Progress in GLOBEC GCOA NPZ modeling

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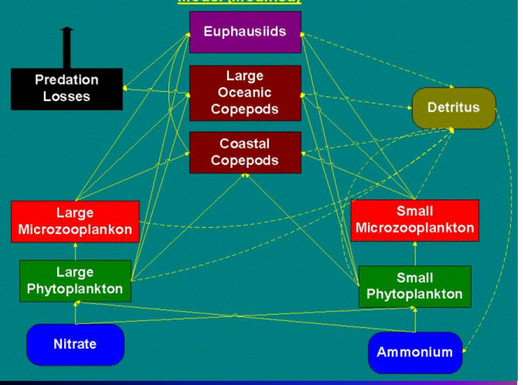
Activities in 2002

1. Revision of Food Web
2. Inclusion of Oceanic Regions using Iron Limitation
3. Comparison of GLNPZ and NPZD
4. 3D simulations for 1999

Revision of Food Web

- Revised trophic linkages:
  - separate pathways through small and large phytoplankton and microzooplankton
- Microzooplankton boxes now:
  (1) small (<20um)
  (2) large (>20 um)

GoA Nutrient-Phytoplankton-Zooplankton Model (Modified)



Comparison between NPZD (Lewis et al.) and GLNPZ

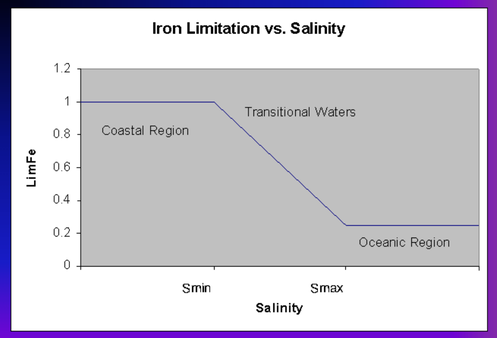
- A goal of the GLOBEC NEP program: compare production in the CGOA and the CCS
- How to compare model results when the NPZ models developed for each area are so different?
- See Dobbins et al. poster

Problem

- Boundary between coastal and oceanic models cannot be fixed in space, we want to follow water masses on and off the shelf, so ONE model is needed for both regions
- Different ecosystems components important in each region
- How do we model differences?

Approach

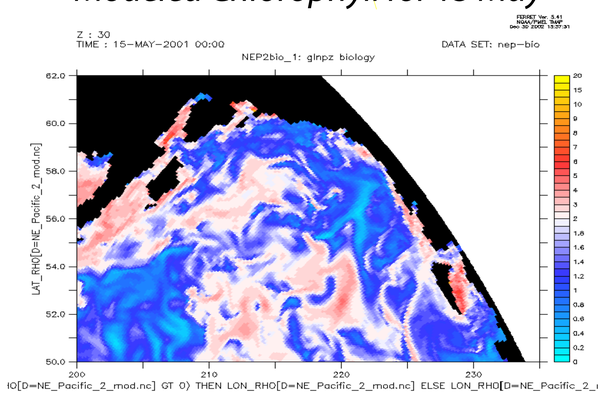
- Extend GLNPZ to oceanic (as well as coastal) region
- Incorporate iron limitation in oceanic area
- Iron limitation = a third multiplicative factor affecting phytoplankton growth, along with light and nutrients (range 0-1)
- Uses salinity as a proxy for iron
- Acts only on large phytoplankton



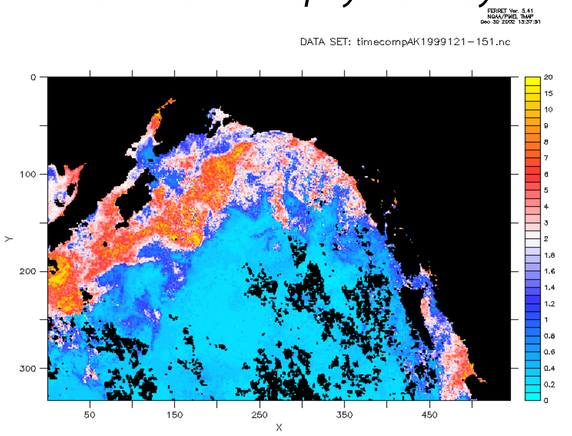
Development of 3D Nested GLNPZ Model

- Added GLNPZ to ROMS physical model code (superior advection, mixing and boundary conditions, ability to run on massively parallel platforms)
- Compared original GLNPZ (used SCRUM model for physical forcing) vs ROMS/GLNPZ

Modeled Chlorophyll for 15 May



SeaWiFS Chlorophyll for May*

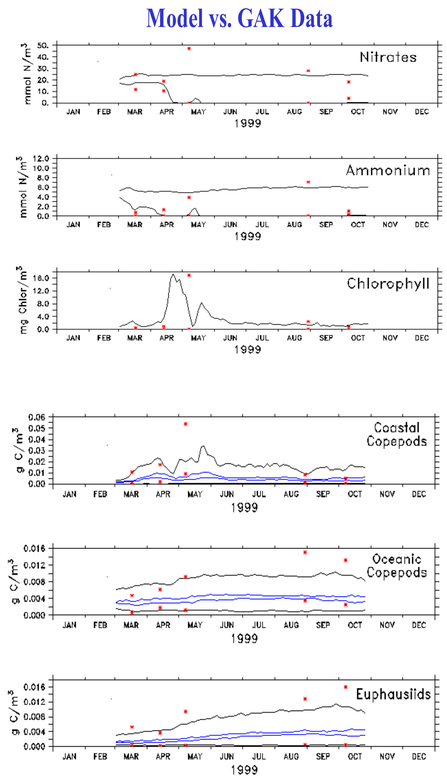


*Data courtesy of A. Thomas, UMaine, GLOBEC NEP Program

Salinity as a Proxy for Iron: Problems

- Small Phytoplankton blooms in oceanic areas
  - -Limitation only on Large Phyto-plankton's uptake of Nitrate
  - -Drives coastal copepod bloom offshore
- Limits productivity when offshore water moves onshore
  - -Upwelling of deep (high salinity) waters via canyons or above banks
  - -Expect high productivity because of high nutrients

Model vs. GAK Data



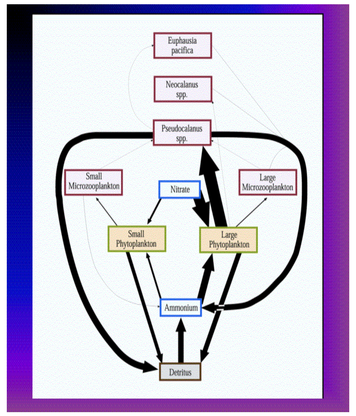
Model results are generally within the bounds of the data.

Data provided by T. Whitledge and K. Coyle, GLOBEC NEP LTOP program

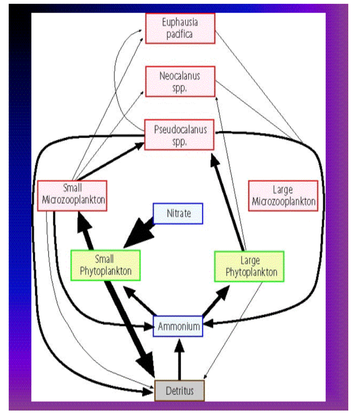
Chlorophyll maximum in the model is several weeks earlier than in the data

Peak of coastal copepods in May is missed by the model

Black: Min/max over stations and depths
Blue: Min/max over stations, depth averaged
Red: Min/max of data over stations and depths



(Left) Nitrogen fluxes (averaged over depth and time) with no iron limitation. Much of the biomass moves through large phytoplankton to small copepods (Pseudocalanus, spp.)



(Right) Nitrogen fluxes with iron limitation. Most of the biomass moves through small phytoplankton, small micro-zooplankton and small copepods, or through small phytoplankton and detritus.