Modeling of climate change induced flood risk in the Conasauga River Basin

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The goal of this study is to evaluate the potential impacts of climate change on flood regimes and critical energy infrastructures at a high-spatial resolution through coupled hydrologic-hydraulics models. The hydrologic simulations are conducted using a 90m resolution Distributed Hydrology Soil Vegetation Model (DHSVM) driven by (1) 1981–2012 Daymet meteorologic observation, and (2) three sets of downscaled Coupled Model Intercomparison Project (CMIP5) global climate model projections for 40 years in the historical period (1966–2005), and 40 years in the future (2011–2050). Flood simulations are performed using a graphic processing unit (GPU)-accelerated Flood2D-GPU hydraulics model that solves the full 2D-shallow water equations using a new finite-volume numerical scheme. The Flood2D-GPU model is first evaluated for its sensitivity to several model parameters, namely, the digital elevation model, Manning's roughness, and initial conditions. Then, the Flood2D-GPU model performance is assessed by comparing to the existing Federal Emergency Management Authority flood inundation maps. Finally, the verified flood model is used to simulate 272 annual maximum streamflow events at 10m spatial resolution for an ensemble-based flood risk evaluation. The flood simulation results are used to evaluate changes in flood regimes and to assess the vulnerability of critical energy infrastructures in a changing climate.

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