



# High Latitude Biogeochemistry Frameworks for CICE/POP

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## Collaborators:

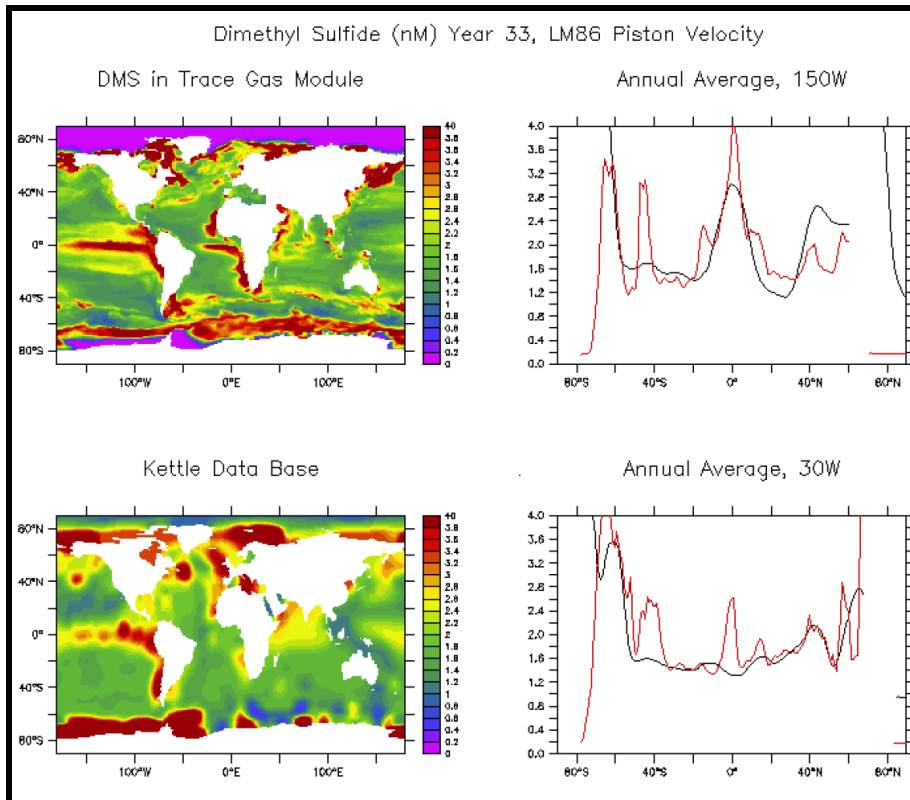
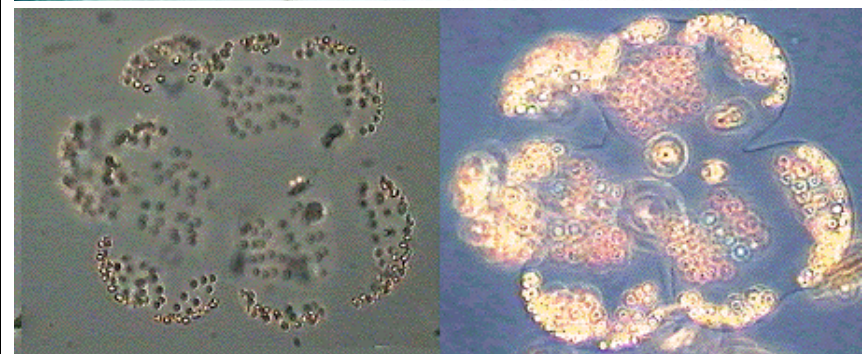
Current: IARC, NMT, NYU, Stanford, Australian Antarctic

Potential: UW, UAF, UTSA

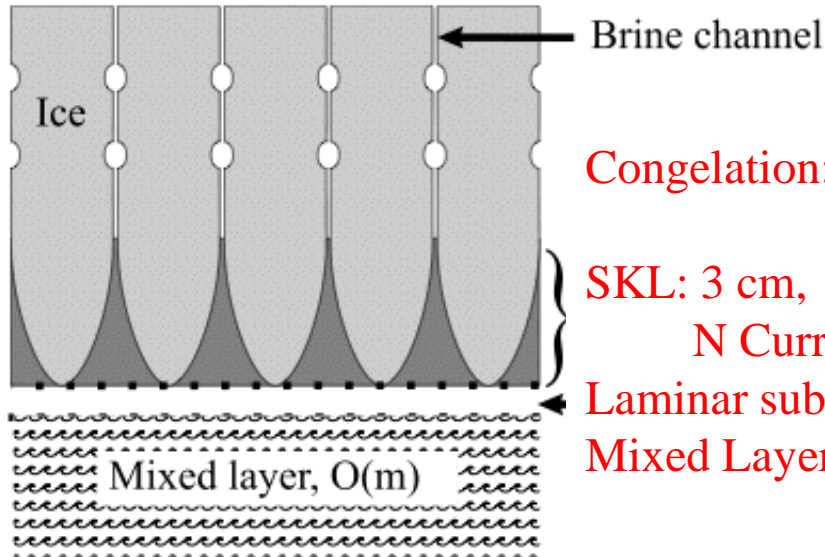
Sponsors: DOE Scientific Discovery through Advanced Computing  
(SciDAC), Climate Change Prediction Program (CCPP), EPSCoR, others

- Global results weak at poles
- Add biology of the ice domain
- Ice algae and pelagics
- Arctic N/S, then C and more

## WINTERIZE THE SYSTEM



# WHEN WE LAST MET



Congelation: No BGC

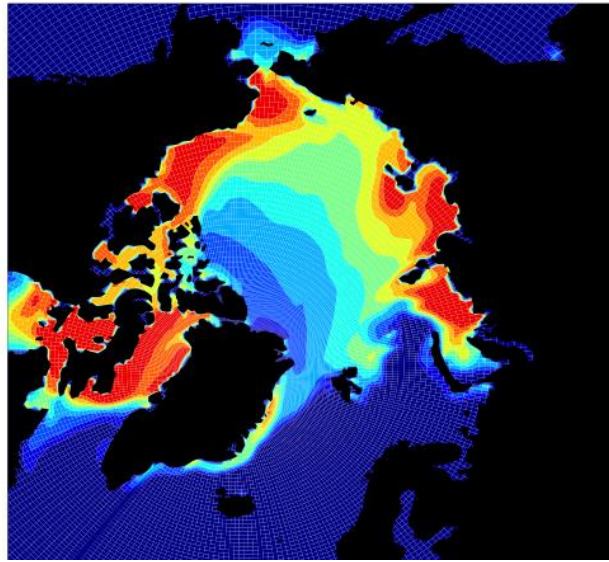
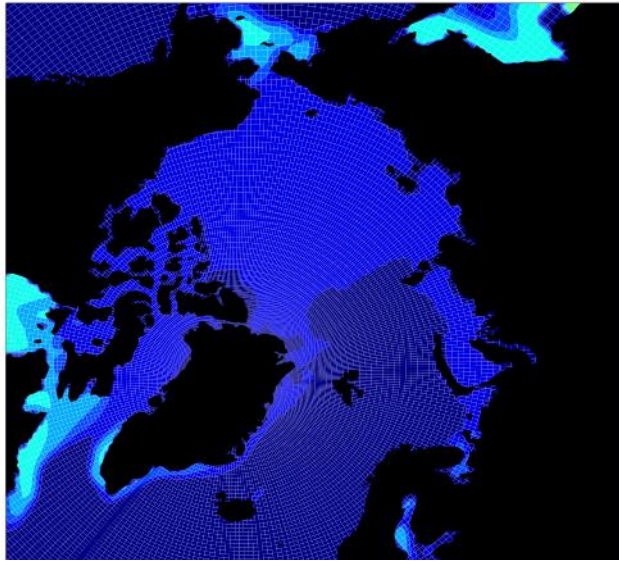
SKL: 3 cm, 3 tracers carried on area,  
N Currency,  $h\nu$ /Si limits, melt loss

Laminar sublayer

Mixed Layer: 10 m, Lagrangian, Si source

Lavoie et al. 2005  
Jin et al. 2006

- Ice biogeochemistry begins
- Landfast extended to sea ice, 3 tracers
- N based but diatoms so just  $h\nu$ , Si limits

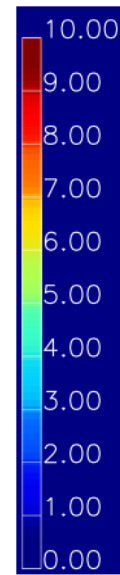
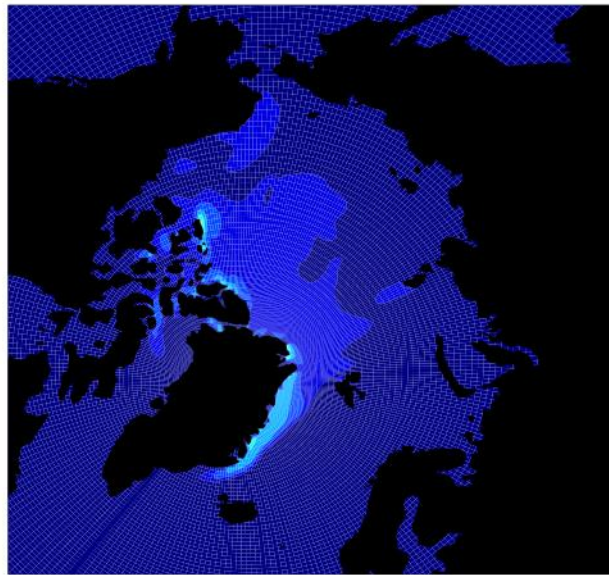
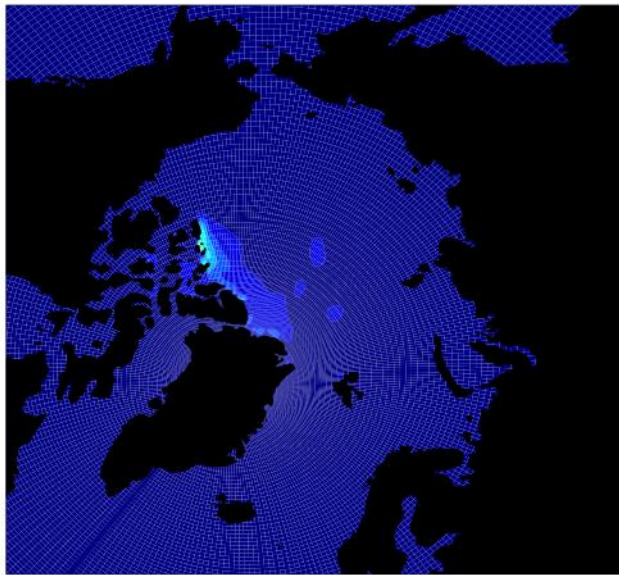


Ice Algae

Feb May

Aug Nov

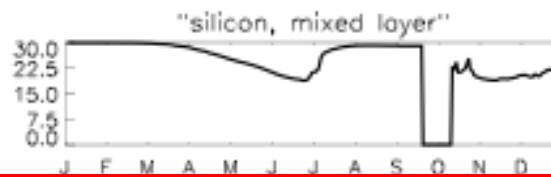
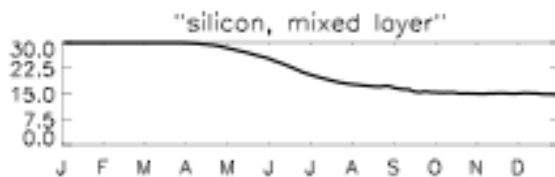
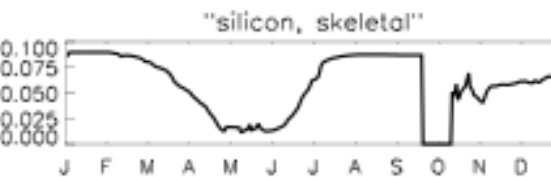
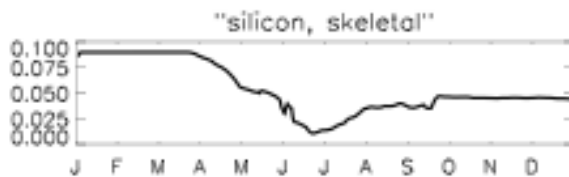
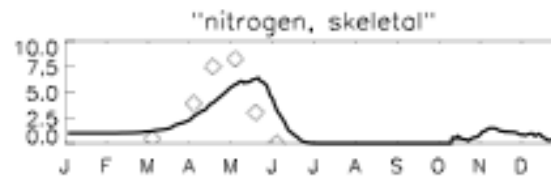
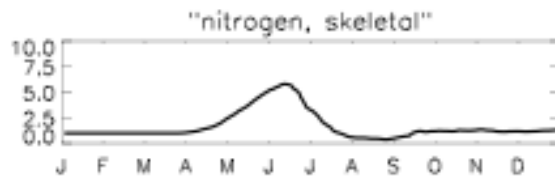
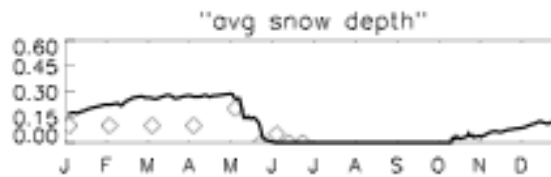
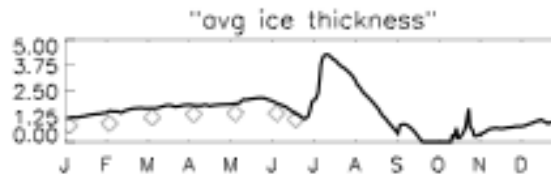
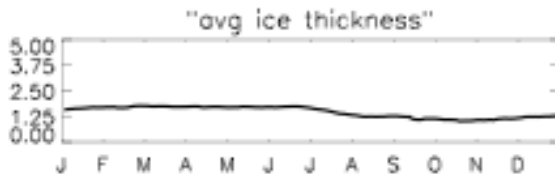
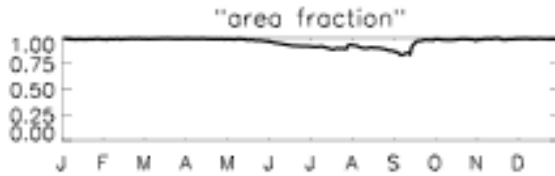
Nitrogen,  
Millimoles/m<sup>2</sup>



# Pole

# Barrow

# Site Analysis

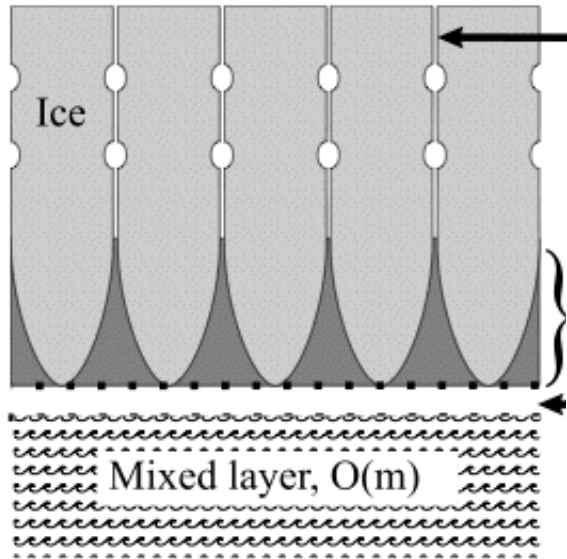


Units:

Length - meters

Concentration -  
Millimoles/m<sup>2</sup>

Barrow data:  
Jin et al. 2006



## SINCE WE LAST MET

Upper Layers: still no biogeochemistry

SKL: 3 cm, 12 tracers carried on area, N Currency plus C/Si/Chl/S,  $h\nu$ /N1/N2/Si limits, melting

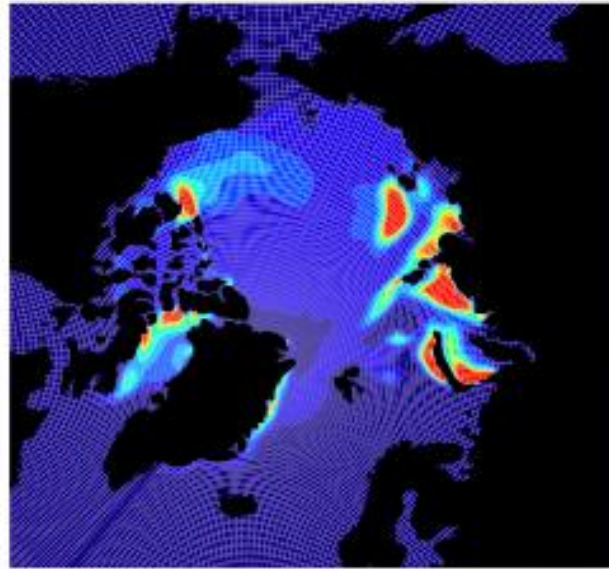
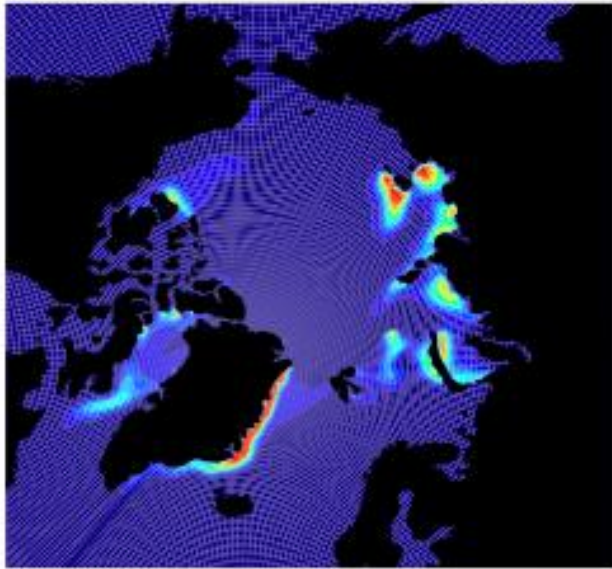
Laminar sublayer

Mixed Layer: 10 m, Lagrangian

$\text{NO}_3^-$ ,  $\text{NH}_3/4^+$ , Si sources, DMS(P,other) sequence

Lavoie et al. 2005  
Jin et al. 2006

- Detail increased in the CICE ecology
- Physical configuration similar
- Other major elements add to N
- Serial S kinetics, sources to potential DMS
- Total of 12 biogeochemical tracers

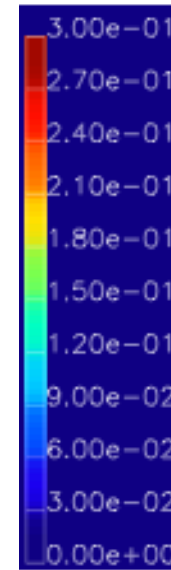
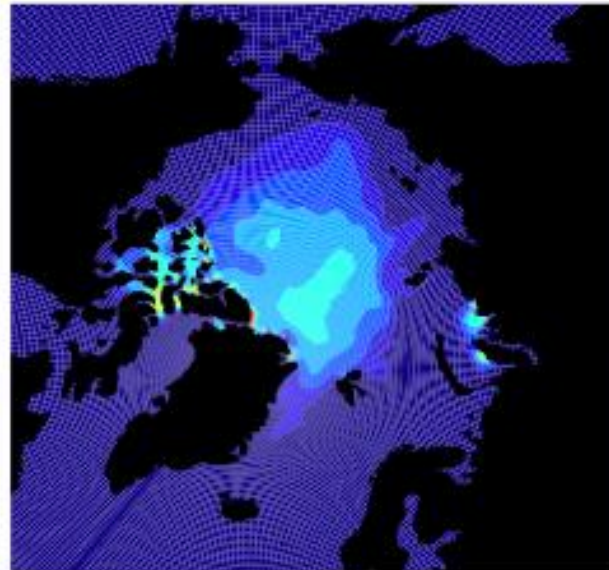
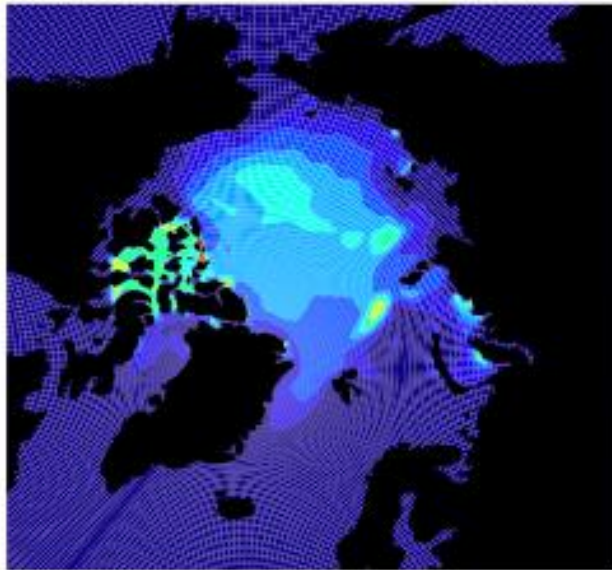


## DMS Potential

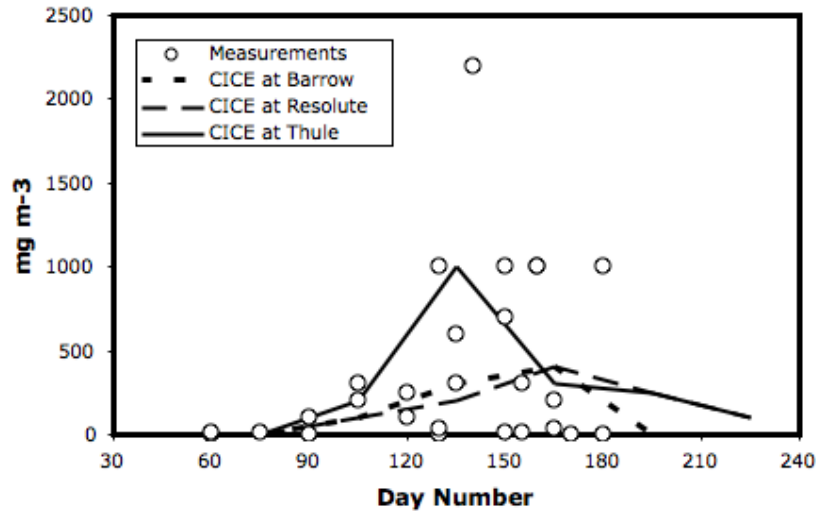
May June

July Aug

Sulfur,  
Millimoles/m<sup>2</sup>



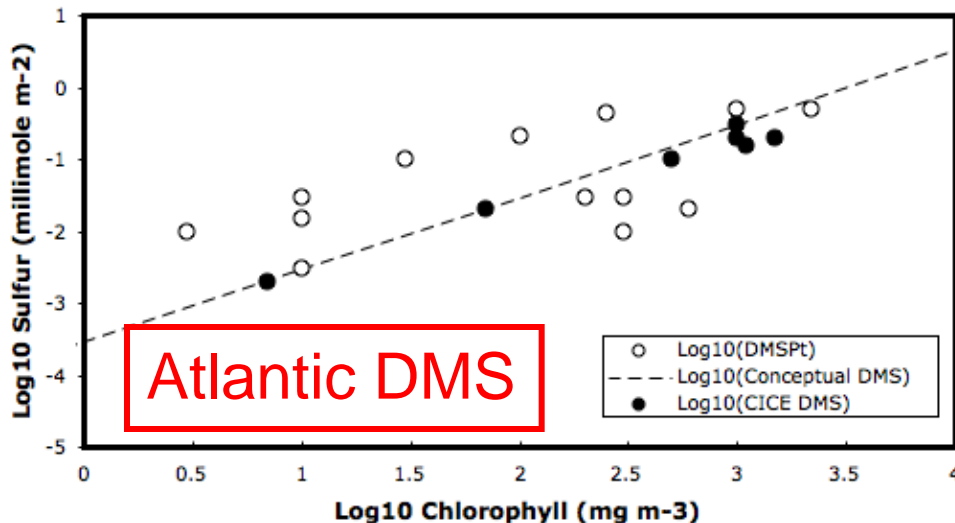
## Chlorophyll in Bottom Layer



## EXPANDED ANALYSIS

- Focused on Arctic S studies
- Chlorophyll plus total sulfur in/near the bottom habitat
- Need POP and upper layers
- Also complete DMS chemistry

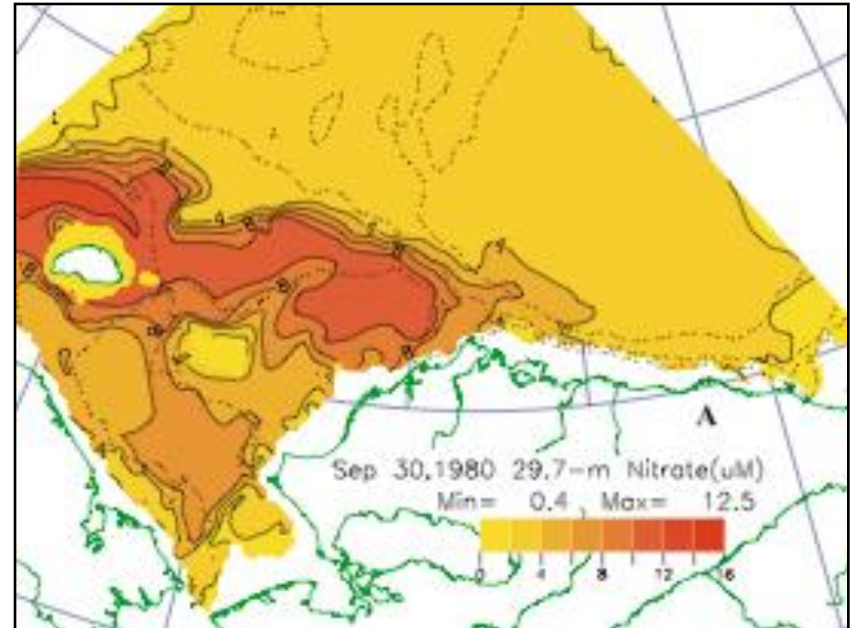
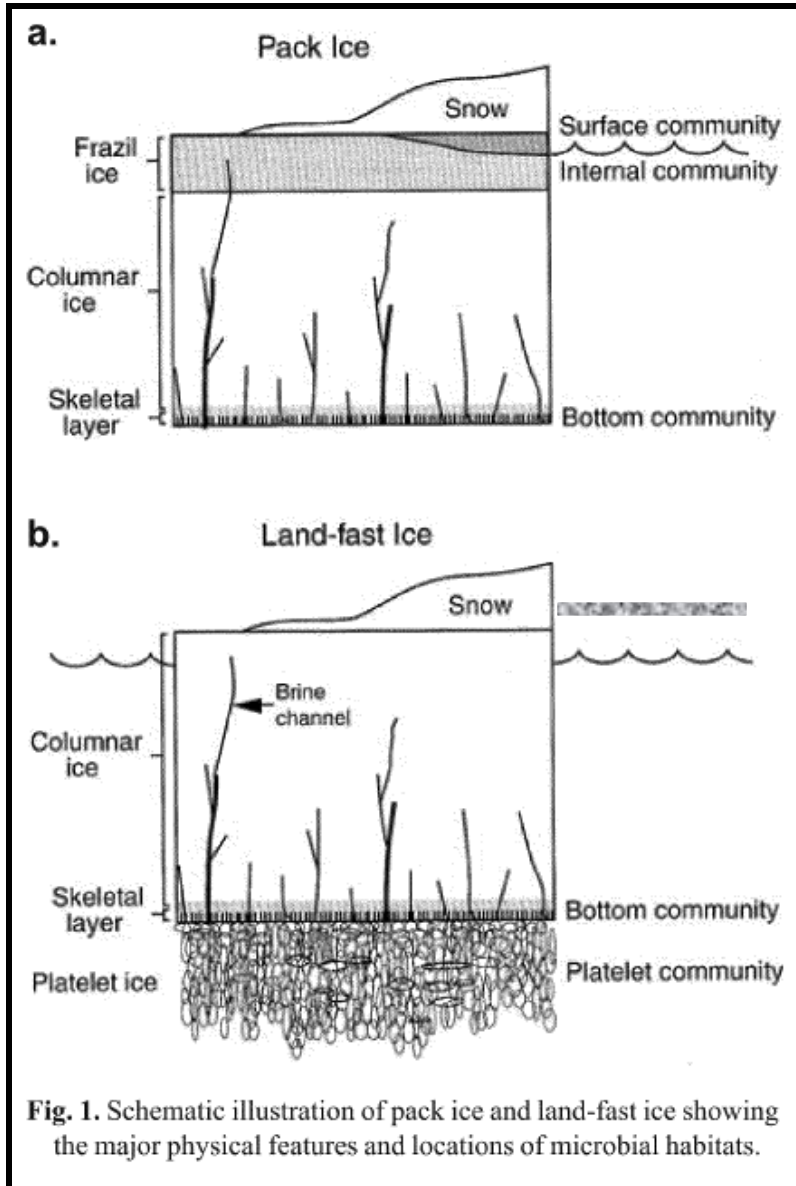
## Log transform S to Chlorophyll Relations



Polar DMS



# ICE ALGAL FUTURES -Upper habitats, POP coupling

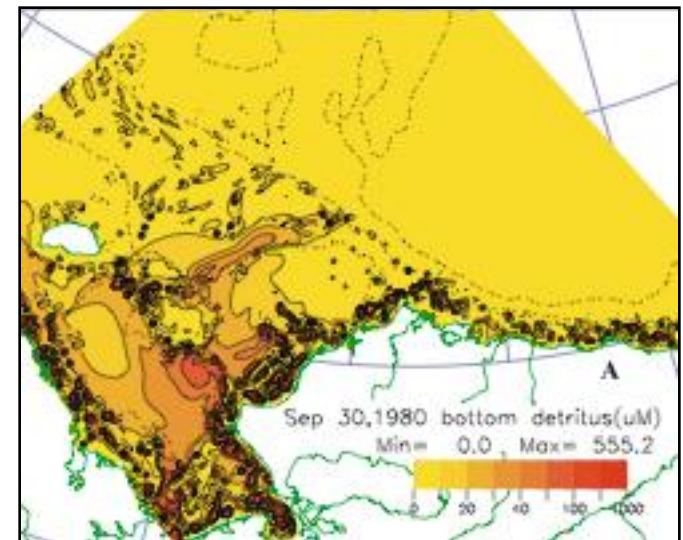
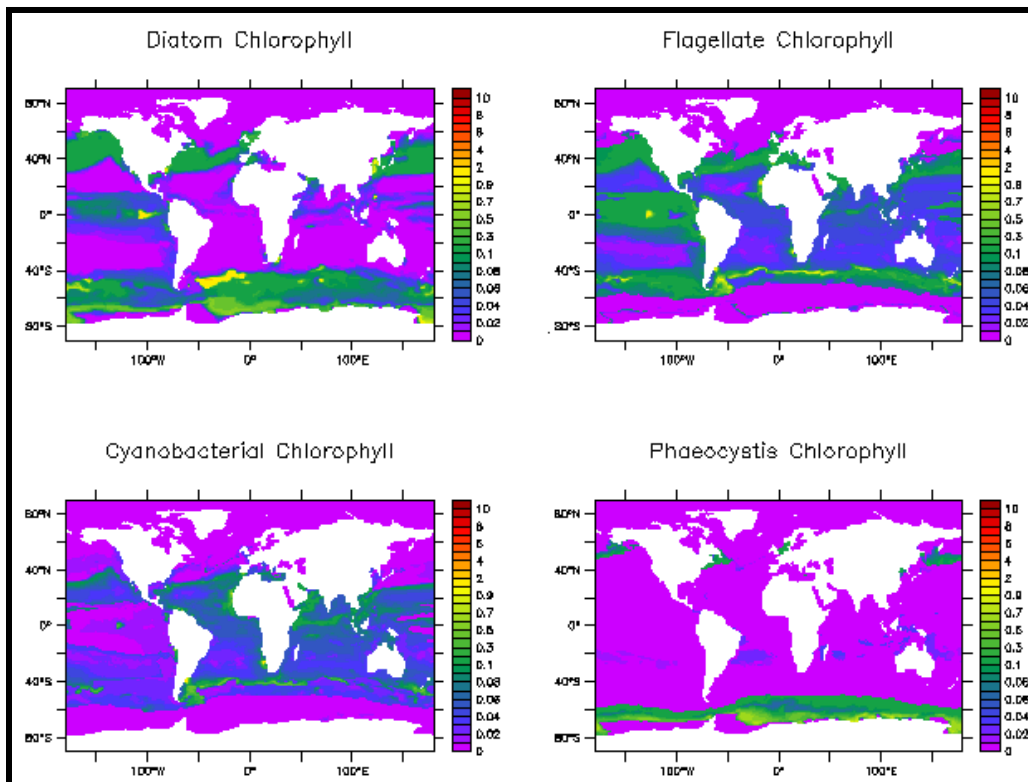


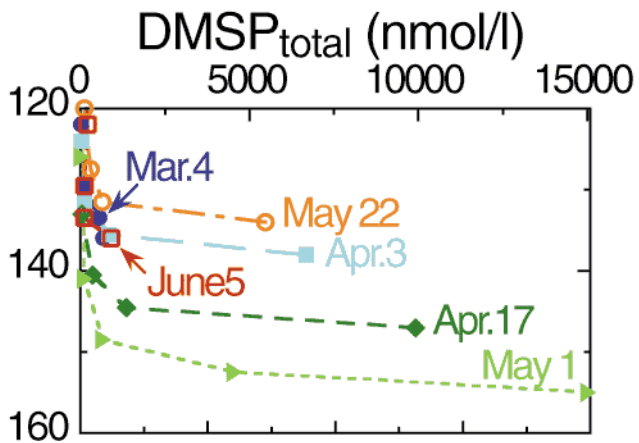
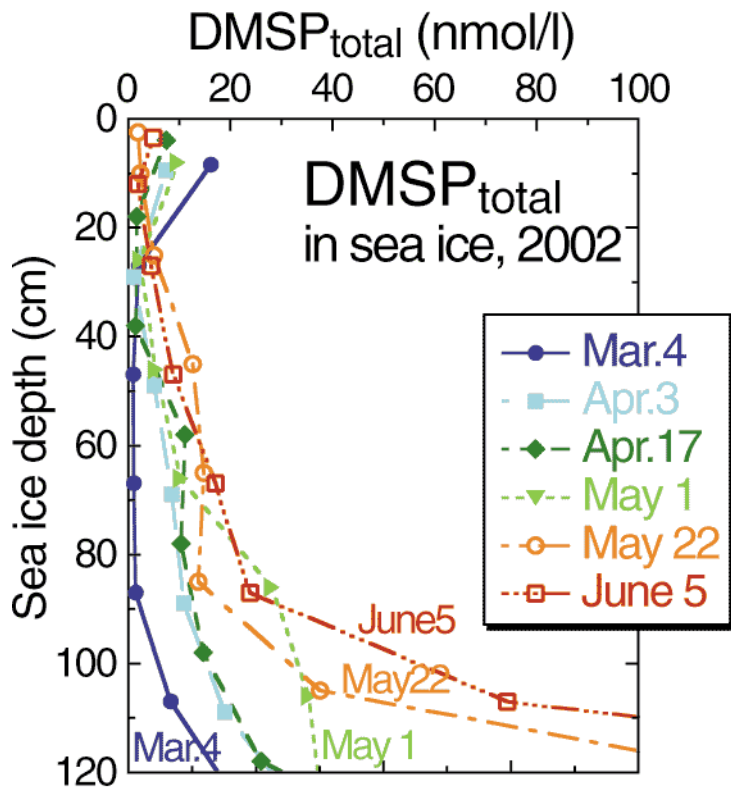
Walsh et al. 2004

Arrigo and Thomas 2004

# PELAGIC AND BENTHIC ISSUES

- Standard POP carries only diatoms, small phytoplankton, coccos
- Phaeocystis now in a sub-ecosystem, still need to insert directly
- Coupling to CICE biogeochemistry to POP analogs
- Communication with sediment





Sulfur Offshore Barrow, Courtesy C. Deal, IARC  
 Photo of yucky brown sludge by E. Hunke, LANL

## ...AND ON TO SCIENCE

- Framework coming together
- Plenty of cool projects await

### DNA evidence for historic population size and past ecosystem impacts of gray whales

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