

## SHEAR SHALLOW WATER : MODELING AND APPLICATIONS

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### ABSTRACT

Shallow flow models provide a far more practical, from the computational standpoint, engineering alternative to the full Euler or Navier-Stokes equations, to model free surface flows. This model integrates vertically incompressible flow equations from the topography bed to the flow-free surface (depth integration). Derivations often assume 1) a relative thin layer flow; 2) minor velocity fluctuations along the flow depth (weakly sheared flow); 3) hydrostatic pressure distribution; 4) slight bed slope. Depth integration leads to removal of the need to explicitly resolve the free surface, the reduction of space dimension and, hopefully, the number of equations to be solved. Despite the reduction and associated simplifications, shallow flow models yield reasonable predictions of some natural process as debris flows, landslides, avalanches, river flows, and even more. However, the classical shallow water model fails in the context of strongly sheared geophysical flows on complex topography. In this context, we must go beyond some modelling assumptions on velocity fluctuation, slopes, and curvature. The usual modelling assumes that the horizontal velocity is weakly varying in the vertical coordinate, which implies that the vertical shear is negligible. The horizontal velocity is a depth average of the three-dimensional velocity field. Since the classical shallow water models assume negligible vertical shear, they cannot model large-scale eddies (rollers) that appear near the surface and behind the hydraulic jump. Under the assumption of the smallness of horizontal vortices, a more general model, named the shear shallow water model (SSW), can be derived, including the second-order velocity fluctuation terms. However, the model is principally hyperbolic and nonconservative, posing difficulty in its numerical resolution.

We propose to gather active researchers that are focussing on this model to clarify the situation on different numerical strategies available: advantages and drawbacks. Then we will discuss on future directions for investigations.

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