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Lava flow hazard and risk maps using DOWNFLOW: sensitivity analysis and maps updating

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Hazard and risk at volcanoes can be assessed through timely analysis of monitoring data and numerical simulations of eruptive phenomena. In the case of lava flows, numerical simulations triggered at possible future vents are used to derive high resolution lava flow inundation hazard and risk maps. For a given volcano, these maps rely on the choice of input parameters for lava flows and on the adopted probability density function (PDF) for future vents opening. Here we present a sensitivity analysis of hazard and risk maps obtained for Mount Etna based on lava flow simulations triggered at about 70,000 possible future vents (regularly distributed on the volcano). Numerical simulations are based on the DOWNFLOW probabilistic code which computes lava flow paths but does not constrain, by itself, lava run-out distance. We study the dependence of these maps on the following input parameters: (1) the number of simulated future vents (i.e. the distance among the considered vents); (2) the lava run-out; (3) the PDF for future vents opening. The risk analysis is based on a database of buildings for the Etnean area. Large databases of lava flow simulations provide quantitative lava flow inundation hazard and risk maps at an unprecedented resolution. Nevertheless, the performed sensitivity analysis shows that these maps are critically dependent on the adopted input parameters. In addition, precursory signals can lead to substantial changes of the initial PDF for future vents opening, entailing repeated updates of hazard and risk maps.