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Multigrid shallow water equations on an FPGA

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A novel computing technology for multigrid shallow water equations is investigated. As power consumption begins to constrain traditional supercomputing advances, weather and climate simulators are exploring alternative technologies that achieve efficiency gains through massively parallel and low power architectures. In recent years FPGA implementations of reduced complexity atmospheric models have shown accelerated speeds and reduced power consumption compared to multi-core CPU integrations. We continue this line of research by designing an FPGA dataflow engine for a mulitgrid version of the 2D shallow water equations. The multigrid algorithm couples grids of variable resolution to improve accuracy. We show that a significant reduction of precision in the floating point representation of the fine grid variables allows greater parallelism and thus improved overall peformance while maintaining accurate integrations. Preliminary designs have been constructed by software emulation. Results of the hardware implementation will be presented at the conference.