Lab 4&5 Part 2

Deadline (Part 2): May 28 (the examination is May 21)

Extend the "Tsunami simulator" to a Roe High-Resolution scheme as explained in Leveque pp xxx. , i.e. compute the corrections $-\frac{\Delta t}{\Delta x}\left(\widetilde{F}_{i+1/2}-\widetilde{F}_{i-1/2}\right)$. You need eigenvalues and eigenvectors to the Roe matrix to compute the correction waves, formulas can be found in L. Note the comments on how to compare the waves from a cell interface to its upstream neighbor, by taking scalar products. A vectorized matlab implementation is preferable, but use loops if you like. Use the minmod limiter.

Check that

- the dissipation is much smaller than for the Roe scheme – the effect of the corrections
- the scheme is conservative (for h)
- the timestep restriction is still $\frac{\Delta t \cdot c_{\max}}{\Delta x} \le s$ $c_{\max}$ is the max. characteristic speed and s is approx. 1 - by experiment
- smooth extrema get clipped – the effect of the limiter

Run also a smooth wave on a constant depth ocean and check the convergence for n = 200, 400, 800 cells and constant Courant number.

Hand in plots of the solutions, demonstrating the above, and the matlab code.