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# The Lituya Bay 1958 tsunami simulation: a detailed modeling investigation using Flow3D

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In the last centuries the consciousness of natural hazards phenomena like tsunamis in lakes and artificial basins (known as impulse waves) has spread since several catastrophes happened. In fact, landslides −either subaquatic or subaerial− can trigger devastating tsunami waves. Recently, the most used commercially-available software for the simulation of impulse waves in mountains lakes and reservoirs is the computational fluid dynamics model Flow3D, which is based on a three-dimensional numerical modelling approach.

This study aims to test the capacity of Flow3D regarding the simulation of a rockslide impacting a water body, to evaluate the influence of the extent of the computational domain, the grid resolution, the corresponding computation times and the accuracy of modelling results. For that purpose, a back analysis of the Lituya Bay event (AD 1958, Alaska, maximum recorded run-up of 524 m asl) is proposed, since a lot of data are available and the comparison with previous analyses and data is possible. A new interpretation of the pre-event Lituya Bay bathymetry is proposed, starting from the available cartography and data obtained from the National Ocean Service. The pre-event topography is recreated with a resolution of 5 m.

Firstly, a detailed analysis of the tsunami formation and run-up in the impact area is accomplished with the numerical model. Several preliminary simulations with simplified bay geometry as a bucket shape are accomplished in order to test the concept of a "denser fluid" for the rockslide material compared to the water in the bay. Following, a real topography and bathymetry of the impact area are set up. The observed maximum run-up in the impact area can be reconstructed using a uniform grid resolution of 5 m. Finally, the model is enlarged along the entire bay (about 12x4 km) to simulate the propagation of the wave. Simulation of the tsunami trimline along the bay requires a mesh size of 15x15x10 m. Additionally, the propagation of the rockslide material along the bay floor can be observed using the second order for the density evaluation.

These simulations show the complexity of the physical phenomena itself. The maximum run-up is reached when the wave overtops the hill crest, then flowing diagonally along the slopes. The trimline along the entire bay is the result not only of the primary wave, but also of several secondary reflected waves. It has been observed that a "dense fluid" is a suitable, simple concept to recreate a sliding mass impacting a water body, in this case with an impact velocity of 91-94 m/s. Concluding, Flow3D software represents a suitable tool for landslide generated impulse wave simulations.