Lava flow risk assessment on Mount Etna through hazard and exposure modelling

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Lava flows represent the greatest threat to exposed population and infrastructure on Mt Etna volcano (Italy). The increasing exposure of a larger population, which has almost tripled in the area around Mt Etna during the last 150 years, has resulted from poor assessment of the volcanic hazard, allowing inappropriate land use in vulnerable areas. We present a new methodology to quantify the lava flow risk on Etna’s flanks using a GIS-based approach that integrates the hazard with the exposure of elements at stake. The hazard, showing the long-term probability related to lava flow inundation, is obtained by combining three different kinds of information: the spatiotemporal probability of the future opening of new flank eruptive vents, the event probability associated with classes of expected eruptions, and the overlapping of lava flow paths simulated by the MAGFLOW model. Data including all exposed elements have been gathered from institutional web portals and high-resolution satellite imagery, and organized in four thematic layers: population, buildings, service networks, and land use. The total exposure is given by a weighted linear combination of the four thematic layers, where weights are calculated using the Analytic Hierarchy Process (AHP). The resulting risk map shows the likely damage caused by a lava flow eruption, allowing rapid visualization of the areas subject to the greatest losses if a flank eruption were to occur on Etna.