How to cope with volcano flank dynamics? a conceptual model behind possible scenarios for Mt. Etna

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Volcano flank dynamics poses a serious hazard, also involving the inhabited lower slopes. Mt. Etna is a well-studied unstable volcano, and a significant amount of data has been collected on the dynamics of its eastern and southern flanks. We first propose a conceptual model to describe and explain flank dynamics at Etna; we identify the preconditions, as due to the differential unbuttressing conditions at the volcano base, and the triggering factors, as shallow magmatic sources (dikes, reservoirs). Evidence and parameters and/or observations for flank dynamics are listed, summarizing the 1994-2010 period of activity. Based on this, we then propose a set of scenarios possibly occurring in case of unrest of the unstable flanks of Mt. Etna. Flank unrest is a variation in the steady state condition of the volcano flanks, possibly accompanied by significant ground deformation, seismicity and eruptions. The scenarios may provide a general reference and recommendation in case of five types of multi-hazard processes related (either as a cause or effect) to flank dynamics: 1) edifice inflation; 2) emplacement of dikes along the NE and/or S rifts; 3) seismicity along Pernicana Fault System; 4) seismicity on the S sector; 5) seismicity along Timpe Fault System. Each scenario is analyzed and recommendations are given. The scenarios may or may not be related to each other, in the sense that the probability of occurrence of one scenario may or may not be contingent or dependent upon the prior occurrence of another. These scenarios provide a qualitative analysis of the multi-hazard processes related to flank dynamics; a more quantitative (i.e. probabilistic) characterization is under consideration.