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Statistical analysis of the cyclical lava dome emplacement and destruction processes at Popocatepetl volcano, central México

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After almost 70 years of quiescence Popocatepetl volcano erupted in 1994. After of a predominantly phreatic activity lasting one and a half years, the volcano entered a magmatic effusive phase that has emplaced a succession of 38 lava domes between 1996 and 2015. The sustained, irregular and non-stationary process of emplacements and further destruction of lava domes shows a complexity that has required the use of various statistical methods to gain insight into the physics and dynamics of the process. The time series describing the lava dome emplacements are modeled with the Weibull and the Mixture of Exponentials (MOED) distributions. Also, residence times (time between the date of emplacement and a main destruction event), the maximum emplaced volumes and the dome thicknesses are modeled with simple exponential distributions. To account for the non-stationary character of the dome emplacement and destruction process, we modeled the dome volume exceedances with a compound non-homogeneous Pareto-Poisson process (NHPPP) in specific time intervals. The statistical analysis of the ongoing episode has allowed to calculate the probability of emplacement of domes exceeding a specified volume in a given time interval, and also to establish objective criteria for recognizing an alteration or a different trend in the non-stationary sequence of emplaced domes that could be indicative of a change in the nature of the cyclic lava dome emplacement and destruction process.