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Behaviour of mudflows realized in a laboratory apparatus and relative numerical calibration

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Nowadays, numerical simulations are indispensable allies for the researchers to reproduce phenomena such as earth-flows, debris-flows and mudflows. One of the most difficult and problematic phases is about the choice and the calibration of the parameters to be included in the model at the real scale. Surely, it can be useful to start from laboratory experiment that simplify as much as possible the case study with the aim of reducing uncertainties related to the trigger and the propagation of a real flow. In this way, geometry of the problem, identification of the triggering mass, are well known and constrained in the experimental tests as in the numerical simulations and the focus of the study may be moved to the material parameters. This article wants to analyze the behavior of different mixtures of water and kaolin, which flow in a laboratory channel. A 10 dm3 prismatic container that discharges the material into a channel 2m long and 0.16 m wide composes the simple experimental apparatus. The chute base was roughened by glued sand and inclined with a 21° angle. Initially, we evaluated the lengths of run-out, the spread and shape of the deposit for five different mixtures. A huge quantity of information were obtained by 3 laser sensors attached to the channel and by photogrammetry, that gives out a 3D model of the deposit shape at the end of the flow. Subsequently, we reproduced these physical phenomena by using the numerical model Geoflow-SPH (Pastor et al., 2008; 2014) , governed by a Bingham rheological law (O'Brien & Julien, 1988), and we calibrated the different tests by back-analysis to assess optimum parameters. The final goal was the comprehension of the relationship that characterizes the parameters with the variation of the kaolin content in the mixtures.