SEDIMENT TRANSPORT IN ESTUARIES: ESTIMATING BED SHEAR STRESS DISTRIBUTION FROM NUMERICALLY MODELED TIDES IN AN ENERGETIC ESTUARY

Research Challenge
The rise in land development and associated increases in impervious surface cover have led to a decline in water quality and estuarine health by depositing higher loads of sediment, nutrients, and pollutants. Numerical modeling is a cost-effective way to predict the impact of sediments on estuary-wide nutrient loads, a potentially significant but so far largely neglected source of nutrients.

Methods & Codes
This project used the Regional Ocean Modeling System (ROMS) within the Coupled–Ocean–Atmosphere–Wave–Sediment Transport (COAWST) coupled modeling framework. The model was forced by a combination of tidal and meteorological boundary conditions to reflect real world conditions. Time series analysis and statistical methods were used to determine the best-fit bottom boundary condition for future model runs. The next phase of the project will incorporate waves and sediment transport.

Why Blue Waters
Blue Waters system provided the necessary computational power to test models using a higher-resolution 10-meter grid, which was previously infeasible for this study. Further, the project support staff were an invaluable asset in getting this project up and running on Blue Waters.

Results & Impact
The results suggest that nutrient fluxes derived from sediment resuspension during a typical tidal cycle are potentially significant and should be considered when estimating nutrient loads in estuaries. This is particularly important for estuaries with tidal mudflats, as mud and cohesive sediment tend to trap more nutrients and pollutants. Scientists, land managers, and legislators should incorporate this finding into nutrient load estimates, especially from non-point sources. This is highly relevant for setting project budgets, regulatory limits, and determining best practices for estuarine management.