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A quantitative model for the time-size distribution of eruptions

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The modeling of the statistical distribution of eruptive frequency and volume provides basic information to assess volcanic hazard and to constrain the physics of the eruptive process. We analyze simultaneously data from several worldwide volcanoes in order to find "universal" relationships and peculiarities linked to different eruptive styles. In particular, we investigate on i) testing the Poisson process hypothesis in the time domain, looking for significant clustering of events or the presence of almost regular recurrence times, ii) the relationship between the time to the next eruption and the magnitude of the previous event (i.e., time predictable model), and iii) the relationship between the magnitude of an event and the previous repose time (i.e., size predictable model). The results indicate a different behavior of volcanoes with open and closed conduit regimes. In the first case, volcanoes follow a time predictable model, with a marked time clustering of events; in the second case, volcanoes have a weak tendency towards a size predictable model and the eruptions occur mostly random in time. Finally, these results are used to build general probabilistic models of the time-size distribution of open and closed conduit volcanoes.