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Scenarios of future eruptions at Vesuvius

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Cross evidences from volcanological, magmatological, geophysical and probabilistic researches account for a violent VEI 4 to 5 possible future eruption at Vesuvius.

A probabilistic approach based on the available volcanological data on the past eruptions of Somma-Vesuvius, has been developed in order to produce pyroclastic fall, pyroclastic density currents and secondary gravity flows hazard maps by using numerical simulations.

Field and laboratory data relative to the whole range of fall out, primary and secondary flows events and their relative occurrence have been assumed as input parameters in a very wide set of numerical simulations. Based on the convection- diffusion and migration equations, and the input data retrieved from the past eruptions, the simulation of fall out events has been carried out.

A general gravity driven model has been adopted in order to simulate both dilute and concentrated density currents on a digital topographic model of Somma-Vesuvius and its surroundings. Primary and secondary flows with specific features are simulated by discrete sampling of a multi-dimensional matrix of dynamic and rheological parameters based on field evidence and inferences as well as data reported in the literature. The simulated pyroclastic density currents are generated from the present Vesuvius vent, while the secondary gravity flows are generated from a set of 40 distinctive sources localized both on the volcano and surrounding mountain slopes. Results provide a set of possible scenarios relative to different types of events including pyroclastic flows, surge, lahars, rockslide avalanches, floods.

The results allow us to explore the hazard related to different types of pyroclastic

fallout and density currents, relative to a complete range of eruption VEI, in Vesuvius area and its surroundings including the city of Naples. Particularly, eruption with VEI ≤ 3 produce a fall out hazard within ca. 10 km range mostly east of the volcano and flow hazard within a range of ca. 2 km from the crater. Larger scale events ($4 \leq$VEI≤ 5) produce fall out hazard up to 80 km from the vent and flow hazard at distance even exceeding 15 km.

In particular the area north-west of Vesuvius which includes the Metropolitan area of Naples, featured by a low hazard level for fallout accumulation, is exposed to the primary PDCs also consistently with field evidences and archaeological findings. Both volcano flanks and surrounding plains and relieves are exposed to moderate - high level of hazard for passage and emplacement of pyroclastic secondary density currents.