



A novel dynamically coupled ocean-river modeling suite for hurricane-induced compound flooding

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Hurricane Harvey 2017

Hurricane Florence 2018



Harvey deposited ~141 million tons of sediment within Galveston Bay and this sediment contained ~6 tons of mercury (Hg) (Dellapenna et al., 2020)

There are 2,000 hog farms and 9.3 million pigs on North Carolina's coastal plain





Dynamic Coupling between Hydrology and Ocean Model

- Computation domain is divided into two subdomains- one for WRF-Hydro and the other for ROMS.
- The two models exchange water level information on every connected cell along the boundary.
- A coupler is applied to assure the two models have the same velocity along the interface boundary.





Bao, D.*, Xue, Z, et al., A Numerical Investigation of Hurricane Florence-induced Compound Flooding in Cape Fear Estuary using a Dynamically Coupled Hydrological-Ocean Model. JAMES (under review).

Model setup

- Topography: NHDPlusV2 (land) + Coastal Relief Model (ocean) + NCEI Estuarine Bathymetric Digital Elevation Model (estuary).
- Tide forcing: TPXO tidal solutions.
- Atmospheric forcing: RAP analysis.
- Time step: 3s (ROMS), 1s (WRF-Hydro), 3s (coupling).
- Simulation period: 09/08/2018 0:00 10/07/2018 0:00

Experiment design

Name	Coupling Method	Precipitation	Wind
Exp1	Stand-alone ROMS		Yes
Exp2	Linked ROMS	Yes	Yes
Exp3	Dynamic Coupling	Yes	Yes
Exp4	Dynamic Coupling	Yes	No
Exp5	Dynamic Coupling	No	Yes
Exp6	Dynamic Coupling	No	No



Observation Diffusive wave Reduced physics



LSU















Water Budget







Sediment Module

CASC2D_SED (Rojas et al., 2008)



Yin, D.*, Xue, Z., Gochis, D. J., Yu, W., Morales, M., & Rafieeinasab, A. (2020). <u>A Process-Based, Fully Distributed Soil Erosion and</u> Sediment Transport Model for WRF-Hydro. Water.12 (6), 1840. <u>https://doi.org/10.3390/w12061840</u>. Yin et al., 2020











Coupled Ocean Modeling Testbed (COMT) Platform for Physics and Contaminant Exchange through the River -Estuary - Ocean Continuum

NOAA



