# High-resolution prediction of coastal compound flooding under future relative sea level rise

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## Abstract

Along much of the U.S. East and Gulf Coasts, many locations have experienced recurrent nuisance flooding (RNF) events that have increased recently. Understanding and predicting how the interactions between high tides and precipitation drive RNF is vital to develop coastal protection policies, guide natural hazards management, and deal with issues such as climate change and relative sea level rise (RSLR). In this study, we develop a hydrodynamic model to study compound flooding, defined as combination of storm tide and precipitation-driven flooding, in an urban flood-prone area. The model is developed based on the Delft3D model and can predict flooding in the Hampton Roads region in southeast Virginia at street to community scales. Hampton Roads region is experiencing a high and increasing rate of RNF as well as the highest rate of RSLR in the U.S. East Coast, and thus can serve as a natural test bed for studying RSLR impacts on RNF. A combination of flexible irregular and regular grids are implemented to include large portion of the U.S. East Coast and the Atlantic Ocean with major estuaries (e.g., the Chesapeake Bay) from low-resolution in offshore areas to high resolution (i.e., ~10m resolution) in Norfolk City, as an urban representative of the greater Hampton Roads. The model is forced by astronomical tidal constituents at the ocean boundary, riverine flows at the landward boundaries, and precipitation in overland areas. The model is then used to investigate the effects of RSLR on RNF in different regions of the Hampton Roads area. We present preliminary results from physics-based simulations of the tropical cyclones storm surge, river flooding, and heavy rainfall events.