What to do when there is neither time nor a group of experts for expert elicitation?

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Two increasingly popular approaches to probabilistic eruption forecasting rely on carefully structured expert elicitation. The Bayesian Event Tree for Eruption Forecasting (BET-EF; Marzocchi et al., 2008) conducts elicitations well in advance of a crisis to identify parameters and thresholds that can then be applied objectively during real volcanic crises. The method of Cooke (1991), adapted by Aspinall (2006), elicits expert opinion during simulated or real volcanic crises. In the latter method, experts are pre-tested to weight their credibility and then asked to evaluate probabilities of various outcomes for unfolding unrest. Both methods are based on monitoring data, eruptive history, volcanologic theory and models and both involve some subjectivity. The main difference is whether subjective analysis is done before or during a crisis.

In some volcanic crises, there is neither a prior elicitation or time and a group to do a new elicitation. An alternative is for one or a few scientists to use all available data sets to estimate probabilities at each node of an event tree such as the generic one proposed by Newhall and Hoblitt (2002). Some of these data sets are small, e.g., limited data on VEIs of the volcano in question. But even at poorly-known volcanoes, the data set may be expanded by considering unrest and eruptions at analogous volcanoes. Several databases can help, e.g., WOVOdat for statistics on origin of unrest, likelihood and magnitude of eruption; Smithsonian GVP database and VOGRIPA for eruption magnitude, phenomena, sectors, and distance); research on the effects of eruptions to judge vulnerability; VPI (Ewert and Harpel, 2000), LandScan, or census data to know populations at risk; and research on human responses to judge whether those at risk can be moved. It is not necessary to favor one data set over another; we consider all and use high and low estimates as measures of uncertainty at each node. The data and logic are explained for each node of the event tree in an accompanying document. Our method risks excessive reliance on the expertise of just a few individuals, but it has an advantage of easy-to-follow tracing of the data and logic for each estimate of probability at each node.

Will such a simple approach stand in a court of law? If each data set for each node is clearly presented and justified, and no attempt is made to choose between them, the facts can stand by themselves. No pertinent data set is ignored, or subsumed into a more amorphous product of many data sets and interpretations. BET-EF and the Cooke-Aspinall method have the advantage of many viewpoints and they may protect individual scientists from legal challenges. However, these procedures may be impractical during a rapidly evolving crisis at a poorly-known volcano. We see great value in all of these probabilistic approaches to forecasting and we recommend that all of them be used and compared whenever practical.