A benchmarking exercise to promote inter-comparison for numerical models of pyroclastic density currents

Sylvain J Charbonnier[1], Domenico Doronzo[2], Tomaso Esposti Ongaro[3]

[1]University of South Florida, USA, [2]SUNY at Buffalo, USA, [3]INGV Pisa, Italy

E-mail: sylvain@usf.edu

Prediction of the impacts of pyroclastic density currents (PDCs) is required for hazard and risk assessment, and for design of risk mitigation measures. The goal of such predictions is to estimate the area that may be affected by the movement of a potential PDC, and to map hazard intensity parameters, such as temperature, dynamic pressure, velocity, depth of flow and thickness of deposits. The technology for making such predictions has advanced substantially in recent years. Numerical computer-based models now exist, capable of approximating the motion of a given volume of pyroclastic material from its source to the deposition area. As the technology begins to mature, it is useful to compare the various models each other.

A benchmark is a comparison of models aimed at simulating the same physical process upon common initial and boundary conditions and outputs, but using different physical formulations, mathematical approaches and numerical techniques. Recently, an effort has been done on PDC numerical modeling in the direction of constraining the models themselves with data coming from different approaches, such as field study and experiments. In particular, one fluid depth-averaged and multiphase models have been constrained with field and observation data from some representative eruptions of Merapi, Montserrat, Mount St. Helens, and Vulcano. Results of these numerical simulations mainly apply to stratovolcanoes, and show interesting points. When PDCs interact with topography, the basal part of the flow is strongly affected by interaction. Then, this interaction is responsible for supplying sediment to the basal flow through a sedimentation rate. Finally, the sedimentation rate is redistributed laterally on the substrate from the basal flow itself. This is a general geological context in which to locate the benchmarking exercise as a starting point of models comparison.

Following the approach of inter-comparison projects for volcanic ash dispersal and atmospheric models, and the 2007 Hong Kong Landslide Runout Analysis Benchmarking Exercise, a one-day workshop will be held at the 2013 IAVCEI Scientific Assembly that will set up the basis for a future general benchmarking exercise on volcanic mass flow models. The workshop program will include an introductory lecture, an open discussion to establish the set of benchmarks able to cope with the challenges of modeling volcanic mass flows and, if possible, selected presentations of preliminary results from the future participants of the benchmarking exercise.