Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile
'Understanding volcanoes and society: the key for risk mitigation'

A new Bayesian Event Tree tool to track and quantify volcanic unrest: application to Kawah Ijen volcano

Roberto Tonini[1] , Laura Sandri[2] , Dmitri Rouwet[2] , Corentin Caudron [3], Warner Marzocchi [1], Suparjan[4]

[1]Istituto Nazionale di Geofisica e Vulcanologia, Roma 1, Italy

[2]Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy

[3]Bullard Laboratories, Department of Earth Sciences, University of Cambridge, UK

[4]Centre for Volcanology and Geological Hazard Mitigation, Indonesia

Keywords: probabilistic eruption forecasting, non-magmatic unrest, Bayesian event tree, monitoring data, Kawah Ijen

Most of volcanic hazard studies focus on magmatic eruptions; however, volcanic hazardous events can also occur when no migration of magma can be recognized, as for examples during tectonic and hydrothermal unrest. In particular, hydrothermal unrest may lead to phreatic eruptions and recent events (e.g., Ontake eruption on September 2014) have demonstrated that they are still hard to forecast, despite being potentially very hazardous. For these reasons, it is of paramount importance to identify indicators to define the condition of non-magmatic unrest, in particular for hydrothermal systems. Often, this type of unrest is driven by movement of fluids, requiring alternative monitoring setups, beyond the classical seismic-geodetic-geochemical architectures. Here we present a new version of the probabilistic BET (Bayesian Event Tree) model, specifically developed to include the forecasting of non-magmatic unrest and related hazards. The model is presented together with its software implementation, a user-friendly and open-access tool aiming to handle probabilistic forecasting and visualize the corresponding results. The new event tree and tool are here applied to Kawah Ijen stratovolcano, Indonesia. The tool is set on the basis of monitoring data for the learning period 2000–2010, and is then blindly applied to the test period 2010–2012, during which significant unrest phases occurred. This application illustrates how this tool can be used to support the activities of volcano observatories, by integrating beliefs, models, past data and monitoring observations in a Bayesian Event Tree framework, in order to provide probabilistic hazard evaluations during volcanic crisis.