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ABSTRACT

Landslides can cause major economic damage and a large number of casualties as it is possible to see from past events occurred all over the world. Being able to predict these kind of hazards would then suppose the achievement of great benefits.

Here a model that combines a depth integrated description of the soil-pore fluid mixture together with a set of 1D models dealing with pore pressure evolution within the soil mass is presented. In this way, pore pressure changes caused by vertical consolidation, changes of total stresses resulting from height variations and changes of basal surface permeability can be taken into account with more precision.

The mathematical model is based on the Biot-Zienkiewicz equations, from where a depth averaged model is derived.

Concerning the material behaviour, the approach used is the one suggested by the Perzyna viscoplasticity, which has been extensively used in the past to model solid behaviour prior to failure. Three different yield criterion are considered in the framework of Perzyna's model: a Von Mises, a Mohr Coulomb and a Cam Clay yield criterion. The obtained results lead to a good agreement with the results achieved using classical rheological models. Then, a simple shear rheological model is derived, providing the basal friction needed in depth integrated models.

The Smoothed Particle Hydrodynamics (SPH) has been the numerical technique chosen to spatially discretised the depth integrated equations of the mathematical model. The SPH technique has been enriched by adding a 1D finite differences grid associated at each SPH node in order to improve the description of pore water profiles in the avalanching soil.

The purpose of this work is to apply the SPH depth integrated numerical model, together with the sub-model that predicts the evolution of the pore water pressure inside the landslide, to simulate the propagation phase of the Aberfan flowslide occurred in 1966.

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