

1 **A probabilistic approach to hazard mapping based on computer**
2 **simulations. An example for lava flows at Mount Etna**

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6 **Abstract** Determining sectors that could be affected by lava flows in volcanic areas is
7 essential for risk mitigation purposes. Traditionally, when adopting methods based on
8 probabilistic numerical simulations, the hazard is assessed by analysing a huge set of
9 simulations of hypothetical events, each characterized by a distinct probability of
10 occurrence based on statistics of historical events. If lateral or eccentric eruptions are also
11 taken into account, simulated lava flows usually start from the nodes of regular grids of
12 potential vents, uniformly covering the study area.

13 In this study, an alternative approach to evaluate flow-type hazard, based on a non-uniform
14 grid of potential vents, is proposed. The method takes into account expected changes in the
15 topographic context due to successive lava-flow bodies, and allows to obtain more detailed
16 maps for the most exposed areas, besides significantly reducing the computational efforts.
17 The approach has been tested to evaluate lava-flow hazard at Mt Etna (Eastern Sicily,
18 Southern Italy), and a preliminary analysis has been performed to investigate the behaviour
19 of the adopted technique with respect to the number of performed sets of simulations to
20 better understanding its predictive capability.

21 **Keywords:** Probabilistic approach, non-uniform grid, hazard mapping, lateral/eccentric
22 eruption, lava flow, Mt. Etna.

23 **1. Introduction**

24 Lava flows frequently threaten people and properties worldwide. About 10% of the world's
25 population lives next to volcanoes that are expected to show renewed activity, more than
26 half a billion people in four big cities being exposed to volcanic risk (Peterson, 1986;
27 Chester et al., 2001; Tilling et al., 2006).

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