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A two-layer shallow flow model with two axes of integration with application to submarine avalanches and generated tsunamis

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There exits in the literature many approaches that has been used to model submarine avalanches (See [5]). These models are mainly based on the pioneer work of Savage and Hutter (SH) [4] that is a shallow water type model for aerial avalanches, which is written in local coordinates, in order to simulate the tangential velocity to the bottom. A depth-averaged SH model over a general bottom with curvature was introduced in [1]. An extension to submarine avalanches is developed in [2]. In this paper the same local coordinate system is used for the two layers. Nevertheless, using a local coordinates the model would prescribe the perturbation at the surface at a wrong placement. In [3] a bilayer depth-averaged model for submarine avalanches is presented with cartesian coordinates for the water layer and local coordinates for the avalanche. The drawback is that the seabed deformation is considered as an input data for the water layer equations, then no interaction between the two fluids are taken into account and it is necessary to do an interpolation of the granular surface at each time step of the numerical simulation. In this work we present firstly the details of the proposed model, a coupled two-layer shallow water system where we consider local coordinates for the granular layer and cartesian coordinates for the fluid one. The main difference with other models that adopt the same stragie is that any interpolation of the granular surface is required. Moreover, the velocity of the granular layer has an explicit influence on the mass and momentum conservation laws of the fluid layer. Secondly, several numerical tests will be presented.

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