Development of a coupled coastal circulation and inland hydrology modeling framework based on ESMF/NUOPC infrastructure

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Abstract:

To enable flexible model coupling in compound inland and coastal hydrodynamic studies, a coupling system based on ESMF/NUOPC technology under a common modeling framework called the NOAA Environmental Modeling System (NEMS) is being developed. The system provides dynamic interaction between the wave, ocean circulation, hydrology and inland flooding components. The data communication between models take place interactively by sending spatiotemporal water level and current fields from the ocean circulation component to the wave component, and in turn send radiation stress gradients from the wave component to the ocean circulation component. Ocean circulation component also provides water level and current velocities at the inland flooding component coastal boundaries and receive river discharge and lateral fluxes as its upstream inflow boundary conditions landward of the ocean circulation computational domain from hydrology component. As our first step, we will construct the coupled system by employing WAVEWATCH III, ADCIRC and National Water Model (NWM) models as our wave, storm-surge and hydrology/in-land flooding components. The system is forced by high-resolution wind and pressure fields derived from the Hurricane Weather Research and Forecasting Model (HWRF). The wave-storm surge sub-system was successfully validated for number of major storm events (e.g. Ike and Sandy) for the whole U.S. Atlantic coasts. The ADCIRC-NWM sub-system will be evaluated for Hurricane Isabel, Irene and Sandy for the Delaware Bay region before its final validation of ADCIRC-WW3-NWM for the whole U.S. Atlantic coast. As our next step, we will further develop the coupled system to include NOS’ three-dimensional ocean circulation operational forecasting systems (e.g. FVCOM and ROMS) as the ocean circulation component.