

2005-2010 InSAR time series at Dallol, a proto-volcanic system in North Afar (Ethiopia)

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Quaternary extension and volcanism in Afar focus along magmatic segments, among which the Erta Ale segment, which includes the Dallol hydrothermal area. Dallol lies in a depressed area ~120 m below sea level, and consists of a ~40 m high mound hosting an active hydrothermal field, without volcanism.

Previous results show that in October 2004 a ~6 km long dyke intrusion occurred SE of Dallol, opening the rift axis up to 4.5 m in ~10 days. Analytical inversion models suggest the concomitant withdrawal of a shallow (1.5–3.3 km) magma chamber that partially fed the intrusion.

Using InSAR analysis, here we study the ground deformation at Dallol after this rifting event, between 2005 and 2010.

Our ground deformation time series, obtained using the π -rate software, suggest that, between Nov. 2005 and Nov. 2007 the Dallol mound slowly uplifted (~1cm/yr) and that between Nov. 2007 and Feb. 2010 it quickly subsided (4–6 cm/yr).

Analytical models for the subsidence period suggest a sill like deformation source at shallow depth (0.8–1.8 km), that is probably the same magmatic source that fed the dyke intrusion. Although a contribution from an hydrothermal source cannot be excluded.

Preliminary results highlight a correlation between the subsidence in Dallol and vertical movements in other volcanoes belonging to the Erta Ale segment (–2.8 cm/yr at Gada Ale, +4 cm/yr at Alu Dalafilla and +2 cm/yr at the Erta Ale caldera) suggesting a possible interaction at regional scale.