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# Quantitative physical models of volcanic phenomena for hazards assessment of critical infrastructures

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Volcanic hazards may have destructive effects on economy, transport, and natural environments at both local and regional scale. Hazardous phenomena include pyroclastic density currents, tephra fall, gas emissions, lava flows, debris flows and avalanches, and lahars. Volcanic hazards assessment is based on available information to characterize potential volcanic sources in the region of interest and to determine whether specific volcanic phenomena might reach a given site. Volcanic hazards assessment is focussed on estimating the distances that volcanic phenomena could travel from potential sources and their intensity at the considered site. Epistemic and aleatory uncertainties strongly affect the resulting hazards assessment. Within the context of critical infrastructures, volcanic eruptions are rare natural events that can create severe hazards. In addition to being rare events, evidence of many past volcanic eruptions is poorly preserved in the geologic record. The models used for describing the impact of volcanic phenomena generally represent a range of model complexities, from simplified physics based conceptual models to highly coupled thermo fluid dynamical approaches. Modelling approaches represent a hierarchy of complexity, which reflects increasing requirements for well characterized data in order to produce a broader range of output information. In selecting models for the hazard analysis related to a specific phenomenon, questions that need to be answered by the models must be carefully considered. Independently of the model, the final hazards assessment strongly depends on input derived from detailed volcanological investigations, such as mapping and stratigraphic correlations.
For each phenomenon, an overview of currently available approaches for the evaluation of future hazards will be presented with the aim to provide a foundation for future work in developing an international consensus on volcanic hazards assessment methods.