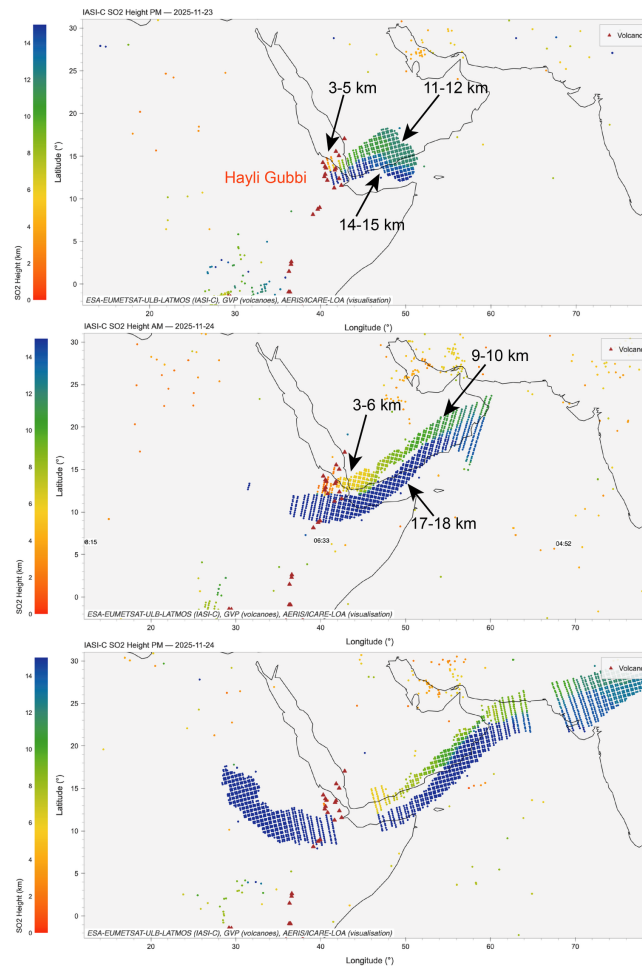


Fig 6 : SO₂ plume height from IASI-C imagery (Metop-C). Credits: ESA-EUMETSAT-ULB-LATMOS (data), VolcPlume / Volcano Space Observatory (AERIS/ICARE-LOA)

InSAR interferograms: Pre-eruptive deformation at Erta Ale and Hayli Gubbi

At the time of writing, there are no post-eruption Sentinel-1 SAR acquisitions, with the latest image being acquired 4 days (19 Nov) before the eruption (23 Nov).

Erta Ale:

Pre-eruptive 24/30-day Sentinel-1 interferograms from the descending and ascending tracks show the contraction of a subsurface source beneath Erta Ale starting in October, consistent with a 5-6 km long contracting dike. Analysis of consecutive 24-day interferograms suggests that although the lateral extent of the deformation does not change with time, the rate of displacement is increasing (Fig 7 a-f). During the latest 24-day period (25-26 October to 18-19 November), there was ~8 cm line-of-sight (LOS) surface displacement away from the satellite. The total LOS displacement from early October is ~14 cm away.

The location and pattern (but not magnitude) of the ongoing deformation are similar to the signal associated with a contracting dike during the previous activity in July 2025 (refer to Event Response Reports 2.1-2.3).

Hayli Gubbi:

The most recent pre-eruptive 6-day ascending interferogram suggests minor uplift (<3 cm LOS) at Hayli Gubbi starting on or after 13 November (Fig 7 g-h).

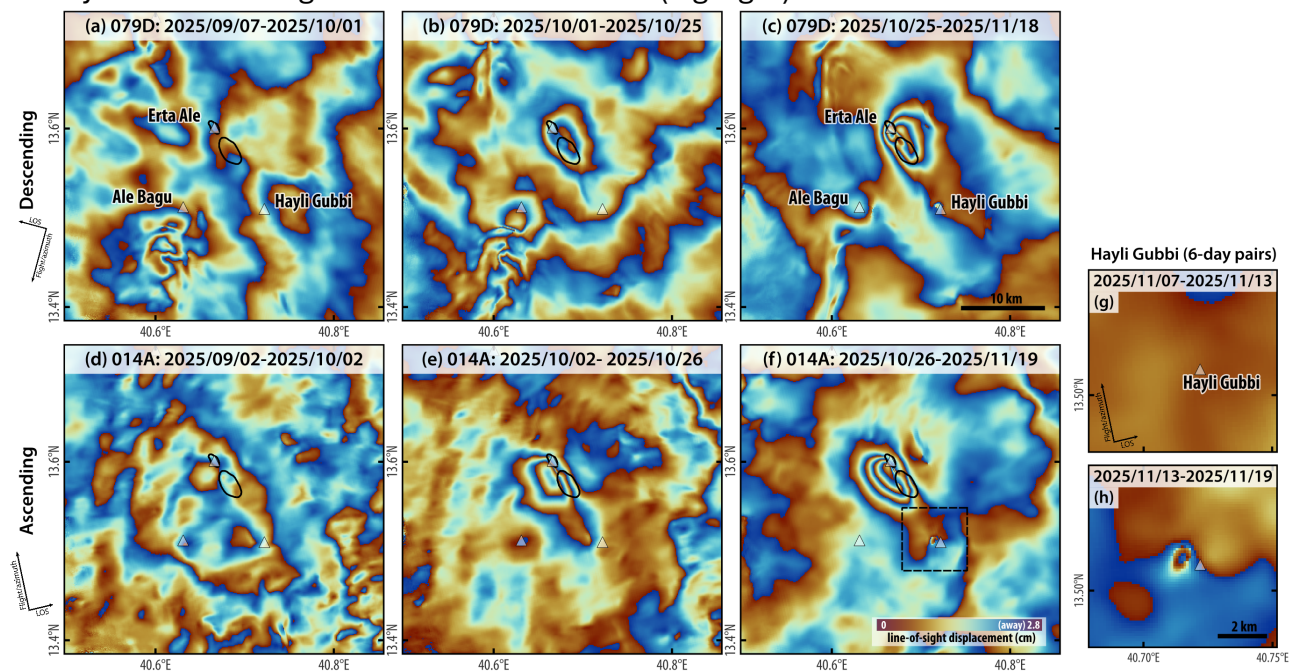


Fig 7: Pre-eruptive Sentinel-1 descending (a-c) and ascending (d-f) interferograms showing deformation centred at Erta Ale. All interferograms are 24-days, apart from panel d which is a 30-day interferogram as there was no ascending acquisition on 8 Sept. Consecutive 24-day interferograms suggest an increasing rate of deformation at Erta Ale. Zoomed-in ascending 6-day interferograms (g-h, location of zoomed-in bounding box in f) at Hayli Gubbi suggests inflation starting after 13 November. Each fringe represents 2.8 cm of satellite line-of-sight (LOS) displacement, red-to-blue indicates range increase (displacement away from the satellite). Deformation lobes in (c) and (f) represents displacement away from the satellite.

Forward look:

We will continue to monitor both Erta Ale and Hayli Gubbi using upcoming satellite acquisitions. The first post-eruption Sentinel-1 ascending acquisition will be on 25 November, at around 15.30 UTC. COSMO-SkyMed Second Generation (CSG) data will be used to track possible lava flow and detect high-resolution surface deformation. With an 8- or 16-day revisit cycle, the next CSG acquisition will be acquired on 29 November or 7 December. Gas emissions will continue to be monitored using daily overpasses from TROPOMI.

Data used:

- InSAR images collected by the European Sentinel-1 satellites, processed using the COMET LiCSAR system (<https://comet.nerc.ac.uk/comet-lics-portal/>)
- Copernicus Sentinel-2 imagery, and Sentinel-5P TROPOMI SO₂ retrievals (<https://browser.dataspace.copernicus.eu/>), Volcano Space Observatory (vso.icare.univ-lille.fr)/VolcPlume portal (<https://volcplume.aeris-data.fr/>) and SO₂ Flux Calculator tool (<https://dataviz.icare.univ-lille.fr/so2-flux-calculator>) for visualisation of MetOp-C/IASI-C imagery provided by ESA-EUMETSAT-ULB-LATMOS
- High-resolution on optical imagery collected by the PlanetScope satellites of the Planet Lab constellation (<https://www.planet.com/>). PlanetScope SuperDove products are copyright of Planet company, provided by R. Grandin (IPGP) under “Education and Research Standard License n°81527”.
- MIROVA (Middle Infrared Observations of Volcanic Activity) provide detections of VIIRS thermal hotspots (https://www.mirovaweb.it/NRT/volcanoDetails_VIR.php?volcano_id=221080)