Explosive volcanic eruptions: analysis of the LaMEVE database

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As a component of the Global Volcano Model (GVM), the Volcano Global Risk Identification and Analysis Project (VOGRIPA) aims to facilitate global volcanic hazard and risk assessment in an open access environment. The Large Magnitude Explosive Volcanic Eruptions (LaMEVE) database is the first and central component in this undertaking, and is now available to all online at www.bgs.ac.uk/vogripa.

The LaMEVE database comprises information on over 3000 volcanoes, with approximately 1900 Quaternary eruptions of magnitude or VEI 4 and above. Such eruptions can be catastrophic on regional and even global scales. We welcome input from the volcanological community to maintain this comprehensive database to ensure accuracy and sustainability.

Data regarding the VEI, magnitude and intensity of eruptions is recorded in the database. A good correlation is found between magnitudes and VEI, with 90% of VEI 4 to 6 eruptions having equal corresponding magnitudes (i.e. 90% of VEI 5 eruptions lie within the magnitude range of M5.0-5.9). Further analysis of the LaMEVE database has identified the issue of under-recording of eruptions, with 50% of eruptions recorded in about the last 20ka despite the dataset extending to the beginning of the Quaternary (2.58Ma). Under-recording varies by region, demonstrated by the dominance of Japanese activity in the database, with approximately 40% of all eruptions being from Japanese volcanoes. This illustrates the need for further research to gain a better understanding of global volcanism and its implications. The preservation potential of larger eruptions with more widespread deposits is observed, with a clear decrease over time in the recording of magnitudes 4 to 6. However, analysis of the magnitude-frequency relationship continues to identify proportionally lower frequencies of larger events. We have quantified the increase in under-recording back in time for different magnitude eruptions and empirically estimated the global frequency and its uncertainty assuming that volcanism is stationary. We have also examined deviations from a simple monotonic functional fit through the eruptions rate data to see if there is evidence for non-stationarity. We present a revised magnitude-frequency relationship for large magnitude global explosive activity which indicates a departure from a simple power law for M>6.5, supporting a reduced rate of eruption for these large magnitudes compared to extrapolation of the power law representing M<6.5 data.

Further databases concentrating on individual volcanic hazards as well as vulnerability are being prepared in a collaborative effort with numerous institutions. The hazards databases will be inter-related to permit the identification of locations at high risk and gaps in knowledge, and to allow scientists and disaster managers to analyse risk within a global context of systematic information.