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A SPH Depth Integrated Model for Popocatepetl 2001 Lahar.

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Lahars at volcanoes inundate surrounding areas and damage or destroy nearby communities. Unlike any other volcanic hazard, lahars do not require an eruption to occur. They can be triggered by bad weather or by edifice failure long after an eruption a timing that can worsen the hazard. Modeling of lahars has become an important tool in the assessment of the related hazards in order to undertake appropriate mitigation actions and reduce the associated risks.

In January 22, 2001, a violent explosion occurred in the Popocatépetl volcano (México) and a pumice- rich pyroclastic flows were spread out over a distance of 7 Km. The remobilization of this deposit formed a lahar that flowed through Huiloac Gorge for as far 12 Km to the town of Santiago Xalizintla.

In this paper, we used a depth integrated coupled mathematical model derived from the velocity-pressure of the Biot-Zienkiewicz model which was discretised using SPH method to simulate Popocatepetl 2001 lahar. In order to investigate the convergence of the model we use a range of different SPH mesh resolutions. Once the optimum mesh resolution is bounded we analyse the model sensitivity to initial lahar volume, the density of the geomaterial, and the rheological parameter of the Bingham fluid. The obtained results highlight the capability of the proposed model to replicate the propagation stage of such complex phenomena. Moreover, the paper shows the effects of SPH mesh resolution and the relevant role played by the rheological parameters.

Keywords:
Numerical modelling, SPH, fluidised geomaterial, lahar, Popocatépetl volcano.