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A procedure to forecast volcanic ash dispersal: Application to the 2010 Mt. Merapi's eruption

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After an initial phase, started on 26 October 2010 and mainly characterized by gravitational pyroclastic flows, Mt. Merapi shifted its activity to produce intense sustained plumes. This activity released a significant amount of ash in the atmosphere producing a serious threat to aviation and surrounding region. We report here forecasts from numerical modelling of atmospheric dispersal of volcanic ash generated by these buoyant plumes.
Numerical results were produced by a new forecasting procedure able to automatically produce maps of hazardous ash concentration and deposition. The procedure is based on the dispersal code VOL-CALPUFF (Barsotti et al. 2008), a hybrid Eulerian-Lagrangian model able to describe the transient and three-dimensional dynamics of the volcanic plume and ash cloud movements since its release to ground deposition. The procedure requires several input data to be executed. The main are the geophysical and meteorological datasets, the emitting starting time and duration of the emission, an estimate of the eruptive mass flow-rate (or, alternatively, the column height), and the grain size distribution of the mixture. Once the volcano of interest is selected, the procedure automatically downloads and elaborates USGS geophysical data and weather forecasting data coming from the Global Forecasting System (GFS) over a predefined spatial domain.
Since it is often not possible to have accurate data on the on-going eruptive activity (such as its intensity and duration) a multi-scenario approach should be adopted to address the main uncertainties affecting the system. During the Mt. Merapi's eruption we simulated two plausible explosive scenarios characterized by different eruptive intensities and properties defined on the basis of the volcano history and satellite image retrievals.
The new procedure has been developed in the framework of the EU-funded SAFER Project and it has been used to support the Center of Volcanology and Geological Hazard Mitigation (CVGHM) partner of MIA-VITA Project during Merapi's crisis. Ultimately, it could be a useful tool to inform and support the decisions of Civil Protection authorities in mitigating the volcanic risk. In particular forecasting hazard maps could be used to mitigate the impact of ash on aviation traffic, human health, and terrestrial transportation and infrastructures. Moreover this experience demonstrated an important level of cooperation between FP7 projects also showing the preparedness and rapid response of scientific teams during a major volcanic event.