Towards a multiphase finite element code for the evaluation of volcanic risk

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Abstract

The emergency planning of areas subjected to volcanic risk requires the evaluation of impact induced on different element exposed (people, buildings, infrastructures, economy, etc.) by different volcanic phenomena. The quantification of the hazard has been obtained, in previous works with numerical simulations [1] involving finite difference method and multiphase flow approximations.

In this work we present a preliminary study for the sumulation of pyroclastic flows induced by sub-Plinian volcanic eruption of type I (reference scenario by the Volcanic emergency plan), characterized by injection in the atmosphere of gas at high temeperature and pressure convecting solid particles. We use a Finite Element discretization of the mutiphase flow model proposed in [2] in kinetic and thermal equilibrium. The numerical instabilities arising for advective dominant problems solved with standard finite elements are treated using a variational multiscale method [3]

The numerical code under development is a promising tool for a correct determination of pressure and temperature induced on buildings after a volcanic event. Future developments will include the coupling between the fluid and the convected solid particles and the set up of a Montecarlo analysis for the quantification of the action due to pyroclastic flows on the buildings as a function of the characteristics of the urban settlement.

References

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