PARALLEL ADAPTIVE COMPUTER SIMULATIONS OF GEOPHYSICAL MASS FLOWS

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Large scale geophysical mass flows such as rock falls, debris flows, avalanches and volcanic lava flows are a significant hazard for the population in many parts of the world. High fidelity computational simulation can be an invaluable tool in planning strategies for mitigation of risks arising from such hazards. The accuracy and reliability of the predictions are crucial elements of these tools being successful. We present here a new simulation tool using several new techniques.

Highlights of our methodology are the use of a depth averaged model and an adaptive grid Godunov scheme to solve the hyperbolic system of conservation laws [1, 2]. The software is designed to run on distributed memory supercomputers and make use of digital elevation data dynamically, i.e. refine the grid and input data to finer resolutions to better capture flow features as the flow evolves. We also use un-refining strategies to maintain computation efficiency. We are currently investigating other higher order approximations including *hp* adaptive Discontinuous Galerkin Methods.

The computer program named TITAN2D is written using C, C++ and FORTRAN modules. Our software is integrated with the standard geographical information system tool GRASS. Simulations are validated using quantitative and qualitative comparisons to tabletop experiments and data from field observations. Our software will be made publicly available.

References

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[2] R.M. Iverson, and R.P. Denlinger, "Flow of variably fluidized granular material across three-dimensional terrain 1. Coulomb mixture theory," *Journal of Geophysical Research* , v. 106, p. 537-552, 2001.