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Mapping long-term pyroclastic density current hazard in a caldera setting: application to Campi Flegrei caldera (Italy)

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Mapping of pyroclastic density current (PDC) hazard is particularly challenging due to the complex dynamics of the flow and the uncertain nature of future events. Such a task is even more difficult in a caldera setting due to the large uncertainty on vent location and the complex topography affecting the flow propagation. Nevertheless, probabilistic mapping of PDC invasion, able to account for the significant intrinsic uncertainties affecting the system, is needed for both long- and short-term hazard assessment. Campi Flegrei is an example of active and densely urbanized caldera with a very high risk associated with the occurrence of PDC produced by explosive events of variable scale and vent location. In this study we present preliminary results of literature review, field and laboratory work, and statistical analysis of past eruptive activity aimed at producing long-term probabilistic PDC hazard maps at Campi Flegrei. Particular attention was given to the analysis of the volcanic activity over the last 5 ka in order to characterize the expected eruptive scenarios. Probabilistic maps of vent opening were first obtained by analysing the spatial distribution of past vent locations and other volcanological data. A Bayesian approach was adopted to account for different types of data and the relative uncertainties affecting them. Maps of vent opening and PDC runouts estimates, derived from field reconstructions and simple correlations, were then used to produce probabilistic long-term PDC hazard maps for different eruptive categories and for their ensemble. Results allow to quantify the influence of the different sources of uncertainty and theoretical assumptions on the maps produced and to better plan future research developments aimed at more accurate PDC hazard assessment in caldera settings.