Global sensitivity analysis of the Tephra fallout carried out by a numerical dispersion model of the volcanic particles: an application to Etna

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In this paper, we present the results of global sensitivity analysis of tephra fallout carried out by TEPHRA model, an advection-diffusion 2D model that describes the sedimentation process of particles from volcanic plumes. We calculated the tephra fallout coming from some explosive eruptions of Mt. Etna and estimated the uncertainty. The assessment of uncertainties has important implications in health impact studies. Very little has been done so far, mainly because the characterization of the full chain of uncertainties (from errors in primary data down to model selection and use) is the most difficult step of the analysis.

We use a methodological approach for the characterisation of the uncertainty of the tephra fallout which is based on the Monte Carlo method. The global sensitivity analysis on the TEPHRA model is conducted using the extended Sobol' approach, a technique based on the decomposition of the output variance developed at the JRC. A combination of sensitivity analysis and Generalised Likelihood Uncertainty Estimation, a technique developed by Beven and Binley for hydrological models, is used for Bayesian parameter estimation and model quality assessment.

We illustrate the results of a few case studies for the Etna volcano.