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Population vulnerability and risk ranking of European volcanoes for insurance applications

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Large volcanic eruptions are rare events, but when they do occur, they have the potential to cause devastation to property and activities over a wide area, causing huge economic losses, and threatening human populations. There are significant numbers of highly active volcanoes in the wider European region, including those in Iceland, the Spanish Canary Islands, the Portuguese Azores and the French islands of the Lesser Antilles, Italy, and Greece.

This paper presents a new risk ranking of European volcanoes, designed to compare the risks to human populations on a consistent basis, enabling the identification of those volcanoes which would require further detailed studies. The risk ranking uses newly available population data combined with statistical data on the impacts of volcanic eruptions to identify the number of people who may be at risk from different volcanic hazards.

The risk ranking was conducted in three steps. First, a list was compiled of all European volcanoes which have had eruptions of magnitude VEI2 or above in the last 2 millenia. Secondly, statistical data from global eruptions was used to identify the areas of probable influence of tephra fall at different levels, and also of pyroclastic flow runout, for each volcano. Finally, a global population dataset was used to produce an estimate of the population exposed to each level of hazard, leading to a table of risk ranking in terms of population affected.

A ranking was subsequently made on the basis of the number of people at risk from life-threatening hazards – either tephra fall exceeding 25 cm, or pyroclastic flow

runout - and this number has been converted to a logarithmic scale (5=100,000 people at risk. 4=10,000 people at risk etc). Vesuvius, with a risk ranking of 6.2 is by some margin the most dangerous volcano in the European region, and the only one creating life-threatening hazards to more than one million people. But two other volcanoes have a risk ranking exceeding 5 (more than 100,000 people exposed to life-threatening hazards); Campi Flegrei, also close to Naples, and Soufrière, of Guadeloupe. A further 8 volcanoes have risk indices greater than 4, i.e. threatening to more than 10,000 people, one each in Italy and Iceland, three in the Caribbean and three in the Azores.

This risk ranking does not consider the relative vulnerability of the population or the building stock, which would need to be the subject of more detailed investigations, volcano by volcano. In spite of its limitations, it is thought that the risk index proposed clearly identifies the scale of the risk, and the risk ranking based on historical experience, and therefore shows which volcanoes demand more detailed studies, given their potential population vulnerability.