AvH8-10
8th Alexander von Humboldt International Conference
Cusco, Peru, 12 – 16 November 2012

The probability of future plinian eruptions at the Central American Volcanic Arc: a statistical time series analysis

H. Wehrmann (1), Y. Dzierma (2,3), S. Kutterolf (1), and T. Schaller (2)

(1) SFB574, GEOMAR | Helmholtz Centre for Ocean Research Kiel, Wischhofstr. 1-3, 24148 Kiel, Germany , (2) SFB 574, Dept. of Geophysics, Institute of Geosciences, Christian-Albrechts-Universität zu Kiel, Otto-Hahn-Platz 1, 24118 Kiel, Germany, (3) Dept. Radiation Oncology, Saarland University Medical Centre, Homburg/Saar, Germany

Plinian eruptions belong to the most devastating types of volcanic activity, thus posing a dramatic hazard for people and property far beyond the immediate surroundings of a volcano. Assessing such hazard involves an estimate of how strongly a particular locality/area will be affected by a future eruption, combined with the question of how likely it is that an eruption will happen. The first issue is approached by determination of typical eruption behaviour in terms of eruption styles, magnitudes, and intensities, inferred through detailed isopach and isopleth mapping of past eruptions' deposits. Thereby, risk-exposed areas can be identified and evaluated under consideration of their infrastructural vulnerability. The second aspect requires to understand the chronological character of a volcano or a volcanic area. Analysing eruption records by means of statistical time series provides a powerful tool for meeting the growing demand for probabilistic eruption forecasting.
The Central American Volcanic Arc (CAVA) has been site of numerous exceptionally explosive and voluminous plinian eruptions over the past 200 000 years. We here process the long-term plinian eruption record of the subduction system by statistical means, considering felsic and mafic eruption sequences separately. After ensuring that the necessary conditions for the analysis are fulfilled, the Kaplan-Meier method is applied to estimate survival functions. Subsequently, the exponential, the Weibull, and the log-logistic distribution are fit to the data. All functions are confirmed by goodness-of-fit tests to describe the data sets adequately well. Future eruption probabilities within a given time interval are then estimated from the survivor functions. The likelihood that a large felsic plinian eruption will occur at the CAVA within the next ∼100 years is 5-8 %, and the 50 % probability is reached within ∼1300 years. Mafic plinian eruptions are less likely to occur, their probability to happen within ∼100 years amounts to 1 %, while the 50 % and 100 % probability is reached in ∼6,000 and ∼50,000 years, respectively. Compared to the felsic plinian eruptions, this latter result may seem relatively reassuring – but in the context of the worldwide record, in which plinian eruptions of mafic compositions are extremely scarce and still considered exotic, it is a high probability. As an unusually common phenomenon at the CAVA, we emphasise the importance to adequately consider mafic plinian eruptions in the course of comprehensive volcanic hazard assessment.