Geophysical Research Abstracts, Vol. 7, 02622, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02622

A probabilistic event tree analysis (ETA) of the risk posed by Arenal-type pyroclastic flows generated by crater wall collapse and the outpouring of an active lava pool at the popular resort of Arenal Volcano, Costa Rica

A. F. Meloy

University of Portsmouth, England (afmeloy@hotmail.com)

A probabilistic event tree risk analysis is performed at Arenal volcano, Costa Rica for the newly recognised hazard of Arenal-type pyroclastic flows. These flows are generated by the sudden depressurisation and fragmentation of an active basalt-andesitic lava pool as a result of a partial collapse of the crater rim. The deposits of this type of flow typically have flow fronts of $\sim$2 m high, are reverse graded with blocks up to 9 m in diameter, and include juvenile clasts which are rarely found in other types of pyroclastic flow.

An event tree is a useful tool and framework in which to analyse and graphically present the probabilities of the possible occurrence of many events in a complex system, allowing the probabilities of different scenarios or outcomes to be compared. Each node on each branch of the tree is a possible event that is a logical consequence of the one before it, and a necessary precursor of the one that follows. The event tree is read from left to right where the intermediate events become increasingly more specific from the first initiating event through to the final outcome. As probabilities are attached to each event (and the events at each level of the tree are mutually exclusive and exhaustive) the event trees can also be referred to as *probability trees*. Four such probability trees are created in the analysis, three of which are extended to investigate the individual risk faced by three fictitious individuals: Señor Ramon the resident, Carlos the worker, and Mrs. Jones the tourist. These individuals represent the three different groups at risk from the volcano. The population is split in this way because the probability of exposure (and thus individual risk) varies according to the activity patterns of each individual.

Two sets of risk maps are created from the probability values determined by the ETA and these are used to show how the risk varies for each individual in different areas around the volcano. The first set shows the general, geometric distribution of risk based solely on the results of the event trees, while the second set is created in conjunction with various topographic maps to infer the likely flow paths and thus better constrain the areas of risk i.e. higher risks in valleys than on topographic highs etc. The risks are then compared to more familiar risks through the conversion of the raw probability values into a set of linguistic expressions (i.e. VERY HIGH, HIGH, MODERATE etc) using an established risk classification scale. The varying response of each individual when faced with their individual risk estimates and their semi-tailored risk maps is then explored with reference to the concept of risk tolerance. In some cases the level of risk can be reduced by two whole classes by relocating from the north to the south.

Several recommendations concerning the ETA are suggested in order to improve its appeal to an observatory as an effective modelling and forecasting tool. These include the modification of the technique through the use of fuzzy set theory to allow the implementation of a fuzzy event tree analysis (FETA), properly taking into account the inherent uncertainty of the probabilities involved. While the general use of fuzzy logic in volcanology has previously been explored, as far as can be judged a FETA has not been applied to a volcanic environment before.