

Bachelor/Master/Project thesis

Shallow water equations extension

Course of study: mathematics/applied mathematics
Kind of thesis: modeling and numerical simulation
Programming language: C++/Matlab/Mathematica as preferred
Start: anytime, duration 3-6 months

Problem

The shallow water equations are a widely used model for the simulation of flow problems like Tsunamis, floods, snow avalanches and atmospheric flows. The model is derived from conservation of mass and momentum using the assumption of small wave amplitudes in comparison to the depth of the water. Vertical movement of water and variations in horizontal velocity are neglected and the evolution equations for water height h and velocity u can be written as

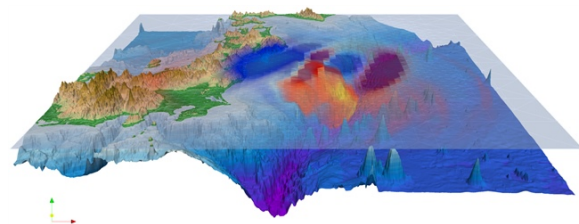


Abbildung 1: Shallow water equations simulation.

$$\partial_t h + \partial_x (hu) = 0, \quad \partial_t (hu) + \partial_x \left(hu^2 + \frac{1}{2}gh^2 \right) = 0. \quad (1)$$

Goal

This project's goal is the derivation and numerical solution of an extension of the shallow water equations to increase accuracy of the model and enable improved simulations of applications like Tsunamis or floods.

Preliminary work

The extended shallow water model can directly be implemented following the literature. An existing flow solver for hyperbolic PDEs can be used. Tools for visualization and analysis of the data are readily available.

Task

The investigation of the moment model for the shallow water equations can include (in part)

- analytical derivation of a simplified 1D moment model from the shallow water equations
- modification of the equations to obtain hyperbolicity
- implementation of the model into the existing software framework
- numerical simulations

The final tasks will be discussed with the supervisor. Please feel free to get in contact.

Supervision

Contact: **Dr. Julian Köllermeier**
 Address: Institut für Mathematik
 Arnimallee 6, 14195 Berlin
 Room: 016
 Tel.: +4930 838 75368
 Email: koellermeier@zedat.fu-berlin.de