The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

On shallow water, diffusive, and kinematic flow approximations for modeling rainfall runoff

Ethan J. Kubatko[1] **and Younghun Kang**[1]

[1] The Ohio State University, Department of Civil, Environmental and Geodetic Engineering, 2070 Neil Avenue, 417D Hitchcock Hall, Columbus, OH 43210, kubatko.3@osu.edu

Keywords: *Shallow water, rainfall runoff, finite element, discontinuous Galerkin methods*

Rainfall runoff can be a significant contributing factor to inland flooding during hurricanes due to the torrential rainfall that often accompanies the storms. When the rainfall rate exceeds the local infiltration rate of the inland area, overland flow occurs in the form of rainfall runoff. While this overland flow can be modeled using the full shallow water equations (with the addition of a source term for rainfall), simpler approximations to the shallow water equations — namely, the diffusive and kinematic wave approximations — have been shown to accurately represent overland flow under conditions often encountered in natural watersheds. In this work, we compare numerical solutions to the full shallow water, diffusive, and kinematic wave flow equations for a variety of rainfall runoff flow scenarios using discontinuous Galerkin finite element methods and discuss the merits of each approximation in terms of accuracy and computational cost.