

POST-ERUPTIVE DEFORMATION ASSOCIATED WITH THE 1986-87 AND 1989 LAVA FLOWS OF ETNA DETECTED BY RADAR INTERFEROMETRY.

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Abstract

We analysed 92 interferograms produced using ERS1 SAR images taken on Etna between May 1992 and October 1993. Nineteen show a local subsidence in the eastern flank of the volcano, correlated with the location of the 30 October 1986 - 1 March 1987 and 27 September - 9 October 1989 lava flows.

Using fringe unwrapping and data gridding techniques, and assuming that over the sampled time-window, deformation was a linear function of time, we derive a map of along range rate of motion. The correlation between the deformation field covered by recent lavas suggests that compaction of the lava flows continues several years after the eruptions.

The area of maximum subsidence (47 mm/yr.) is localised at the narrowing of the 1989 flow, between 1500 and 1700 m a.s.l. We observe that subsidence extends outside the lava flows, accounting for at least 12 mm/yr.

Assuming a relaxation process of the substrate in response to loading produced by recent lavas, a simple 1D Maxwell visco-elastic model predicts a maximum subsidence rate of 25 mm/yr and a relaxation time of about 3.5 years.

The relaxation time agrees with those derived from post-eruptive displacements observed by levelling on Etna and Piton de la Fournaise after several eruptions.

We conclude that at the time of our measurements, 25 to 50% of the deformation was related to relaxation of the substrate and the other part due to compaction of the lava flows.

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