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Tsunami in Alps reservoirs: the case of Mauvoisin dam (Valais, Switzerland)

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A rock instability has been monitored above the Mauvoisin reservoir, Valais, Switzerland. It is characterised by five compartments ranging from 80'000 to 500'000 m3. The smallest volume is the most likely to fail, when a full collapse is less probable. The slide will in any case reach the lake and may potentially generate a tsunami that may overtop the dam.

The aims of the study are (1) to compute the propagation of the landslide-generated impulse wave in order to (2) assess the risk of an overtopping as well as (3) a sensitivity analysis of the slide parameters.

The wave propagation is simulated using a 2.5D homemade model, based on the shallow water equation integrated in a 10 m resolution DEM, including the bathymetry. In order to validate this model, a comparison with analytical solution is performed. Furthermore, the results are compared with those of a generally applicable equations developed from model tests (VAW, Heller et al., 2009).

The application to the case study requires to link the rockslide with the tsunami, i.e. the wave generation step. This latter, is based on the equivalence between the kinetic energy of the slide at impact point and the potential energy of a depression, the initial state of the simulation. As the model takes into account the depth and the shape of the reservoir, the shoaling effect and the constriction are taken into account. Thus, the run-up height at the dam is directly available.

The variations of the slide parameters (volume, thickness, width, velocity, porosity) as well as changing the type of event (landslide, rockfall, icefall), are used as inputs for the wave generation. This leads to changes of the wave characteristics, such as wave height, run-up height and travel time.

In the worst case scenario, with the reservoir at its maximum level, the collapse of the less stable compartments is triggering an impulse wave, which gives, as preliminary results, a 0.5 m high run-up at the dam. This is less than the freeboard, indicating no overtopping. Nevertheless, as the compartment used is the most likely to occur, therefore not the biggest, a largest volume will doubtless lead to an overtopping.