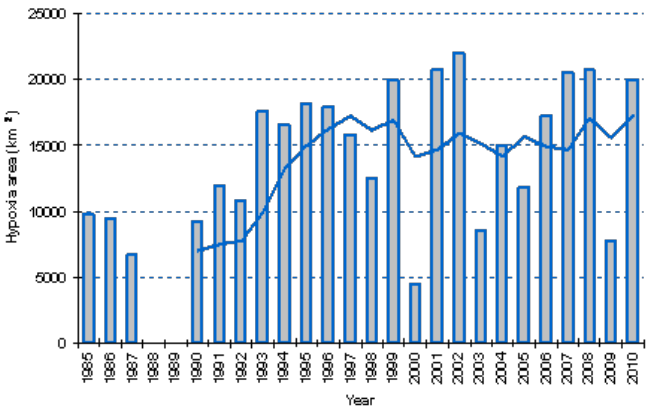
United States Environmental Protection Agency

EPA Gulf Ecology Division

Gulf Hypoxia FY10-12 Activities



GULF ECOLOGY DIVISION

Gulf Breeze, Florida

United States Environmental Protection Agency

Conduct ecological effects research to assess estuarine and coastal condition and services, determine cause(s) of affected and declining systems, predict future risks to populations and ecosystems, and support development of criteria to protect coastal systems.

65 EPA Staff, 40% with Ph.D.s

16.1 Fed-owned acres

- **66,000 ft^2 workspace**
- **32,000 ft^2 lab space**
- **Seawater system and wet lab**
- **Coral research lab**
- **Research fleet**

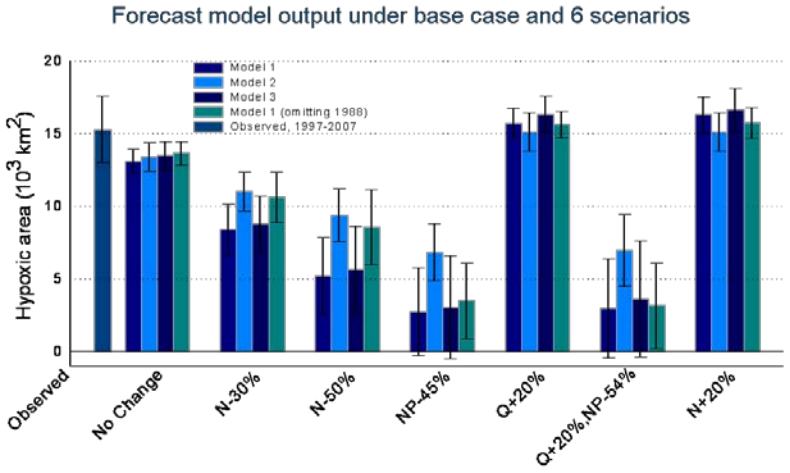
Research Focus Areas

- **Nutrients and hypoxia**
- **Ecosystem services**
- **Predictive ecotoxicology**

United States Environmental Protection Agency

Project Overview

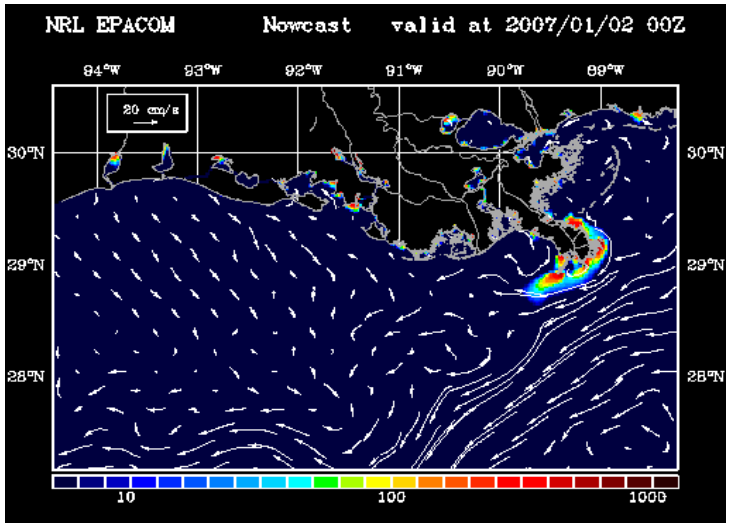
- Addresses scientific priorities identified by EPA's Science Advisory Board and the Gulf Hypoxia Task Force.
- Project has evolved:
  - Shelf wide monitoring to support modeling (2002-05)
  - Field work to measure production, respiration, and nutrient cycling rates, monitoring, and modeling (2006-08)
  - Modeling and analyses, sediment biogeochemistry (2009-present)
- Technical support to EPA Office of Water and Task Force during Action Plan reassessment



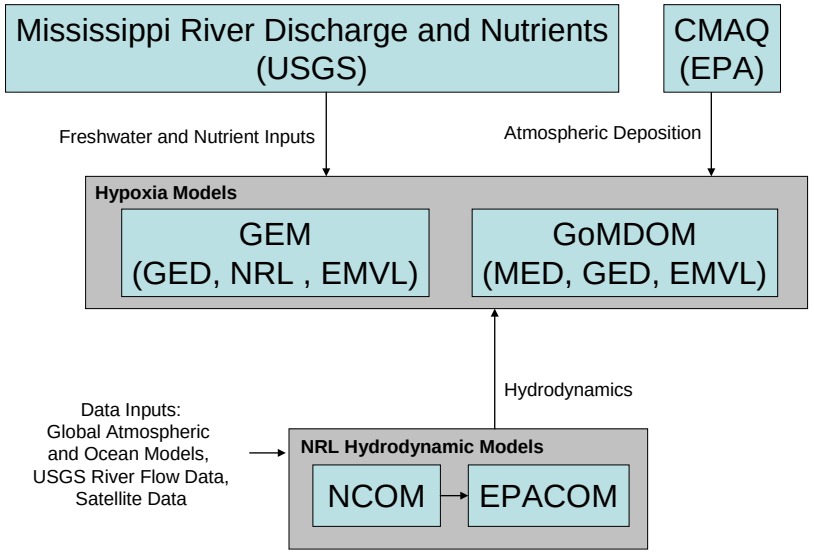
Greene et al. (2009)

GED FY10-12 Activities

- Develop and report field and model results that contribute to our understanding of the development and maintenance of hypoxia
  - Focus on improved understanding of sediment dynamics
  - Focus on comparison of observed rate processes with modeled rate processes
- Assess the strengths and limitations of the models for predicting hypoxia and assessing potential nutrient reduction scenarios
  - Coastal ocean hydrodynamic models (NCOM and EPACOM)
  - Eutrophication models (GEM and GoMDOM)
  - Loading models



Schema for Modeling Activities



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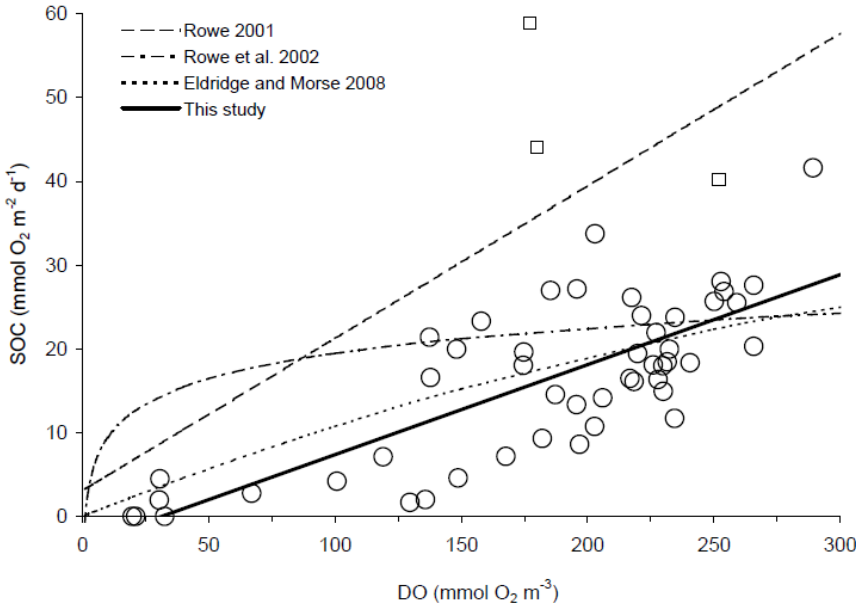
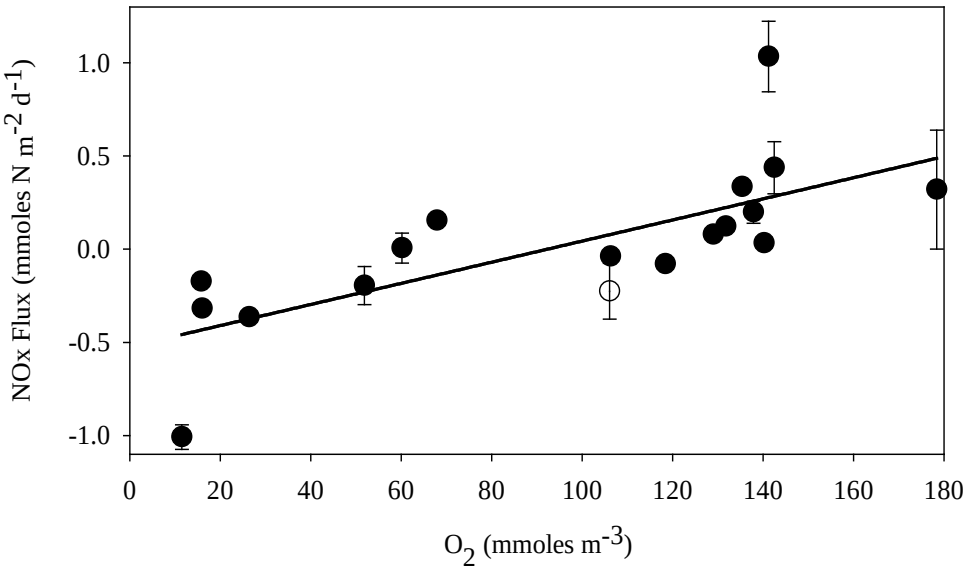
Sediment fluxes in relation to bottom water oxygen concentration



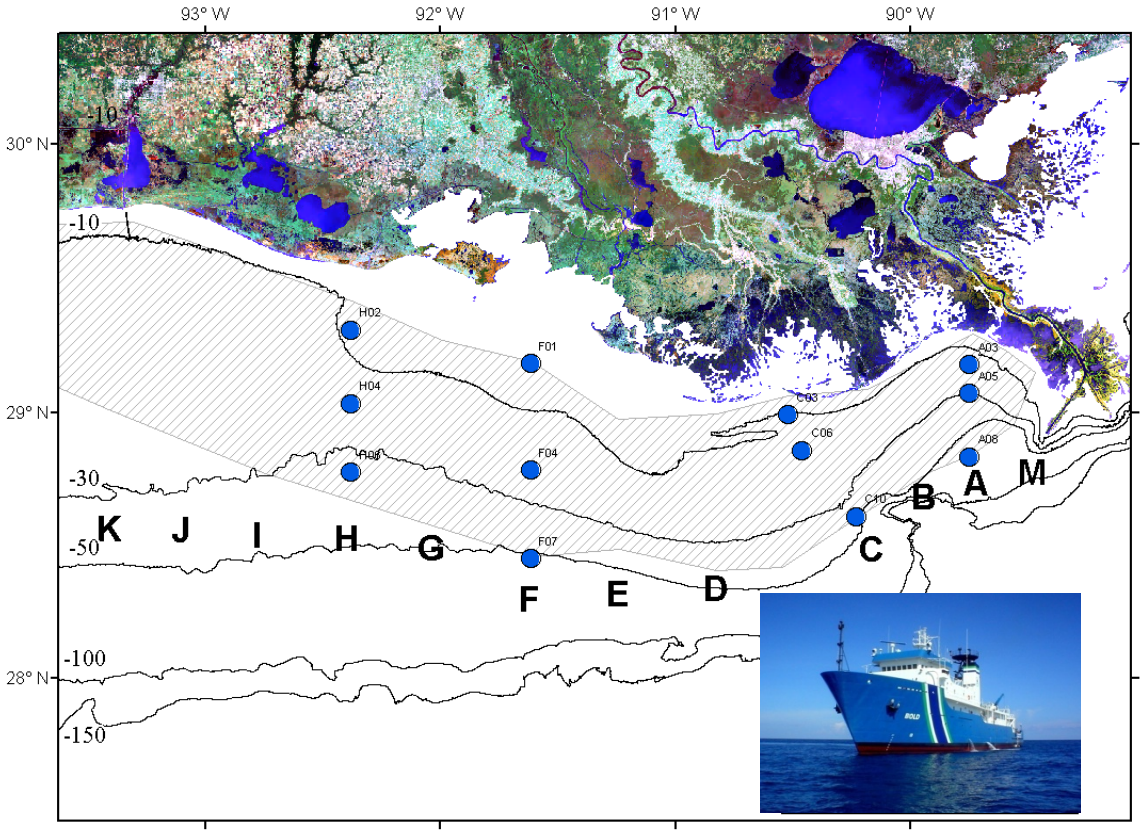
Murrell and Lehrter (2011)



Lehrter et al. (In review)

FY11 Field Work

- October 2010
  - Two week cruise to examine spatial variability in sediment fluxes and carbon cycling rates
  - Preliminary results show a strong inshore to offshore gradient in rates
  - Fluxes and Rates measured
    - N2, O2, Ar, DIN, DIP, DIC, alkalinity
    - Fe, Mn, and SO4 reduction
  - Sediment geochemical profiles measured
    - Nutrients, DIC, pH, alkalinity, Fe, Mn, S
    - Bulk density, porosity, grain size
    - C and N isotopes
    - Radioisotopes for geochronology



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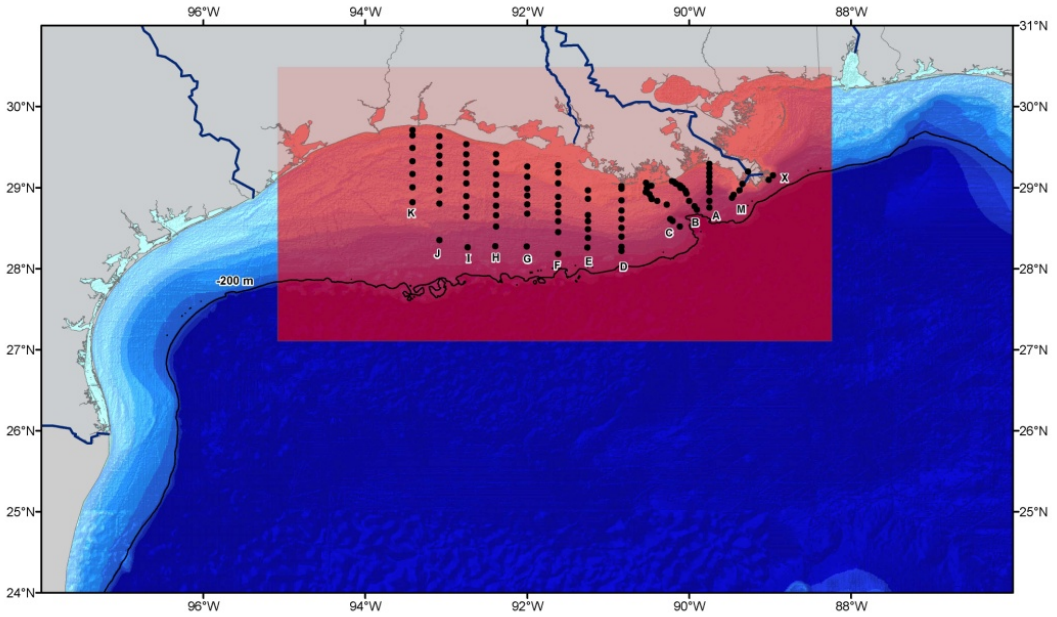
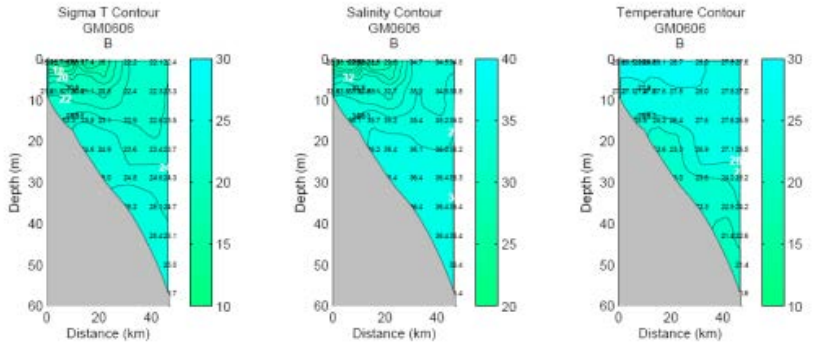
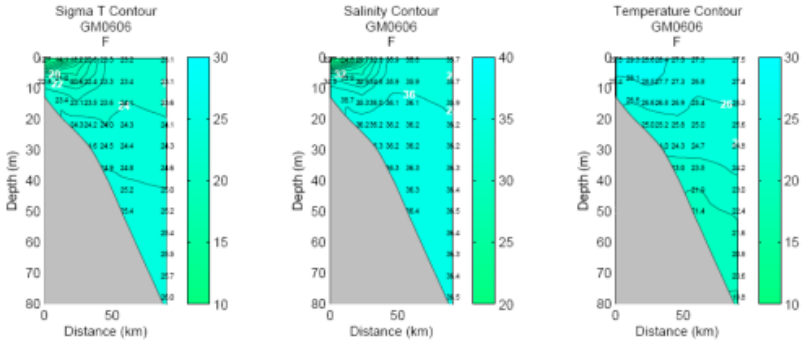
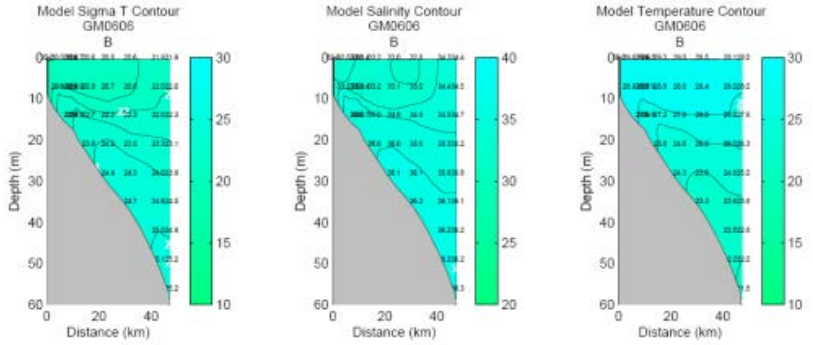
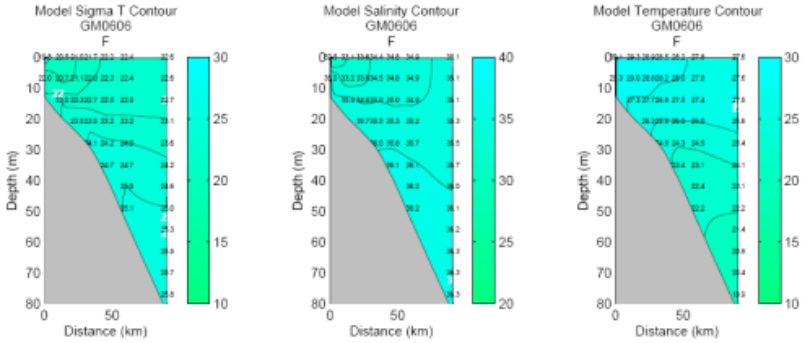
Assessment of the hydrodynamic model











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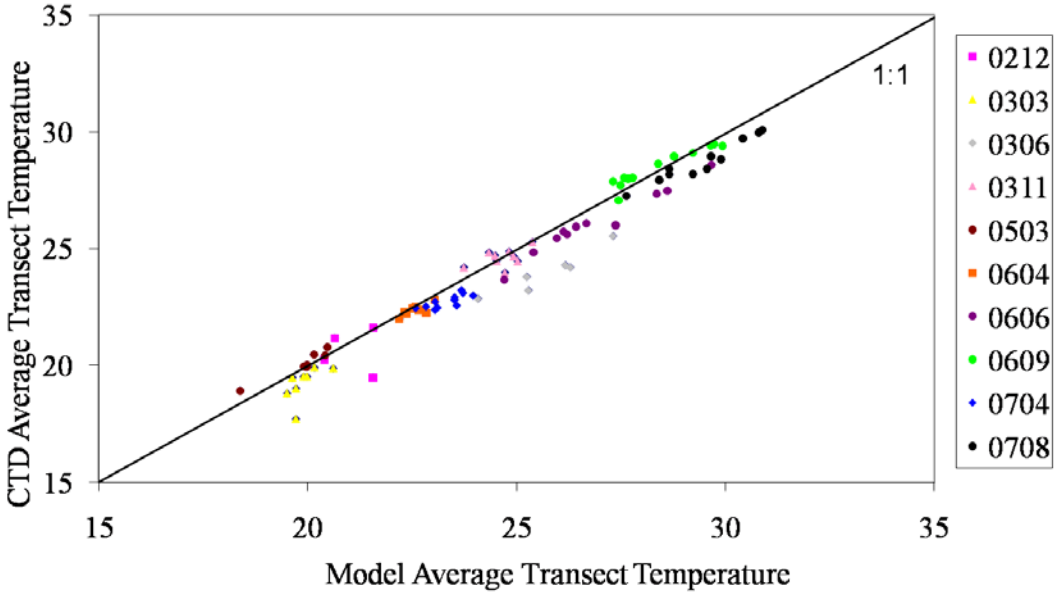
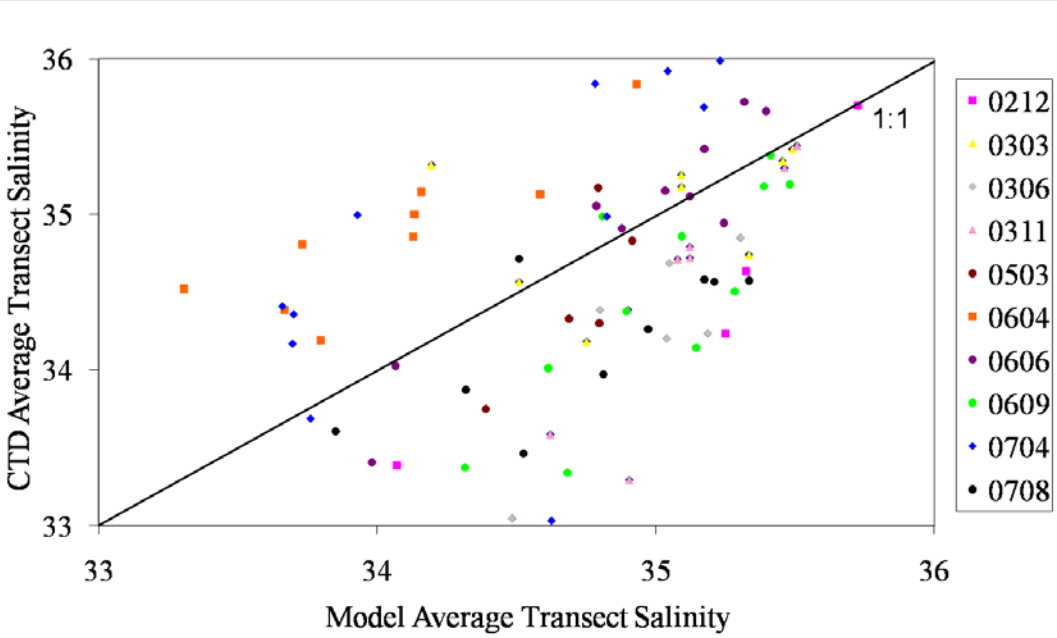
Model Assessment





Assessment of the hypoxia models

GEM

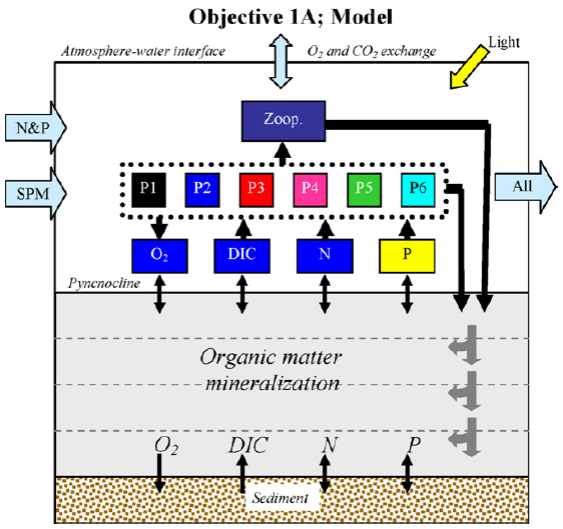
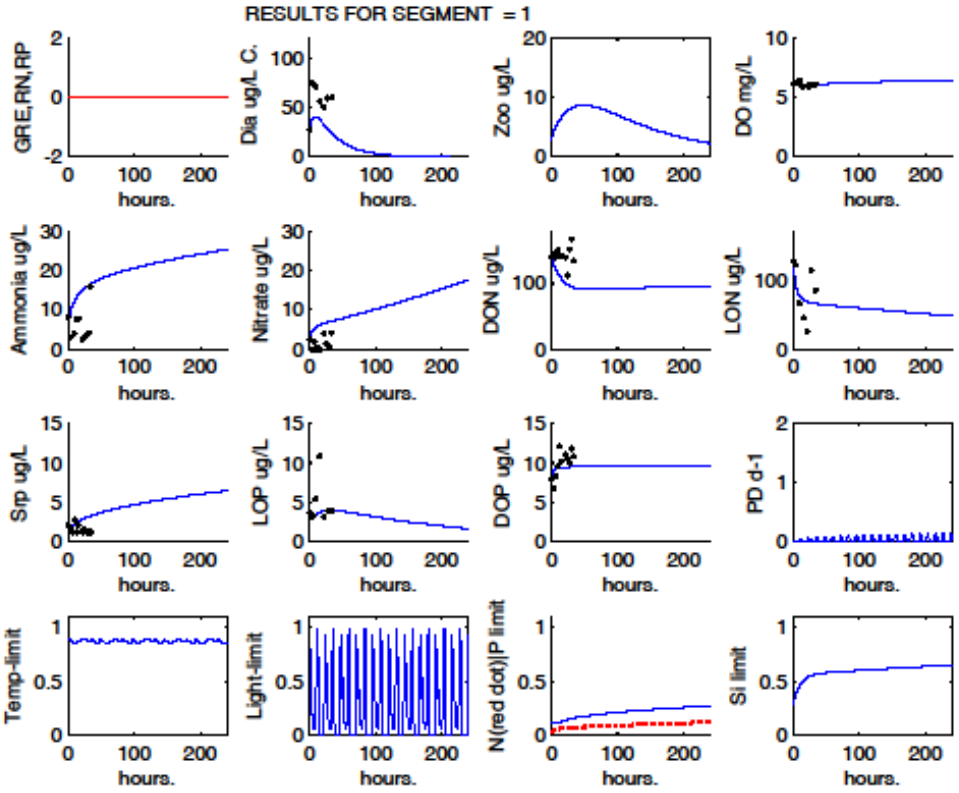


Fig. 2. We employed a three compartment model where the surface mixed layer, four bottom layers, and the sediments are depicted. In the surface layer, a plankton food web model was used depicting the demographics of multiple phytoplankton groups, P1–P6 (Roelke et al., 1999; Roelke, 2000) and in the bottom layers and sediments a multi-element diagenetic model was used (Morse and Eldridge, 2007; Eldridge and Morse, 2008). Dissolved inorganic nitrogen (N) and phosphate (P), and suspended particulate matter (SPM) advected into each model region. Oxygen and carbon dioxide exchanged between the surface layer and atmosphere, were produced and consumed by phytoplankton in the surface mixed layer, and also the bottom layers and sediments (carbon modeled as dissolved inorganic carbon, DIC).

Eldridge and Roelke (2010)

GoMDOM



Pauer et al (In Prep)

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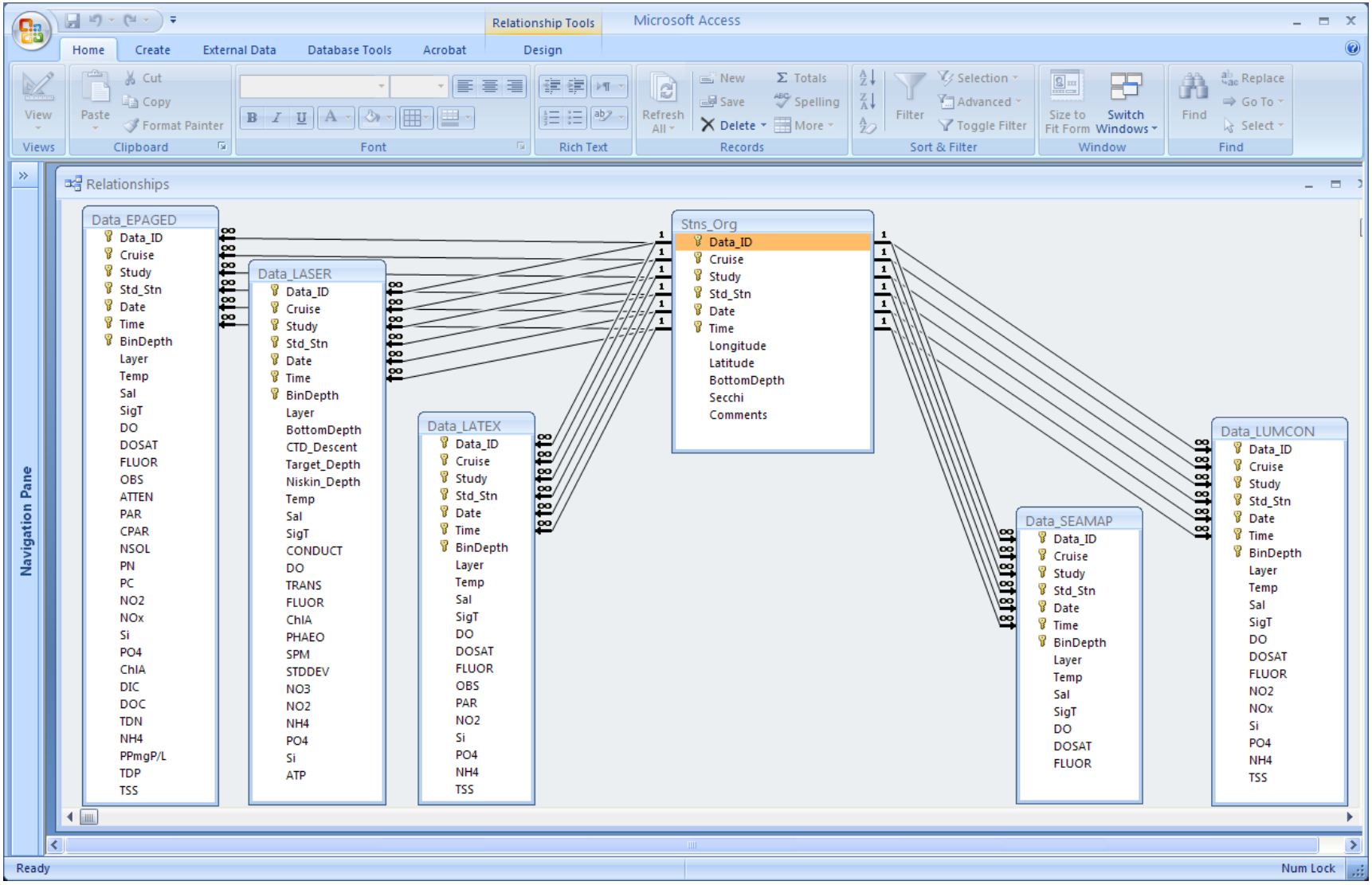
Database development for the management and research community



Thanks to GED's hypoxia research staff (and many others)