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Crustal controls on the frequency and magnitude of volcanic eruptions

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Quantifying the frequency-Magnitude (f-M) relationship for volcanic eruptions is important to estimate volcanic hazard. Furthermore, understanding how this relationship varies between different groups of volcanoes can provide insights into the processes that exert control on the frequency and size of volcanic events. Using the LaMEVE record of large-magnitude volcanic eruptions we calculate the f-M relationship for sets of volcanoes according to factors such as morphology and tectonic setting. We use a Bayesian framework, which allows us to conceptualize the volcanic record as a series of individual and unique time series, associated by common group behavior. We identify variations in f-M behavior between different regions on Earth, with volcanic arcs where the crust is thicker associated with a higher proportion of larger-magnitude eruptions. Together with crustal magma fluxes, the crustal thickness is used to explain regional variations in the f-M relationship. The comparison between sets of volcanoes with different characteristics allows us to understand the processes that determine both similarities and differences in the tempo of volcanism for different groups. Additionally, understanding the link between tectonic setting, physics of magmatic processes, and the recurrence rate of volcanic eruptions will serve to improve our capacity to quantify volcanic hazard in regions with limited geological and historical records of volcanic activity.