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A Methodology for Lava Flows Hazard Zonation of Large Areas: An example of application to for the SE flank of Mt Etna

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The objective of this work is the application of a new technique for the definition of lava flows hazard maps to the SE flank of Mt Etna (Italy), one of the most dangerous areas in Europe in terms of volcanic hazard. The method relies on a "virtual laboratory", namely the lava flows simulation model SCIARA which, when adequately calibrated and validated, allows to well forecast the paths of new hypothetical events on present morphological data. The SE flank of Mt Etna was subdivided in different areas, each one characterised by a different probability of activation of eruptive vents (vents probability), and their union "covered" by a regular grid of vents. From each vent, different simulations were executed, each one with a particular effusion rate and duration. As for the areas, even the effusion rates were characterised by a probability of occurrence. For both cases, such probabilities were devised by analysing the behaviour of Mt Etna in the past 400 years. By considering the extent of the considered flank of Mt Etna, the density of the grid and the number of simulations executed for each vent, a total of 17000 simulations were carried out (that is, 50 different effusion rates for 340 lava source points). As it can be easily supposed, the execution of a so elevated number of simulations required the massive adoption of parallel computing. A "weight" was assigned to each of them (i.e. to each point in the DEM of the considered area interested by the lava flow), which was set greater for those simulations having the source point located in areas characterised by a high probability of vents

activation, and a highly probable emission rate. Moreover, other criteria can be considered, e.g. one related to the vent altitude, as it was observed that the more probable events are those more near to the summit of the volcano. The final hazard map was therefore compiled by considering each cell of the Etnean flank DEM and, for each of them, by adding the weights of all the simulations that interested it. Therefore, if the DEM is characterised by an elevated level of detail (as in this case), even the obtained map is so, as it is possible to determine an exact measure of the chance to be hit by a lava flow for each cell of the DEM itself.