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# Computational performance of a two-dimensional flood model in single and multiple GPU frameworks

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The objective of this study is to investigate the computational performance and accuracy of multiple implementations of a 2D flood model called Flood2D-GPU: i) on a single GPU and ii) multiple GPUs. The model is based on shallow water equations (SWE) and uses an upwind-finite difference numerical formulation to simulate flood events. The GPU based implementation has been developed, using NVIDIA's Compute Unified Development Architecture (CUDA) programming model. The increase in the computational performance would permit simulation of larger domain sizes, more refined spatial and temporal resolutions, and more simulations (ensembles). In addition to HPC platforms, all implementations of the model are developed within a geographic information system (GIS) environment for both preprocessing and post processing of spatial datasets (e.g. topography, land use/land cover, etc.). For this study, these implementations are being applied to simulate a dam break event at the Taum Sauk pump-storage hydro-electric power plant in Missouri, which occurred on December 14, 2005. A single GPU implementation provides a significant speed up, up to two orders of magnitude compared to a CPU version of the model. We will discuss the computational approaches for multiple GPUs, and the benchmarking results from the set of dam break simulations.