MODELING NONLINEAR PHYSICAL-BIOLOGICAL INTERACTIONS: EDDIES AND SARGASSUM IN THE NORTH ATLANTIC

Research Challenge
- To highlight interactions among the macroalga Sargassum and mesoscale eddies and fronts
- To better predict Sargassum dispersal and growth

Methods & Codes
A system of four coupled models was used to perform these simulations:
- A modified version of the Hybrid Coordinate Ocean Model (HYCOM) code
- A biogeochemical model including nutrient chemistry and plankton growth
- A Lagrangian particle model to simulate Sargassum raft movement
- A Sargassum growth model including reproduction and mortality

Results & Impacts
This study found the Gulf of Mexico and Western Tropical Atlantic are the two key regions that influence the Sargassum distribution throughout its range. Eddy activity may help maintain the populations in these key regions. This is important for tracking the sources of the Sargassum blooms that lead to costly wash-up events that have inundated Caribbean and Gulf beaches in recent years.

Why Blue Waters
The HYCOM model has a high computational cost; the research proposed here also requires additional ocean biogeochemistry models. The professionalism of the NCSA staff has also been key to the success of this project. Their responsiveness and expertise made implementing and running this code on Blue Waters as straightforward as possible.

Allocation: 2015-2016 BW Grad Fellow
Maureen T. Brooks
University of Maryland
Biological Oceanography

(upper) Attracting Lagrangian coherent structure field for the Gulf of Mexico for November 6, 1993, as calculated by finite-time Lyapunov exponent from a 28-day backwards-time particle integration. (lower) Normalized biomass of Sargassum particles, overlaid on the LCS field for the same date. Note higher biomass in the western GoM.

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