SIMULATION OF THE ENERGETIC PROCESSES INVOLVED IN THE GENERATION OF WAVES BY HIGH MOBILITY SUBAERIAL LANDSLIDES

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In this paper, we study the problem of waves generated by subaerial landslides; a very complex problem involving granular physics, fluid mechanics and wave processes.
Recently, a few studies (Bullard *et al.*, 2019; Rauter *et al.*, 2021) proposed a simplification of the generation stage, considering a water slide (i.e., an inviscid liquid with the same density as the reservoir fluid). In these studies, they concentrate on the prediction of the maximum wave amplitude after generation.
In the present paper, we follow the same strategy of simplification, but this time, focus on the energetic transfer processes from the stage of generation, to the end of the main wave transformations.
A RANS multiphase Navier-Stokes VOF simulation (multiphaseInterFoam model) is used for this investigation. This type of model (as soon as the generation stage is simplified), allows a complete description of the energetic processes and gives all the variables necessary for the interpretation. A turbulence model is mandatory for a proper description of the dissipation processes. Here, the k-ω SST modified with a buoyancy term, as proposed by Devolder *et al.* (2018) is used.
The model is first thoroughly validated, considering all the processes intended to be described. This work pointed out the importance of a fine tuning of the model for a proper description of the processes. Hence, the time step should be low enough to respect convective and diffusive CFL conditions as described in Rauter et al. (2021). The discretization schemes for convective terms also play a critical role regarding energy dissipation. Finally, with the model set-up proposed, we achieved a correct representation of the dissipation processes, but not perfect, as non negligible numerical dissipation is still present for the most violent wave breaking cases.
With this model, the processes of energy transformation are then studied. We focus on the energy content of the leading wave after the main transformations (generation, dispersion, dissipation) as being representative of the hazard.
The leading wave energy (at the end of the channel) is shown to be the result of sequential processes. First, generation determines the basics impulse wave characteristics, Then, the wave is submitted to dispersion (frequency and amplitude) and dissipation induced by breaking. The result is the final leading wave energy. We show that this global energetic process has an optimum in terms of efficiency which occur for a specific slide volume. We explain the reasons for this existence thanks to the simulation results.

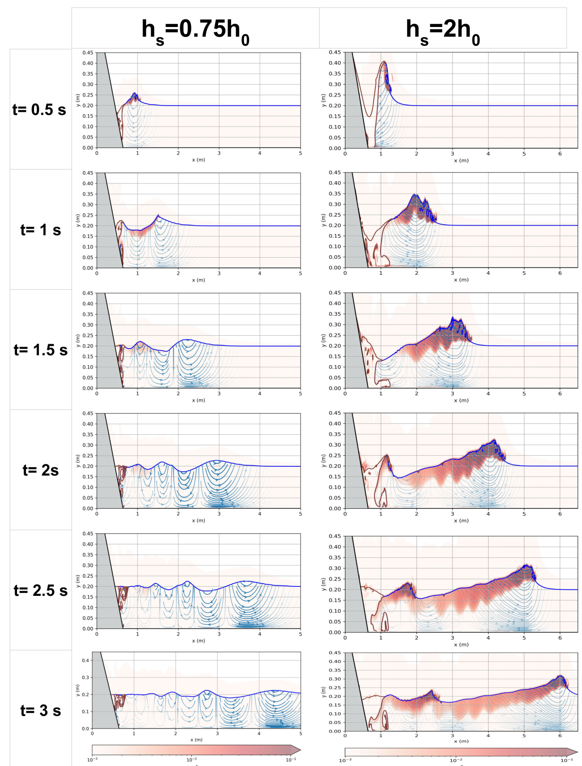

Figure 1 – Illustration of the generation process for two different initial volumes. In this case the slide is a water wedge located just above the water line at t=0 (with h_s wedge side and h_0, water depth). The surface contour shows the distribution of the rate of dissipation of turbulent kinetic energy (ε).

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