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Development of a debris flow model in a geotechnical centrifuge

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Debris flows occur in three main stages. At first the initial soil mass, which rests in a rigid configuration, reaches a critic state releasing a finite mass over a failure surface. In the second stage the released mass starts being transported downhill in a dynamic motion. Segregation, erosion, entrainment, and variable channel geometry are among the more common characteristics of this stage. Finally, at the third stage the transported mass plus the mass gained or loosed during the transportation stage reach a flat and/or a wide area and its deposition starts, going back to a rigid configuration.

The lack of understanding and predictability of debris flow from the traditional theoretical approaches has lead that in the last two decades the mechanics of debris flows started to be analysed around the world. Nevertheless, the validation of recent numerical advances with experimental data is required. Centrifuge modelling is an experimental tool that allows the test of natural processes under defined boundary conditions in a small scale configuration, with a good level of accuracy in comparison with a full scale test.

This paper presents the development of a debris flow model in a geotechnical centrifuge focused on the second stage of the debris flow process explained before. A small scale model of an inclined flume will be developed, with laboratory instrumentation able to measure the pore pressure, normal stress, and velocity path, developed in a scaled debris flow in motion. The model aims to reproduce in a controlled environment the main parameters of debris flow motion.

This work is carried under the EC 7th Framework Programme as part of the MUMOLADE project. The dataset and data-analysis obtained from the tests will provide a qualitative description of debris flow motion-mechanics and be of valuable information for MUMOLADE co-researchers and for the debris flow research community in general.