COMET

Event Response

Area of Interest: Erta Ale Volcano, Ethiopia
Dates Covered: 21 – 30 July 2025

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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Acknowledgements: The analysis and report were produced in collaboration with Addis Ababa University, and the projects: VolcScatter (ESA Fellowship); MAST (ERC Consolidator); University of Manchester postdoctoral funding for BE; and University of Bristol PhD scholarship to LW.

Plain language summary:
Lava flow propagation at Erta Ale has stopped and activity is confined to pit craters in the northern (summit) caldera. The dike between Erta Ale and Lake Afrera has not propagated further south. However, the southernmost section of the intrusion is still opening and surface cracks and fractures of up to 50 cm wide have been reported near Afdera town (50 km from Erta Ale). The opening rate is declining - the line-of-sight (LOS) displacement has decreased from about 1 m during 16-22 July to about 50 cm during 22-28 July. Thermal anomalies and gas emissions are still observed but have gradually decreased.

Recent Activity:

<u>No further lava flow activity, activity confined to previous active pit craters</u>

Sentinel-1 backscatter, and Sentinel-2 imagery show no further propagation of the lava flows from Erta Ala since the 16 July. Sentinel-2 and Planet imagery show activity confined to the north and south pit of Erta Ale northern (summit) caldera, with an ash cloud present over the south pit on 22, 23 and 26 July (Fig 1). Thermal anomalies associated with the lava lake and flows remain visible (MIROVA VIIRS375).

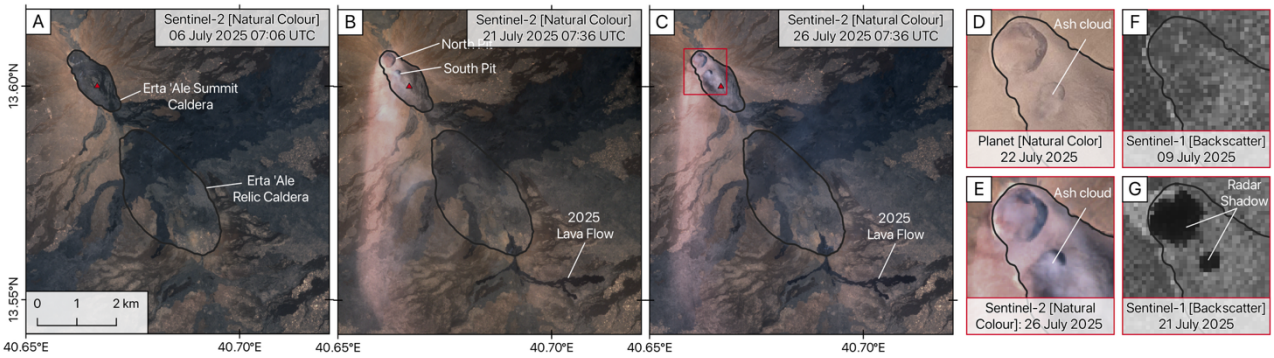

Fig 1. Sentinel-2 natural colour images (A-C) of Erta Ale Volcano during July 2025 showing no major changes to the summit caldera pits and lava flows from the towards the south. Zoom in over the pit craters in the northern (summit) caldera show (D-E) ash clouds in from the south pit and (F-G) Sentinel-1 backscatter images showing collapse of pit craters. Radar shadow (black area) are areas where sensor cannot image due to side looking nature of satellite.

Dike opening continues, but does not propagate further south

Disaster Risk Commission members of the Afar Regional State of the Federal Democratic Republic of Ethiopia have reported the presence of fractures of up to 50 cm wide near Afdera town, located ~50 km southeast of Erta Ale summit crater. Based on Sentinel-1 interferograms, the dike intrusion between Erta Ale and Lake Afrera has stopped propagating since 21 July. However, the southernmost ~10 km segment continues to open at a slower rate (Fig 2c, f). The line-of-sight (LOS) displacement towards the satellite associated with opening in the southernmost segment was > 1 m during 16-22 July, and > 50 cm during 22-28 July. There is no longer any deformation associated with a contracting dike below Erta Ale.

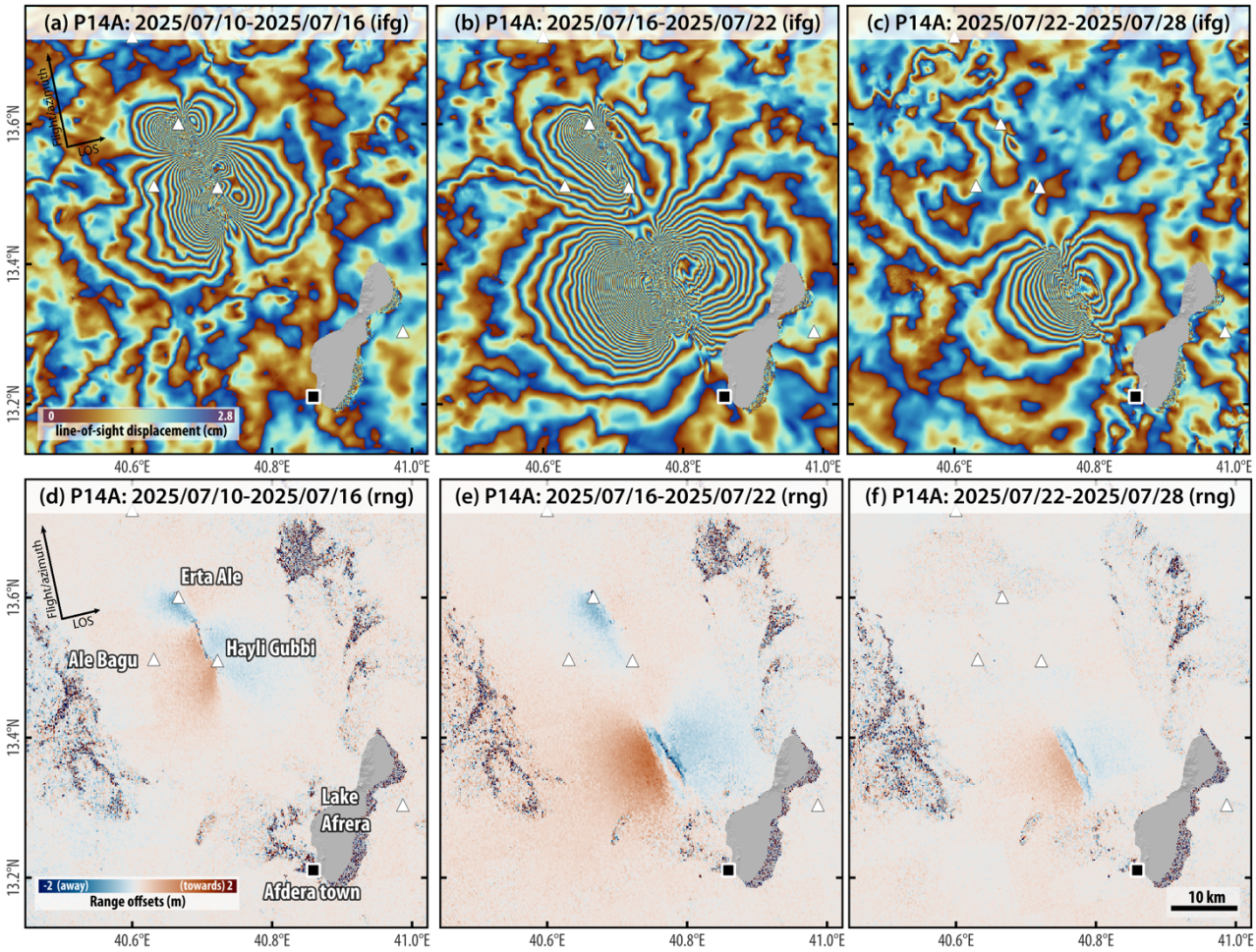

Fig 2. 6-day consecutive Sentinel-1 ascending interferograms (a-c) and range offsets (d-f) show that propagation of the dike intrusion south-eastwards stopped by 22 July 2025 (b,e). The interferogram spanning 22-28 July (c) has fewer fringes than the interferogram spanning 16-22 July (b), indicating that opening in the southmost segment continues at a slower rate. (d-f) Range offsets show motion towards the satellite (red) and away from the satellite (blue).

Continued but gradually decreasing SO_2 emissions

Updated analysis of TROPOMI SO_2 imagery (Fig 3) shows that there is continued emission of SO_2, though this is gradually dropping with time. Note that the difference between PlumeTraj and the disk method is likely due to the assumed plume altitude (the disk analysis here uses the TROPOMI 1 km SO_2 product, whereas PlumeTraj corrects for the retrieved plume altitude). The altitude of the bulk of the SO_2 emission is roughly steady at 1 – 2 km above sea level.

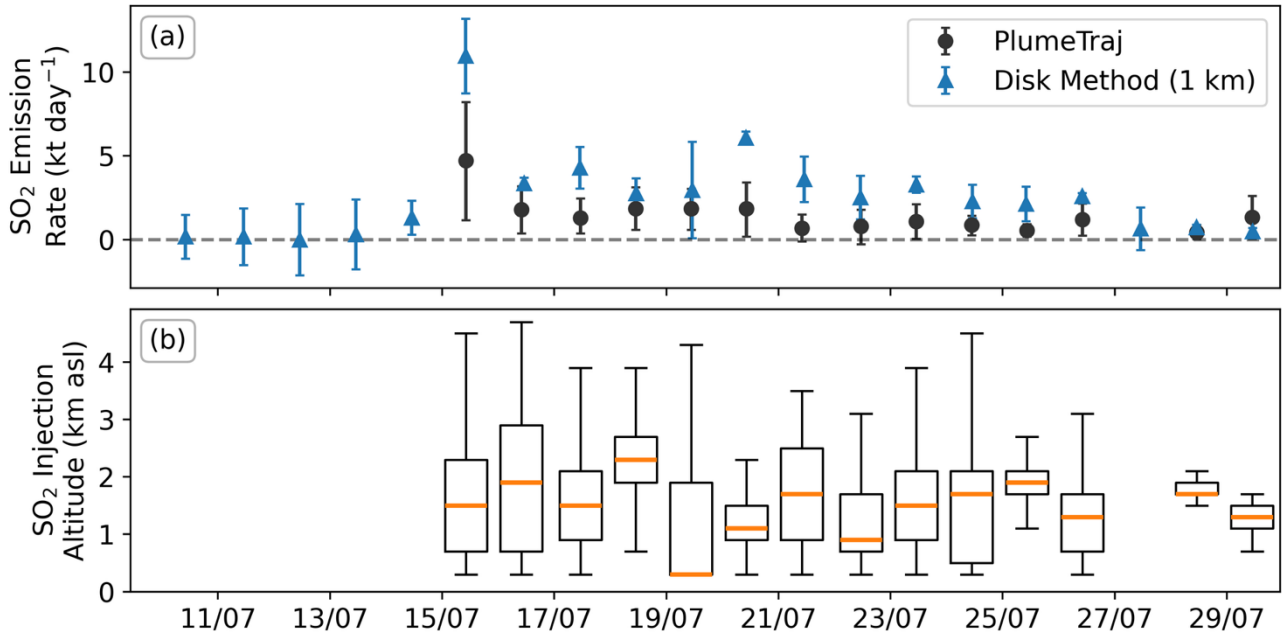

Fig 3. SO2 emissions calculated from daily TROPOMI SO_2 imagery. (a) Daily SO_2 emission rates calculated with PlumeTraj (black circles) and the Disk Method (blue triangles). (b) Box plot of the SO_2 injection altitude calculated with PlumeTraj.

Forward look:

We will continue to monitor lava flow extents, lava lake levels, gas emissions, and surface deformation with upcoming SAR, optical and hyperspectral satellite images. We will continue to monitor the seismic activity with regional seismic stations. This, in combination with other data, observations and models, will provide evidence on which the potential evolution of the event can be considered. The next Sentinel-1 image will be acquired on 2 August.

Data used:

- InSAR and SAR backscatter images collected by the European Sentinel-1 satellites, processed using the COMET LiCSAR system (https://comet.nerc.ac.uk/comet-lics-portal/)
- High-resolution 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”.
- Copernicus Sentinel-2 imagery, and Sentinel-5P TROPOMI SO_2 retrievals (https://browser.dataspace.copernicus.eu/), VolcPlume portal (https://volcplume.aeris-data.fr/) and SO2 Flux Calculator tool (https://dataviz.icare.univ-lille.fr/so2-flux-calculator)
- MIROVA (Middle Infrared Observations of Volcanic Activity) provide detections of VIIRS thermal hotspots (https://www.mirovaweb.it/NRT/volcanoDetails_VIR.php?volcano_id=221080)