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Using OpenFOAM for landslide tsunamis modeling and comparison with a 2D depth-integrated model

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In the literature, OpenFOAM has been used to simulate landslide tsunamis, modeling the landslide as a solid or a two-phase flow. Here we present an approach using three phases (air, water and sediment) modeled as Newtonian fluids. This 3D model is validated against two benchmarks with deformable landslides: one subaerial (Viroulet et al. 2016) and one submarine (Grilli et al. 2017). These benchmarks are also run by a 2D depth-integrated model, AVALANCHE, recently used to reproduce the 2017 Karrat Fjord, Greenland and the 2018 Anak Krakatau, Indonesia events. Both models are able to reproduce either the water waves or the landslide behavior but not both at the same time.

Considering OpenFOAM as a reference code, sensitivity studies on the slope angle, the landslide viscosity and the landslide initial submergence showed that AVALANCHE produces similar results for slope angles between 10 and 45°, for subaerial or close to the surface landslide and/or for low viscosity values. In the other cases (submarine landslides and higher viscosity values) results indicated that OpenFOAM should be preferred to a 2D depth-integrated model.

References:

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