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Multitemporal mapping of effusive eruptions for simulation code validation: the 2001 Etna eruption

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A reliable and accurate reconstruction of the lava flow field geometry (area and volume) is a fundamental step to understand the emplacement processes and to support quantitative studies on the effusive eruptions. The availability of data describing a flow temporal evolution is a key factor for implementing test cases necessary to assess the capability of a simulation model to be used for real time application in support of crisis management.

The method adopted for the quantitative reconstruction of lava flows temporal evolution based on topographical data processing and field measurements is described in this work, focusing on the 2001 Etna lava flow emitted from the 2100 m a.s.l. vent.

Pre and post-eruption Digital Elevation Model (DEM) were extracted from vector contour maps and compared in order to evaluate the final 3D geometry of lava flows.

The 2D flow temporal evolution was correctly reconstructed by means of maps compiled during the eruption from helicopter and field surveys. To enhance their accuracy the maps were rectified and georeferenced on a final orthophoto. These data, together with information about daily thicknesses, permitted the evaluation of partial volumes, at eleven selected dates, which were used to estimate the flow rate trend.

The 2100 flow is a simple flow with a quite simple temporal evolution to be modelled therefore it was considered particularly suitable to check the reliability of simulation codes. A quantitative comparison between observed and simulated flows, obtained by applying different simulation models, is shown. The results show some inconsistencies related to problems in the input data, such as the inadequacy of not directly measured physical parameters or the presence of topographical artefacts.