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Risk assessment at the Soufrière Hills volcano, Montserrat

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The volcanic eruption at the Soufrière Hills, Montserrat began in July 1995 and has continued ever since to 2009. Over 0.85 km3 of andesite magma has been extruded and hazards have included pyroclastic flows generated by dome collapses and vulcanian explosions, volcanic blasts, ash fall and lahars. The eruption led to evacuation of about 60% of the island, the deaths of 21 citizens, a population reduction from 11,000 to about 4,000, and economic losses estimated at over one billion $US by 2001. Scientists from the Montserrat Volcano Observatory (MVO) and scientific advisors to the UK and Montserrat Governments have developed techniques for the probabilistic assessment of hazards and risks, some of which have been applied to a volcanic emergency for the first time. Since 1997 a panel of scientists has met approximately every six months to assess the status of the volcano and attendant hazards and risks. The Panel works by first updating the scientific information on the most recent volcanic activity based on the monitoring of the MVO and on research endeavours in the scientific community, including modelling, analytical studies and experiments. The scientific information and understanding are merged to assess the volcano's status from a hazard perspective. Wherever possible assessments are quantitative and are based on measurements and physical models of hazardous processes (e.g. dome growth and pyroclastic flows). Where understanding is more empirical or qualitative the Panel use expert elicitation methods to estimate critical process parameters and their uncertainties. The assessments are incorporated into an event probability tree that expresses the probability of occurrence of specific volcanic events that can result in hazards (or an absence of them) over different future time periods of interest to the authorities. These probabilities include both central mean values and credible interval uncertainty estimates. The contributions of all volcanic hazards are then combined by Monte Carlo techniques to evaluate societal and individual risks as constrained by, for example, population numbers and geographical distributions. These risk estimates are expressed by charts of probability against number of fatalities and by reference to risk exposure scales and statistics for informing specific hazard mitigation issues for the authorities.