Numerical analysis of the impact of flow-like landslides against structures

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Flow-like landslides (Hungr et al., 2001) are a major threat for the populations of several Countries (UNESCO, among others); they may vary in a wide range of typologies including debris flows (Coussot & Meunier, 1996; Cascini et al., 2014), debris avalanches (Cuomo et al., 2014), hyperconcentrated flows or debris floods (Costa, 1988; Cuomo et al., 2015; Ferlisi et al., 2015), or their combinations. As well, the possible consequence scenarios can significantly differ and may consist of: flooding of urban areas, huge damage to buildings and man-made structures, interruption of roads and pipelines.

The numerical modelling of flow-like landslides is a valuable tool to assess: the dynamics of the landslide and the expected consequences. This paper aims at contributing to both these issues. Firstly, a set of numerical Smoothed Particle Hydrodynamics (SPH) simulations is presented to outline some typical landslide behaviours during the propagation stage until deposition. This includes a discussion on typical ranges of velocities, propagation heights, and pore water pressures inside the flowing mass.

Then, some reference scenarios are individuated to analyse the impact of flow-like landslides against fixed obstacles. To this aim, a short review of methods given by the scientific literature on the topic is provided and potentialities offered by Discrete Element Method (DEM) in analysing the behaviour of the impacted obstacles are emphasized.

Finally, on the basis of the obtained results, a general discussion is proposed, whereas current limitations and potential developments of the research are outlined.

Keywords: propagation, deposition, SPH, DEM, velocity,

References


