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Combining SLBL routine with landslide-generated tsunami model for a quick hazard assessment tool

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Regions with steep topography are potentially subject to landslide-induced tsunami, because of the proximity between lakes, rivers, sea shores and potential instabilities. The concentration of the population and infrastructures on the water body shores and downstream valleys could lead to catastrophic consequences. In order to assess comprehensively this phenomenon together with the induced risks, we have developed a tool which allows the construction of the landslide geometry, and which is able to simulate its propagation, the generation and the propagation of the wave and eventually the spread on the shores or the associated downstream flow.

The tool is developed in the Matlab© environment, with a graphical user interface (GUI) to select the parameters in a user-friendly manner.

The whole process is done in three steps implying different methods. Firstly, the geometry of the sliding mass is constructed using the Sloping Local Base Level (SLBL) concept. Secondly, the propagation of this volume is performed using a model based on viscous flow equations. Finally, the wave generation and its propagation are simulated using the shallow water equations stabilized by the Lax-Friedrichs scheme. The transition between wet and dry bed is performed by the combination of the two latter sets of equations. The intensity map is based on the criterion of flooding in Switzerland provided by the OFEG and results from the multiplication of the velocity and the depth obtained during the simulation.

The tool can be used for hazard assessment in the case of well-known landslides, where the SLBL routine can be constrained and checked for realistic construction of the geometrical model. In less-known cases, various failure plane geometries can be automatically built between given range and thus a multi-scenario approach is used. In any case, less-known parameters such as the landslide velocity, its run-out distance, etc. can also be set to vary within given ranges, leading to multi-scenario assessment. The model computes the evolution of the water depth and velocities trough time in 2.5D. It provides maximum maps, intensity maps, and data from numerical gauge. This tool is developed for quick hazard assessment, thus it is efficient and requires little computational power. Its capacities are demonstrated on case studies.