Forecasting eruption size: what we know, what we don't know

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Any eruption forecast includes an evaluation of the expected size of the forthcoming eruption, usually expressed as the probability associated to given size classes. Such evaluation is mostly based on the previous volcanic history at the specific volcano, or it is referred to a broader class of volcanoes constituting "analogues" of the one under specific consideration. In any case, use of knowledge from past eruptions implies considering the completeness of the reference catalogue, and most importantly, the existence of systematic biases in the catalogue, that may affect probability estimates and translate into biased volcanic hazard forecasts. An analysis of existing catalogues, with major reference to the catalogue from the Smithsonian Global Volcanism Program, suggests that systematic biases largely dominate at global, regional and local scale: volcanic histories reconstructed at individual volcanoes, often used as a reference for volcanic hazard forecasts, are the result of systematic loss of information with time and poor sample representativeness. That situation strictly requires the use of techniques to complete existing catalogues, as well as careful consideration of the uncertainties deriving from inadequate knowledge and model-dependent data elaboration. A reconstructed global eruption size distribution, obtained by merging information from different existing catalogues, shows a mode in the VEI 1-2 range, <0.1% incidence of eruptions with VEI 7 or larger, and substantial uncertainties associated with individual VEI frequencies. Even larger uncertainties are expected to derive from application to individual volcanoes or classes of analogue volcanoes, suggesting large to very large uncertainties associated to volcanic hazard forecasts virtually at any individual volcano worldwide.