An operational approach to generate and visualize Bayesian probabilistic volcanic hazard curves and maps by means of BET_VH tool

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The recent renewed software design of BET_VH code (available on the Vhub cyber-infrastructure at http://vhub.org/resources/betvh) has represented the opportunity for both improving dissemination and usability of this tool and, at the same time, introducing new important features as the calculation of volcanic hazard curves for a given point, or area, of interest and the corresponding hazard maps.

So far, the BET_VH tool was designed to plot maps for a selected target region showing the probability of overtaking a given threshold associated to a given phenomena (for example a given load of tephra fallout), either conditional to the occurrence of an eruption of a specific size from a specific vent, or absolute (i.e. considering every possible size and vent location). These maps can show either a best guess value (e.g. the mean or the median), or, being a Bayesian tool, can be provided in terms of a selected percentile, to have an idea of the dispersion around the best guess, i.e. of the epistemic uncertainty. Such maps are a good synthesis of the hazard evaluation, but much more information is available beyond these maps.

Hazard curves shows, for a given area of interest, the exceedance probability (y axis) as a function of the threshold intensity measure (x axis) of the considered phenomena (e.g. tephra load). The production of hazard curves within the renewed BET_VH tool represents a significant improvement since: (i) it allows to preserve more detailed hazard information, by providing the probability of overcoming different threshold values for each spatial point or area; (ii) hazard curves are the most common output from hazard investigations for quantitative risk assessment, as they can be successfully coupled to vulnerability analysis; (iii) they allow the production of statistical hazard maps, where the intensity providing a pre-defined value of the probability of exceedance is plotted (e.g. 10% in 50 years). Furthermore, as BET_VH is a Bayesian tool, the uncertainty associated to these curves is computed and visualized as well.

In the present work all the operational steps to provide hazard curves to BET_VH tool will be introduced and described, from the method of generating the curve to its implementation in the code and, finally, its visualization in the tool. The work is mutually supported by the ByMuR project, hosted at the Istituto Nazionale di Geofisica e Vulcanologia, Italy, and the Vhub team of the University at Buffalo, US.