



# Regional and Mesoscale Models Nested in a Global Model: Dynamics and Boundary Conditions

Gallacher, P. C.<sup>1</sup>, M. R. Schaferkötter<sup>2</sup> and S. Piacsek<sup>1</sup>  
<sup>1</sup>Naval Research Lab, <sup>2</sup>Sverdrup Technologies Inc.,  
 Stennis Space Center, MS, USA

## Abstract

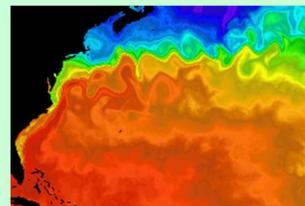
Regional and mesoscale models are being used to study various aspects of Coastal Oceanography. We are using a regional model of the MidAtlantic Bight with an embedded mesoscale model of the New Jersey shelf/slope to study the outer shelf dynamics, particularly the internal wave field, and its affect on acoustical propagation. The results will be compared with data from the SWAT experiment and with tide gauges.

Both the regional and the mesoscale models are set up using the Navy Coastal Ocean Model (NCOM). NCOM is designed for efficient nesting with the capability of one- or two-way nesting. The effects of remote forcing are included through active open boundary conditions. These boundary conditions prescribe the temperature, salinity and velocity fields from the Global version of NCOC and tidal amplitude and phase from the ADCIRC model. The boundary conditions also allow for the radiation and advection of temperature, salinity and velocity out of the domains. Surface fluxes are taken from Coastal Ocean and Atmosphere Prediction System (COAMPS) forecasts.

## Navy Coastal Ocean Model (NCOM)

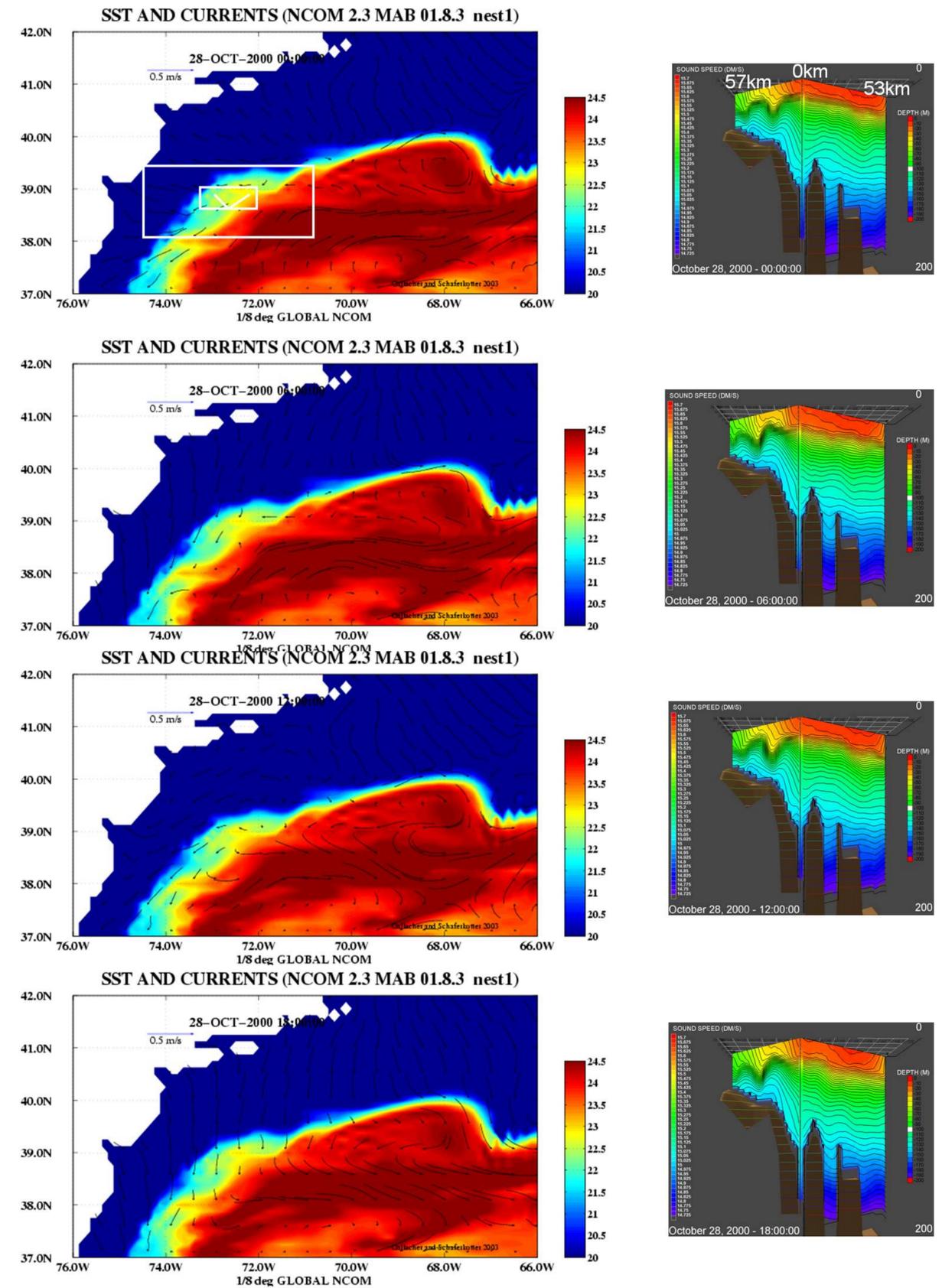
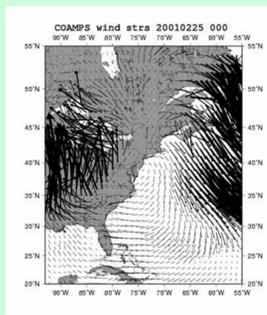
- Combined sigma-z vertical coordinate
  - improves simulations over steep topography
- Based on
  - Princeton Ocean Model (POM) physics
  - Coupled Ocean Atmosphere Prediction System(COAMPS) numerics
- Nested Grids
  - Horizontal
  - C grid,  $dx = dy = 1/8^\circ = 12\text{km}$ ,  $dt = 360 \text{ sec}$
  - C grid,  $dx = dy = 1/24^\circ = 4\text{km}$ ,  $dt = 120 \text{ sec}$
  - C grid,  $dx = dy = 1/72^\circ = 1.33\text{km}$ ,  $dt = 40 \text{ sec}$
  - Vertical
  - 41 levels, 21 sigma, 20 z
  - dz varies between approx. 1m and 100m
  - Leapfrog
- Bathymetry
  - DBDB5 enhanced with DBDB2 and Sandwell
  - and CIA coastline (Ko and McKinney)

## Initial and Open Boundary Conditions



- NCOM Global  $1/8^\circ$  Model
  - Currents (U, V)
  - Temperature SST
  - Salinity
  - Sea surface elevation
- ADCIRC
  - 8 Tidal components

## Atmospheric Forcing



Outermost domain on left and upslope and along slope sound speed sections at right (see upper left figure for orientation). Internal waves, excited tidally and by large scale flow, propagate mainly upslope, significantly affecting acoustics and dynamics on the slope and shelf. The internal waves can have amplitudes exceeding 50m.