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Granular porous landslide tsunami modelling with OpenFOAM

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Subaerial landslides are among the most complex sources for tsunamis, as several complex processes occur simultaneously in various regimes, with multiple phases interacting. The simulation and prediction of these events is respectively difficult.

We will present a three-dimensional multiphase model (granules, air, water) that considers the effects and properties that we deem most important: (i) a sharp water-air interface with low diffusivity, (ii) granular rheology for the landslide, (iii) differentiation between effective pressure and pore pressure, as well as (iv) porosity, dilatancy and permeability. No depth-integration or other form of simplification is applied. The resulting mathematical model is solved with the fluid dynamics toolkit OpenFOAM.

Many effects and processes that are lost in depth-integrated models are directly simulated in our approach. This allows the simulation of complex events with a relatively simple model, however for a large computational cost. The model parameters are widely intrinsic material parameters, which promises a prediction of events without significant parameter optimizations.

We will show results for small scale experiments as well as for a well documented real scale event and will give an outlook on further developments and remaining problems.