Study highlights new advancements to simulate multiscale coastal processes

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Credit: Lâm Trần from Pexels

Simulating flooding where rivers meet the ocean is challenging because existing Earth system models struggle to capture the complex interactions between river flows, ocean tides, and storm surges.

In response, researchers developed a comprehensive framework for the Energy Exascale Earth System Model (E3SM), incorporating advanced river and ocean models that improve how such interactions are simulated. The work is published in the *Journal of Advances in Modeling Earth Systems*.

Compound flooding happens when elevated river discharge and ocean water levels interact in a coastal zone. There are limitations in current Earth system models to accurately simulate these processes because of insufficient resolutions in the computational meshes and insufficient details on how rivers and oceans are connected.

This study creates a comprehensive framework for E3SM and demonstrates the framework's ability to simulate a specific compound flooding event in a Mid-Atlantic estuary. The framework combines atmosphere, land, river, and ocean models—each with its own level of detail near the coastline—to account for their different physical processes.

The results show that the E3SM framework can reproduce river discharge and sea level variations reasonably well. By simulating the interaction between river and ocean, we can better understand the effects of coastal water on river discharge forced by tides and storm surges during a compound flooding event.

The simulation reveals that compound flooding is most significant when a tropical cyclone produces the highest storm surge but moderate river discharge. This study demonstrates the capability of the E3SM model to accurately simulate the detailed coastal processes.

More information: Dongyu Feng et al, Simulation of Compound Flooding Using River-Ocean Two-Way Coupled E3SM Ensemble on Variable-Resolution Meshes, *Journal of Advances in Modeling Earth*

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