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Operational eruption forecasting and probabilistic tephra fallout hazard assessment at Campi Flegrei (Italy)

Paolo Perfetti ¹, Jacopo Selva ¹, Laura Sandri ¹, Giovanni Macedonio ², Roberto Tonini ³, Luca D'Auria ², Antonio Costa ¹

¹INGV, Bologna,

²INGV-Osservatorio Vesuviano, Napoli,

³INGV, Roma

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BET-Tephra is a software tool written in Python to compute and visualize long- and short-term eruption forecasting and probabilistic tephra hazard assessment. The tool is based on the procedure described by Selva et al. (2014) that combines a Bayesian Event Tree method and results from Fall3D tephra dispersal simulations. BET-Tephra uses a Probabilistic Volcanic Hazard Analysis (PVHA) strategy to capture the intrinsic variability in eruptive sizes and vent positions and to assess the uncertainty due to the limited knowledge about past events and present state of the volcano. In order to address the computational intensive work required, the overall architecture has been designed to be distributed, using the popular open source distributed task queue Celery. To disseminate the results that depend on a wide range of stochastic variables, the computed hazard curves and post-processing results are visualized in a web page served via an internal Flask web server, along with tephra models results and parameters values. BET-Tephra creates both static images and it uses standard open technologies and resources like javascript and OpenStreetMap tiles to render dynamic map widgets easily explorable by decision makers. BET-Tephra is currently installed at the monitoring room of the Osservatorio Vesuviano and it is used to automatically gather the available monitoring parameters from local databases, downloading and converting data from weather forecast, running external tephra dispersal simulations and provide short-term PVHA for Campi Flegrei. The program is scheduled to run and update data on a regular interval depending on the alert level (as declared by the Italian Department of Civil Protection) while a secondary equivalent running installation is deployed at INGV in Bologna, Italy to ensure a geographically resilient backup.