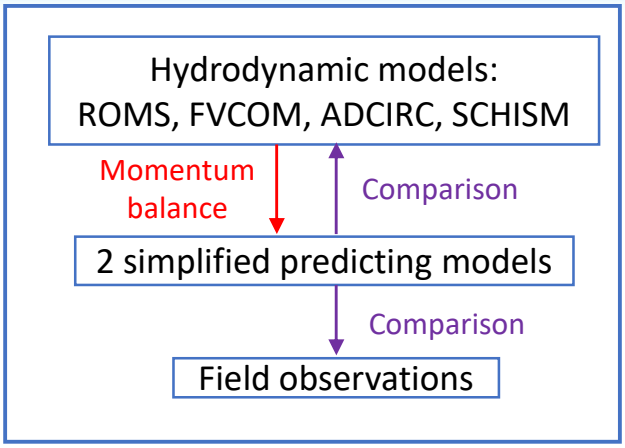
Simulation of Tides Through a Narrow Inlet at Guilford, CT

Project Description

Numerous inlets and culverts connect coves and salt marshes to the Connecticut coastal waters. Predicting the water quality and the flooding water level in those regions becomes critical. Observations show a narrow inlet (~5m) constraints water exchange at a marsh basin in Guildford, CT: the tidal amplitude drops 1/3 through the inlet, from 1 m at the open water to 0.66 m inside the mash. The effect of inlet width on the tidal exchange between two idealized basins is studied numerically using four hydrodynamic models (ROMS, FVCOM, ADCIRC, and SCHISM).



Methodology

Project Findings

- The along-inlet water level drop is primarily caused by horizontal eddy viscosity.
- For the no-slip scenario, the across-inlet flow shear is augmented along the inlet banks and leads to a large along-inlet water level drop.
- For the slip scenario, water levels drop downstream at both inlet mouths, where the changing of flow divergence enhances the horizontal eddy viscosity.
- All the no-slip model results are more consistent with the Guilford observation: ROMS, FVCOM, and SCHISM give comparable constraints, while ADICR is much less.

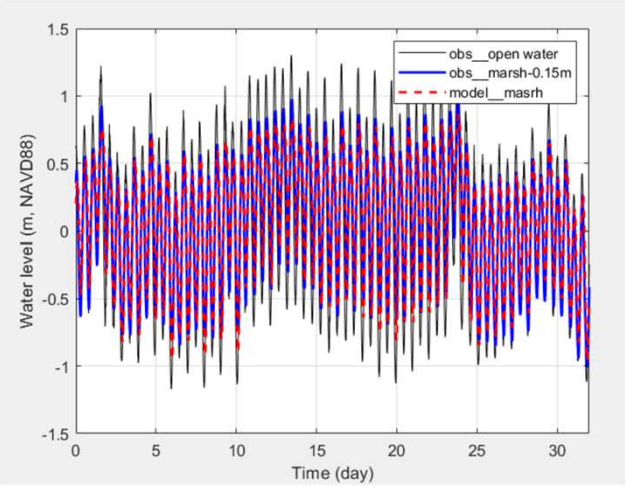


Figure: Time series of observed and modeled water levels

Research Gaps and Recommendations

- Horizontal eddy viscosity plays a critical role in the dynamics of the narrow inlet flow constraint.
- The results can direct numerical model selection and grid design in coastal modeling.
- Two simple predicting models are built, which provide quick and useful guidance on exchange rates between basins for ecologists and engineers.