Community-based short-term eruption forecasting at Campi Flegrei

Jacopo Selva[1], Warner Marzocchi[2], Paolo Papale[3], Lucia Civetta[4], Edoardo Del Pezzo[4], Laura Sandri[1]

[1] *Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Bologna, Bologna, Italy*
[2] *Istituto Nazionale di Geofisica e Vulcanologia, Sezione Roma 1, Roma, Italy*
[3] *Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Pisa, Pisa, Italy*
[4] *Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Vesuviano, Napoli, Italy*

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A key element in emergency preparedness is to define in advance tools to assist decision makers and emergency management groups during crises. Such tools must account for all of the expertise and available scientific knowledge. During a pre-eruptive phase, the key for sound short-term eruption forecasting is the analysis of the monitoring signals. This involves the capability (i) to recognize anomalous signals, relating single or combined anomalies to physical processes, and to assigning them probability values, and (ii) to quickly provide an answer to the observed phenomena even when unexpected. Here we present a > 4 years long process devoted to define the pre-eruptive Event Tree (ET) for Campi Flegrei. A community of about 40 experts in volcanology and volcano monitoring participating to two Italian Projects on Campi Flegrei funded by the Italian Civil Protection, has been constituted and trained with periodic meetings on the statistical methods for the ET definition, based on the model BET_EF (Marzocchi et al., 2008). Model calibration has been carried out through public elicitation sessions, preceded and followed by devoted meetings and web forum discussions on monitoring parameters, their accuracy and relevance, and their potential meanings. The calibrated ET allows anomalies in the monitored parameters to be recognized and interpreted, assigning probability values to each set of data. This process de-personalizes the difficult task of interpreting multi-parametric sets of data during on-going emergencies, and provides a view of the observed variations that accounts for the averaged, weighted opinion of the scientific community. We first discuss all mathematical aspects of the probabilistic model used to translate available data, expert opinions, and monitoring measures into a probability assessment. Then, we discuss the results of this 4-years process. Notably, the results draws a clear and rational picture of what the community, as a whole, considers well established and then useful for practical applications. The elicitation process enables us to filter out possible biases introduced by personal and/or specialist beliefs that the community (still) considers not enough constrained or too speculative. Such a common picture can be also particularly useful to guide future implementations of the monitoring network, as well as research investments aimed at substantially improving the capability to forecast the short-term volcanic hazard.