Hypoxia in Chesapeake Bay: A Model Intercomparison Analysis

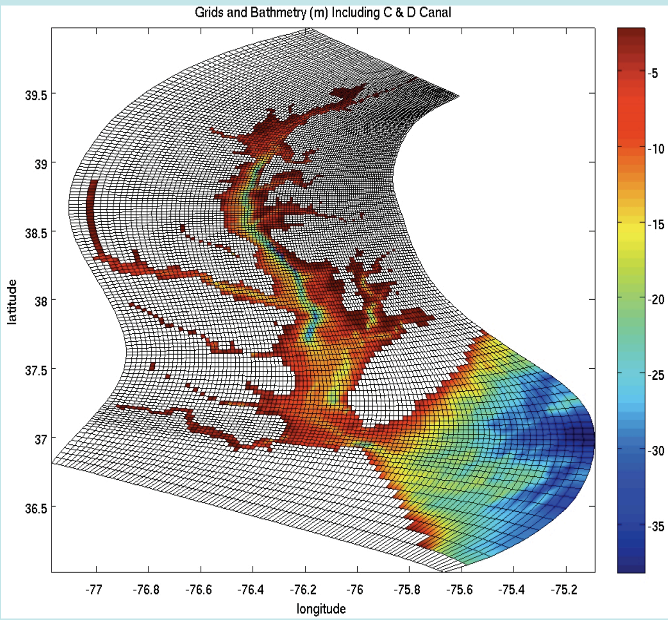
M. Friedrichs, A. Bever, M. Scully, C. Friedrichs

Methods: 5 Hydrodynamic models

3 flavors of ROMS

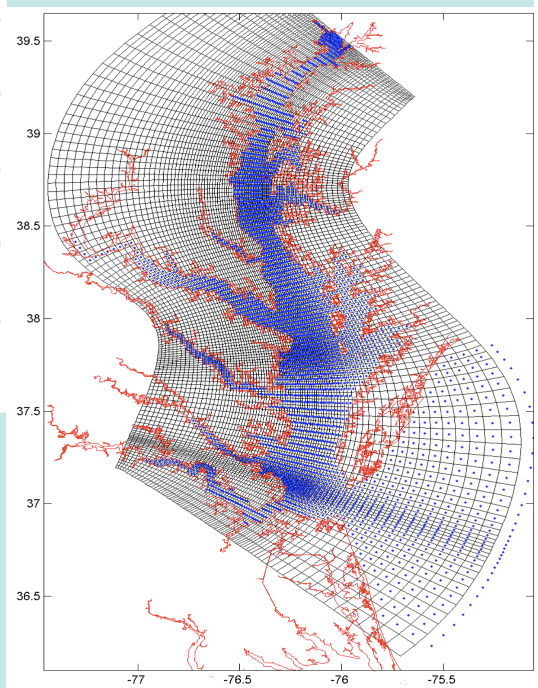
ROMS = Regional Ocean Modeling System

ChesROMS
(R. Hood, UMCES)



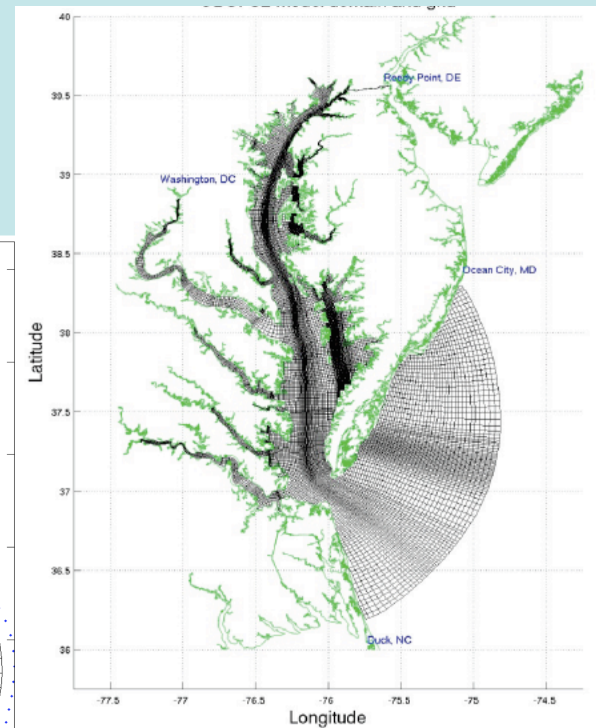
100x150 = 15000 grid cells
~5000 wet cells

UMCESroms
(Ming Li, UMCES)



160x240 = 38400 grid cells

CBOFS2
(L. Lanerolle, NOAA-CSDL)



332x291 = 96612 grid cells
~20000 wet cells

Multiple Models – Classical Paradigm

2006:

"…workshop participants felt that … from a regulatory and practical point of view multiple models are not appropriate for the CBP… **If there are multiple models… then court cases are invited.** …Development of multiple models… is often impractical and potentially counterproductive…."

2006 STAC Workshop Report:
Modeling in the Chesapeake Bay Program: 2010 and Beyond

Multiple Models – New Paradigm

2010:

Use of a multiple model consensus, where models use different approaches and assumptions, provides one way to better inform management decisions. This approach is well known for its application to forecasting hurricane paths and predicting the effects of carbon dioxide fluctuations on climate…

2010 Report on Scientific Assessment of Hypoxia in U.S. Coastal Waters. Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

Multiple Models – New Paradigm

2010:

…it is now possible… for several independent or "competing" modeling efforts to address similar issues for the same geographic location. This development is a positive one because **scientific debate and consensus building – which promote scientific advancement – cannot occur effectively if there is only a single modeling program.**"

2010 Report on Scientific Assessment of Hypoxia in U.S. Coastal Waters. Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health of the Joint Subcommittee on Ocean Science and Technology. Washington, DC.

NOAA IOOS Modeling Testbed

Four Teams:

Cyberinfrastructure Team
Coastal Inundation Team
Shelf Hypoxia Team (Gulf of Mexico)
Estuarine Hypoxia Team (Chesapeake Bay)

NOAA IOOS Modeling Testbed

Estuarine Hypoxia Team:

Carl Friedrichs (VIMS)
Marjorie Friedrichs (VIMS)
Aaron Bever (VIMS)
Jian Shen (VIMS)
Malcolm Scully (ODU)
Raleigh Hood/Wen Long (UMCES, U. Md.)
Ming Li (UMCES, U. Md.)
John Wilkin/Julia Levin (Rutgers U.)
Kevin Sellner (CRC)

Federal partners

Carl Cerco (USACE)
David Green (NOAA-NWS)
Lyon Lanerolle (NOAA-CSDL)
Lew Linker (EPA)
Doug Wilson (NOAA-NCBO)

NOAA IOOS Modeling Testbed

Overarching Goal of EH Component:

To help improve operational and scenario-based modeling of hypoxia in Chesapeake Bay:

What causes the temporal and spatial variability of hypoxia in Chesapeake Bay?

Methods:

1. Compare hindcast skill of multiple CB models
e.g. salinity, temperature, stratification, DO concentration

2. Generate metrics by which future models can be tested

Outline

1. Methods

- Hydrodynamic models
- Biological (DO) models
- Data

2. Relative model skill

- Animations
- Target diagrams
- Hypoxic volume (HV) time series

3. Model analyses

- Uncertainties in interpolated HV estimates
- Modifications of sampling strategies
- Study of mechanistic processes causing hypoxia

4. Summary and Conclusions

Methods: 5 Hydrodynamic models

EFDC
(Jian Shen, VIMS)

CH3D
(Chesapeake Bay Program)

Grids removed
to make presentation
smaller

18000 wet grid cells

54000 wet grid cells