1D and 2D Hydrodynamic Modeling of Riverine-Estuary System under Extreme Storms: A Case Study of Delaware River Basin

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Conclusions

- The National Water Model (NWM) provides streamflows at about 2.7 million reaches in the Continental U.S. (inland and coastal areas). In the transition zones (coastal to inland interface, red zones in Fig. 1) NWM’s water level forecasts still lack the level of accuracy exhibited inland due to the fact that complex interactions of forcings including tides, freshwater inflows, oceanic boundary forcings, winds, and atmospheric pressure are not currently modeled, until today.

- The vision is to couple NWM and appropriate ocean models at a local scale.

- Various techniques were examined to be used as a “coupler” based upon the following fundamental requirements: (a) properly linking 1D/2D domains and physics (i.e., river-estuary); (b) fully scalable (parallelized); and (c) it is an open-source.

- The coupled 1D HEC-RAS framework does not adequately predict water levels in transition zone during wind-dominated storms.

- DFlow performs well in the estuary and in the riverine network, due to its wind forcing module.

- Combined 1D/2D modeling in estuarine-riverine systems shows considerable improvement as opposed to either a 1D or 2D only modeling approach.

A river-estuary transition zone hydrodynamic problem (with many underlying causes and multiple contributing factors) can greatly benefit from a 1D/2D coupling framework.