Abstract

This thesis examines the numerical solutions to the one-dimensional shallow water equations. These solutions are obtained by use of well-balanced finite volume methods, while the well-balanced terms added in the numerical flux computations are based on the steady state of the lake at rest. In addition, the finite volume method being applied is the Kurganov's central-upwind method, which is a Godunov-type method. Here, the simulations are done to test well-balanced central-upwind finite volume methods with two different sets of reconstructions, namely: stage and momentum, and stage and velocity reconstructions.

The well-balanced central-upwind finite volume methods with stage and momentum reconstructions cannot in general solve the unsteady state problems, such as oscillations in a parabolic canal and dam-break problem in some cases, but these methods work much better to solve steady flow problem than those without well-balanced terms. The performance of the methods with these reconstructions are very dependent on the type of slope limiter being used. These methods using the van Leer slope limiter lead to better results than those using other limiters.

On the other hand, the well-balanced central-upwind finite volume methods with stage and velocity reconstructions are able to capture both unsteady and steady states of water flows. It is an advantage that the performace of the methods are not too dependent on the slope limiter, despite the fact that the methods with these reconstructions using superbee limiter yield the smallest error with relatively fast computations. Moreover, the methods with stage and velocity reconstructions result in better performance than those with stage and momentum reconstructions.