Unique records and common frequencies: An exchangeable approach to analyse global and regional records of volcanic eruptions

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Volcanic eruption of magnitude larger than 4 can occur infrequently, meaning that when calculating the recurrence rate of these events, a large global dataset is required to sample robustly. Resultantly, to account for under-recording a 'global completeness' date is chosen, which is further back in time with increasing eruption size. This approach, however, ignores a fundamental characteristic of volcanoes, that each volcano has its own record and thus it's own completeness date. Employing a Bayesian method we examine the effect of choosing a unique completeness date for individual volcanoes within an exchangeable group of volcanoes. This approach allows us to assess and account for issues of completeness associated with eruption size, such that the level of under-recording in the group is consistent through time across all eruption magnitudes. Using these results and accounting for the systematic level of under-recording in the dataset we observe variation between different exchangeable groups of volcanoes related to fundamental magmatic processes. Furthermore, this method allows us to calculate the level of under-sampling between the different groups and various regions. Our results are in agreement with previous studies and show that the region of lowest under-sampling is Japan, providing support for the assumptions and methodology developed.