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Volcanic hazard assessment for the Canary Islands (Spain) using extreme value theory, and the recent volcanic eruption of El Hierro

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The Canary Islands are an active volcanic region densely populated and visited by several millions of tourists every year. Nearly twenty eruptions have been reported through written chronicles in the last 600 years, suggesting that the probability of a new eruption in the near future is far from zero. This shows the importance of assessing and monitoring the volcanic hazard of the region in order to reduce and manage its potential volcanic risk, and ultimately contribute to the design of appropriate preparedness plans. Hence, the probabilistic analysis of the volcanic eruption time series for the Canary Islands is an essential step for the assessment of volcanic hazard and risk in the area. Such a series describes complex processes involving different types of eruptions over different time scales. Here we propose a statistical method for calculating the probabilities of future eruptions which is most appropriate given the nature of the documented historical eruptive data. We first characterise the eruptions by their magnitudes, and then carry out a preliminary analysis of the data to establish the requirements for the statistical method. Past studies in eruptive time series used conventional statistics and treated the series as an homogeneous process. In this paper, we will use a method that accounts for the time-dependence of the series and includes rare or extreme events, in the form of few data of large eruptions, since these data require special methods of analysis. Hence, we will use a statistical method from extreme value theory. In particular, we will apply a non-homogeneous Poisson process to the historical eruptive data of the Canary Islands to estimate the probability of having at least one volcanic event of a magnitude greater than one in the upcoming years. Shortly after the publication of this method an eruption in the island of El Hierro took place for the first time in historical times, supporting our method and contributing towards the validation of our results.