Numerical modelling of Val d’Arán landslide with material point method

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ABSTRACT

Flow-like landslides in mountainous areas can cause extensive damages, due to their high velocity and long runout distance. Estimation of the initiation and post-failure behaviour is essential for evaluating the risk and quantifying the magnitude of consequences. However, its numerical modelling is still challenging mainly because it involves large deformations, dynamic factors and requires a proper constitutive model able to reproduce the transitional behaviour between solid and fluid.

In this work, a real case of landslide occurred on 11 May 2018 in Val d’Arán (Catalonia, Spain) is considered. It took place after a period of significant rainfall and involved about 50,000 m³ of glacial and colluvial material, travelling about 300 m until the valley bed.

With the aim to assess the capabilities of the Material Point Method (MPM) [1,2], a plane strain analysis with the 2-phases 1-point formulation [3,4] is conducted on a representative section by using the Anura3D software, developed by the MPM Research Community (www.anura3d.com).

Based on available field and laboratory data, the slope material is described with the Ta-Ger constitutive model [5,6]. It is an elastoplastic model based on the critical state theory and developed with the aim of reproducing the behaviour of a soil under different types of loading, drainage conditions and initial stresses, without the need to recalibrate its parameters. The objective is to ascertain if Ta-Ger is able to track the triggering of the movement and the post-failure behaviour by reproducing the strength loss due to the propagation of pore water pressure, allowing the landslide mass to travel a long distance.

REFERENCES