



## **Phreatic eruptions at Ruapehu: Occurrence statistics and probabilistic hazard forecast**

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Phreatic eruptions, although posing a serious threat to human life in crater proximity, are often underestimated or neglected, and have been comparatively understudied with respect to magmatic events.

The detailed eruption catalogue for Ruapehu Volcano (North Island of New Zealand) provides an exceptional opportunity to study the statistics of recurring phreatic explosions at an active crater lake volcano. We first carried out a completeness analysis of this catalog; then, we performed a statistical analysis on this phreatic eruption database, which suggests that phreatic events at Ruapehu do not follow a Poisson process. Rather, they tend to cluster, which is possibly linked to an increased heat flow during periods of a more shallow-seated magma column. The average probability for a phreatic explosion to occur at Ruapehu within the next month is about 10%, as inferred from the complete part of the catalog studied. However, the frequency of phreatic explosions is significantly higher than the background level in years prior to magmatic episodes.

The combination of numerical simulations of ejected clasts' trajectory with a Bayesian event tree tool (PyBetVH) has allowed performing a full probabilistic assessment of the hazard due to ballistic ejecta in the summit area of Ruapehu, which is frequently visited by hikers. Resulting hazard maps show that the absolute probability for the summit to be affected by ballistics within the next month is up to 6%. The hazard is especially high on the northern lake shore, where there is a mountain refuge. Epistemic uncertainty associated to the resulting hazard maps is also quantified.

Our results contribute to the local hazard assessment as well as the general perception of hazards due to steam-driven explosions.