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Testing numerical models for landslide-triggered tsunami in alpine context

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Alpine areas, because of the combination of the high density of landslide and water bodies such as lakes, reservoirs and fjords, are subject of a potential catastrophic phenomenon: the landslide triggered tsunamis and the associated overflows. In addition, the fact that populated areas are normally concentrated in valleys, exactly where the resulting downstream flows spread, confers to the situation a really high level of threat.

In order to assess the risk of tsunami phenomenon in alpine regions, it is necessary to model it as accurate as possible. However, the modelling of landslide generated tsunamis in closed and relatively small water bodies is confronted to various difficulties. Indeed, the strong effects due to the bathymetry shape and the necessity of transition between wet to dry state, i.e. run-up modelling, leads to numerical instabilities.

The goal of this study is the development of a numerical code that solves the aforementioned problems and that runs at high resolution.

To this end, several different codes based on the shallow water equations were verified with tests from Toro (2001) and some additional ones. The codes are the Lax-Friedrich scheme, the 2 step Lax-Wendroff scheme, the Godunov centred and the Godunov upwind, and were compared to the exact Rienmann solution. The accuracy, the efficiency and the monotony were tested, in order to define the best code. Finally, validation tests were performed on well-known and well-documented case studies.