Modeling the changing physical and biological drivers for the northern Bering and Chukchi continental shelf

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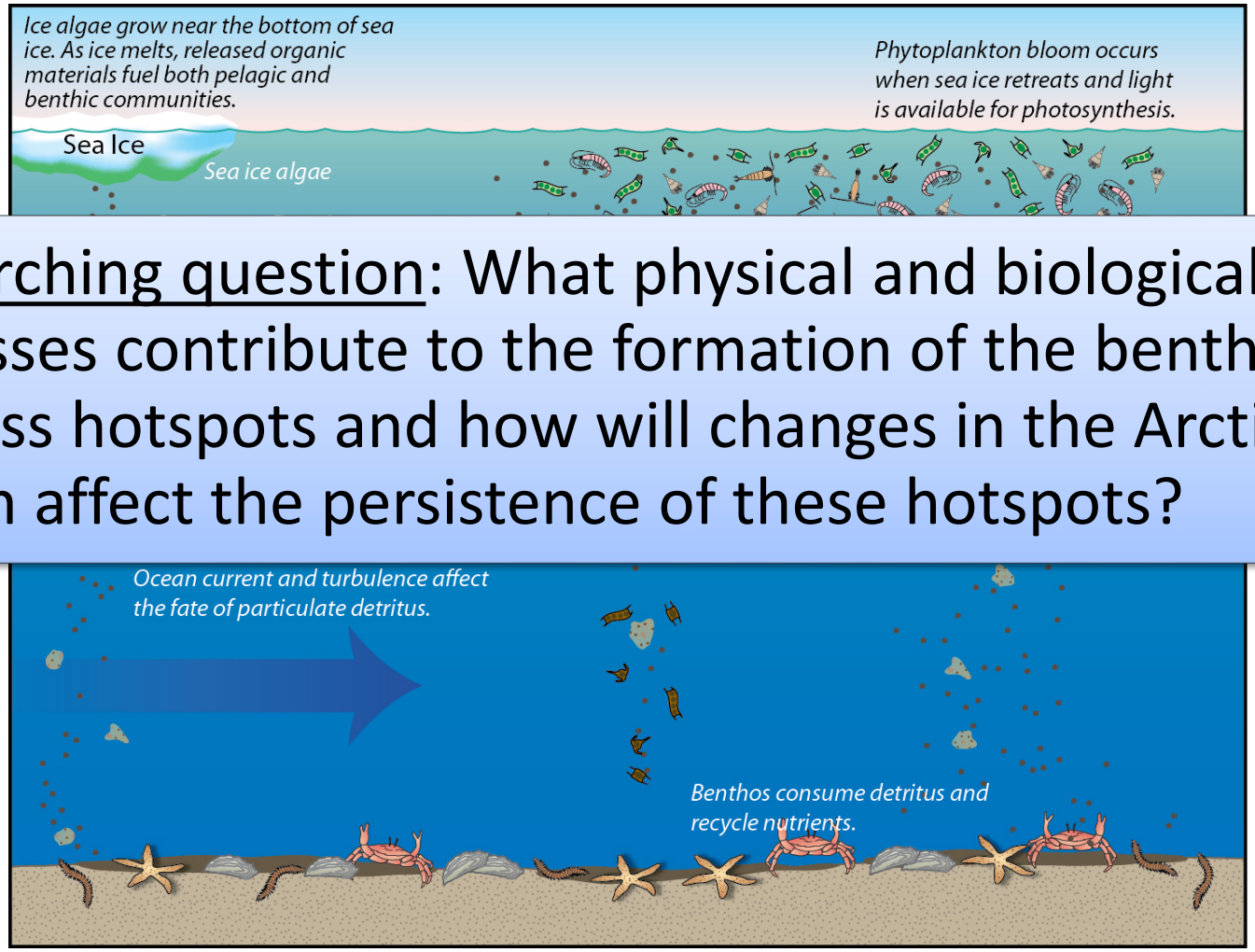
Bering-Chukchi: the Pacific gateway to the Arctic

Grebmeier 2012, Ann. Rev. Mar. Sci.

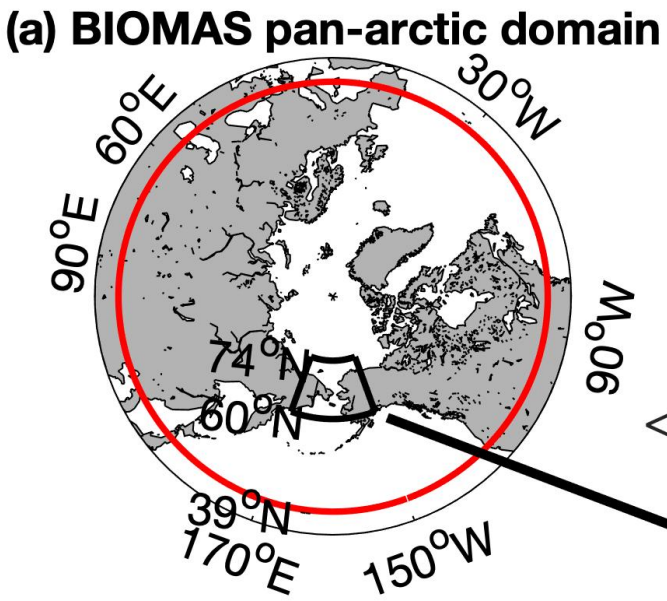
Our study explores food supply mechanisms to the benthos under the changing environmental conditions.

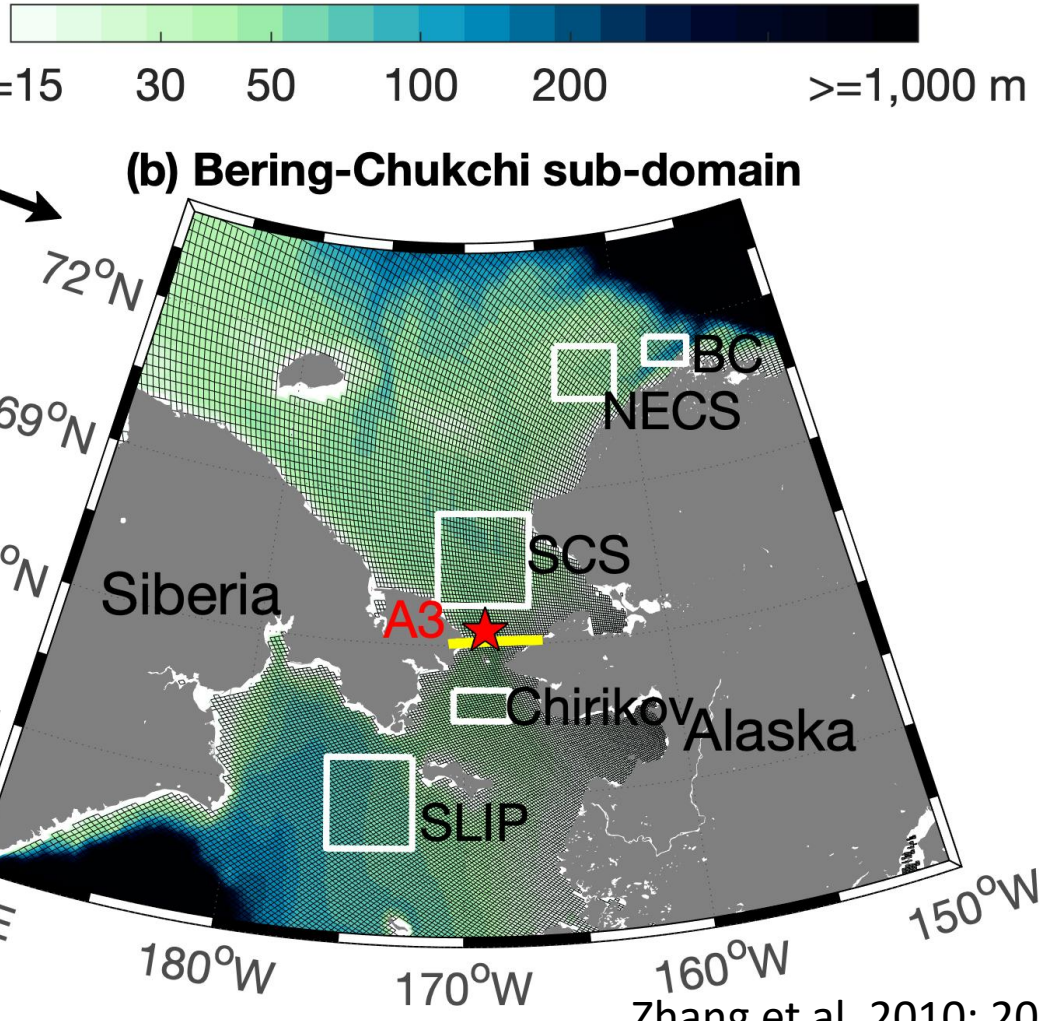


Overarching question: What physical and biological processes contribute to the formation of the benthic biomass hotspots and how will changes in the Arctic system affect the persistence of these hotspots?

Courtesy of Jack Cook (WHOI Graphics)

Biology-Ice-Ocean Modeling & Assimilation System (BIOMAS)

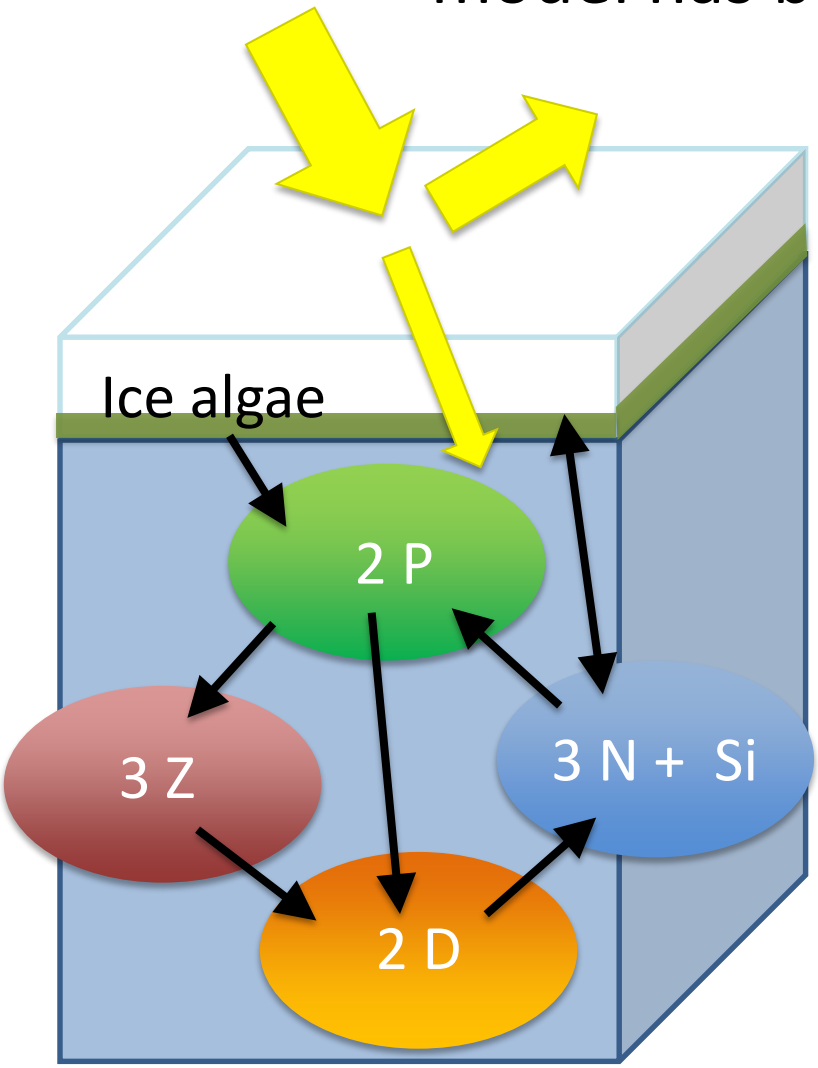


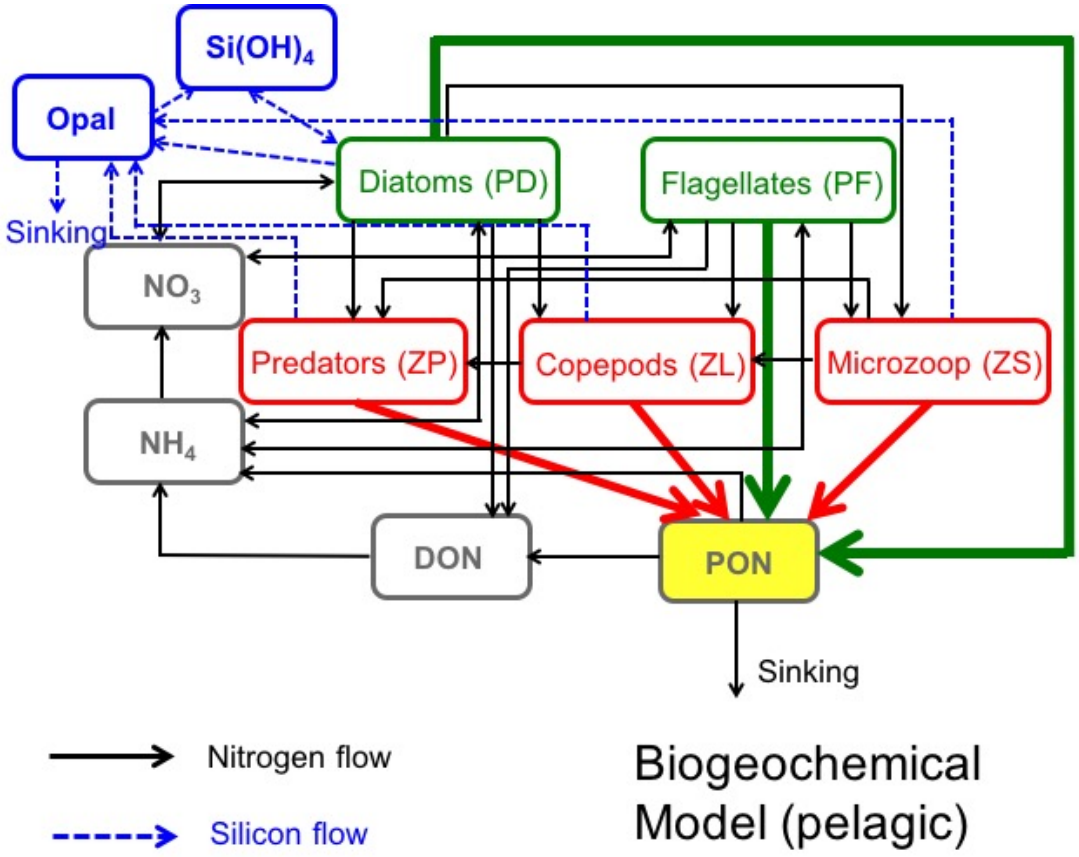


- Sub-models: Sea ice + Ocean + BGC + Ice algae models.
- Climate Forecast System (CFS) Reanalysis forcing.
- Data assimilation of sea ice concentration and sea surface temperature.
- Horizontal: ~10 km.
- 40 vertical layers; 5 m each in top 16 layers.

Zhang et al. 2010; 2015

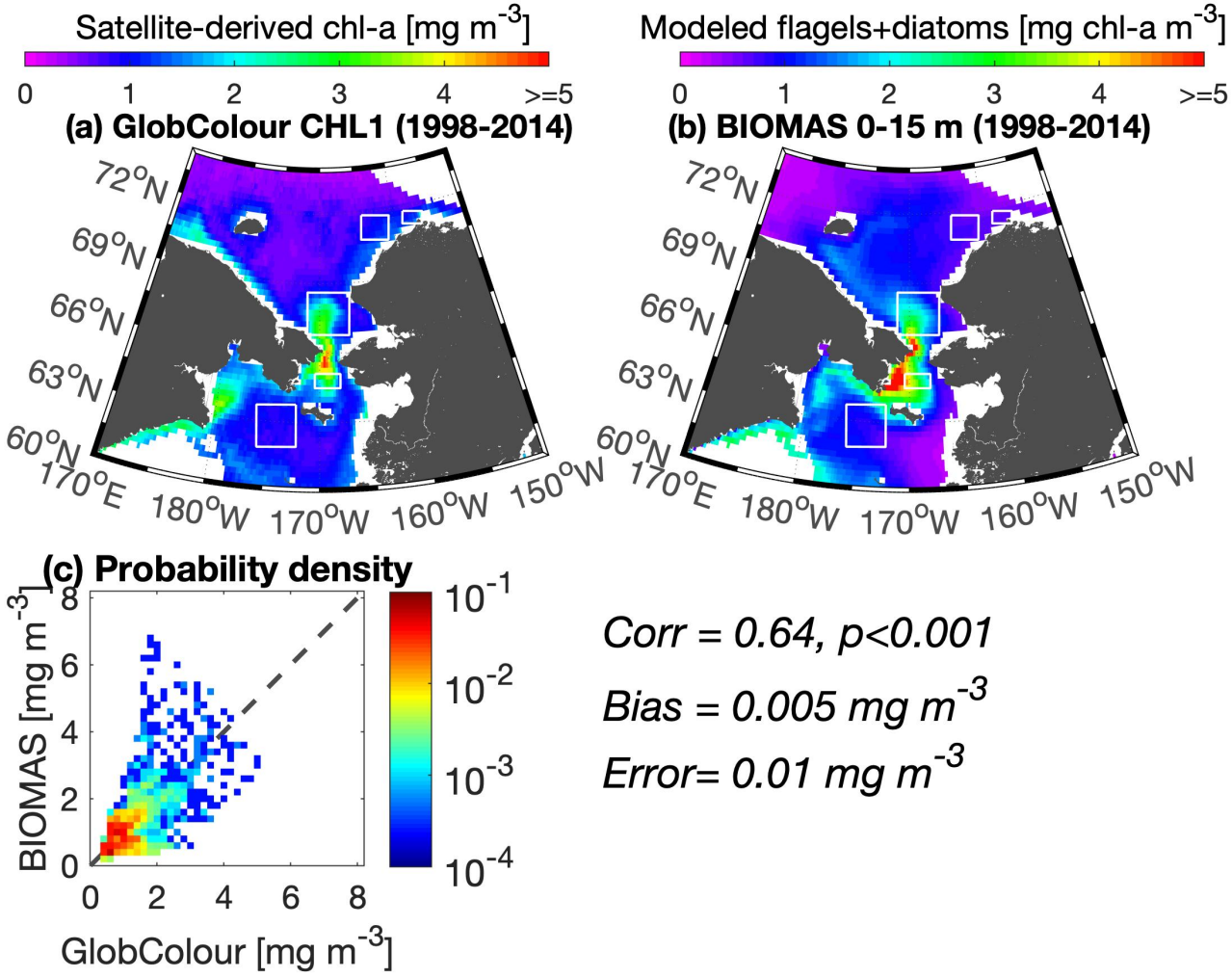
A NEMURO 11-component lower trophic level model has been adapted to the Arctic Ocean.





Kishi et al. 2007; Zhang et al. 2010; 2015

Chl-a Climatology: model vs. satellite

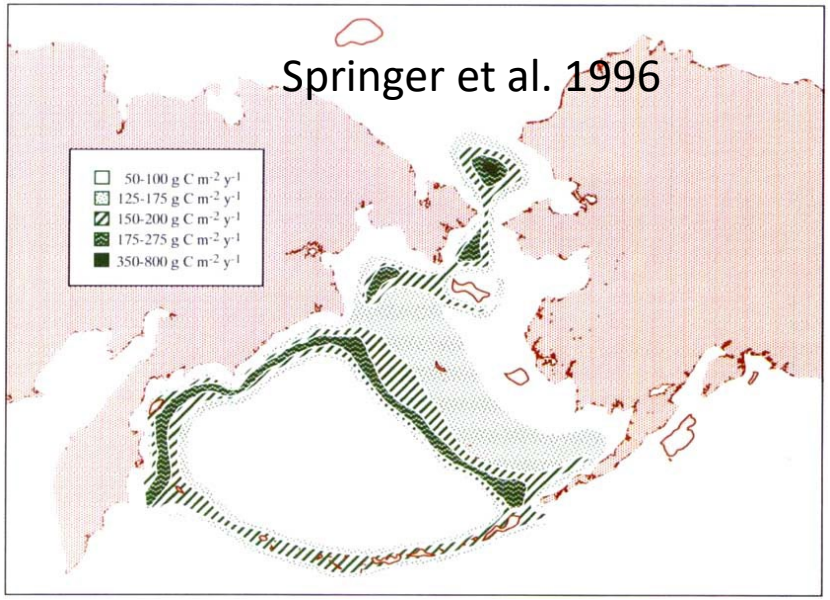


Corr = 0.64, p<0.001

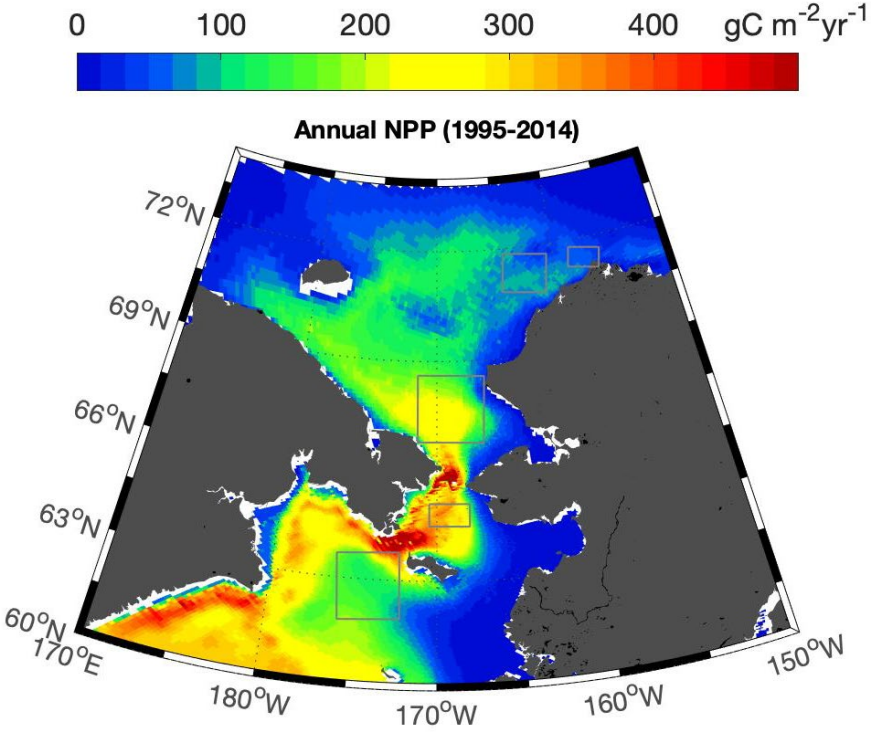
Bias = 0.005 mg m^{-3}

Error= 0.01 mg m^{-3}

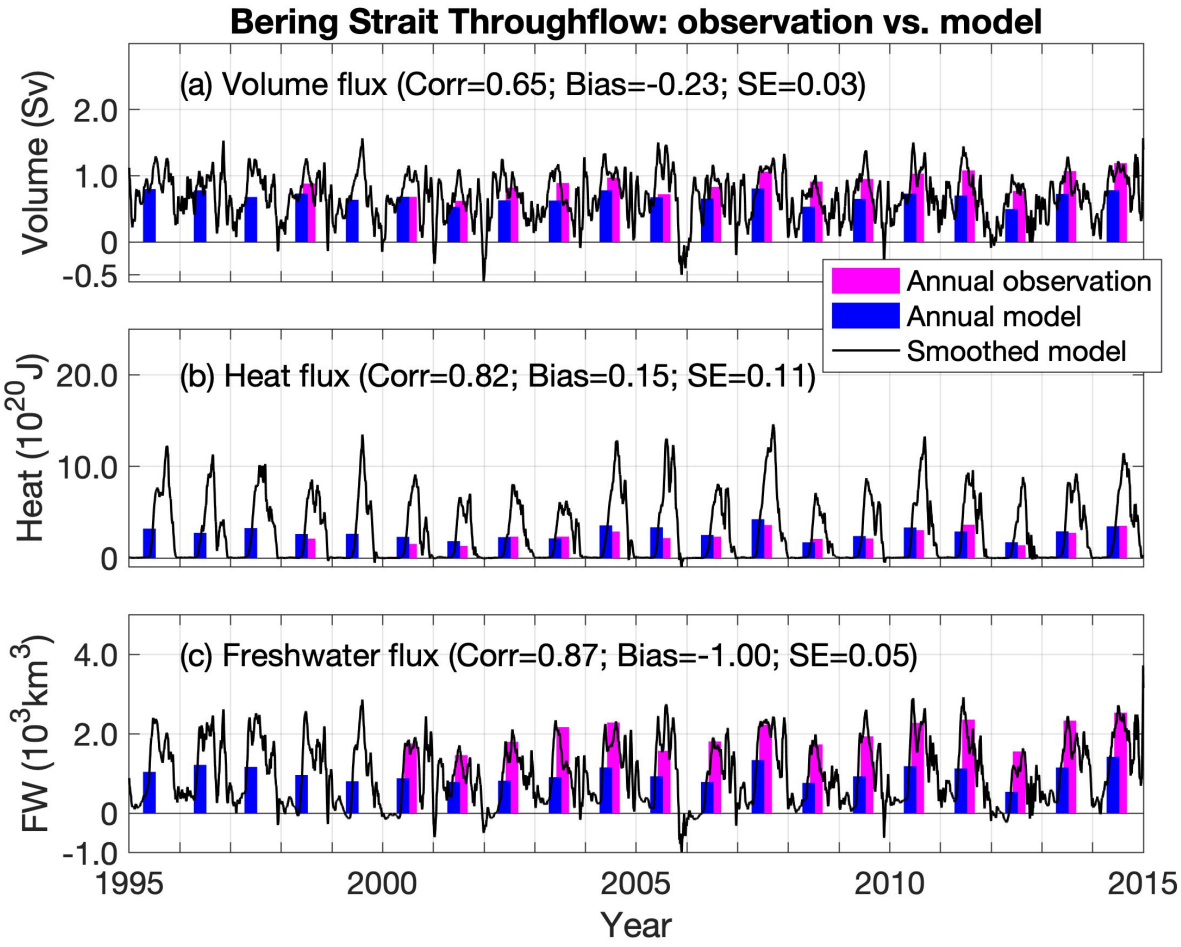
Bering Sea Green Belt



$$NPP = GPP - RES$$



Validation of Bering Strait throughflow using mooring data



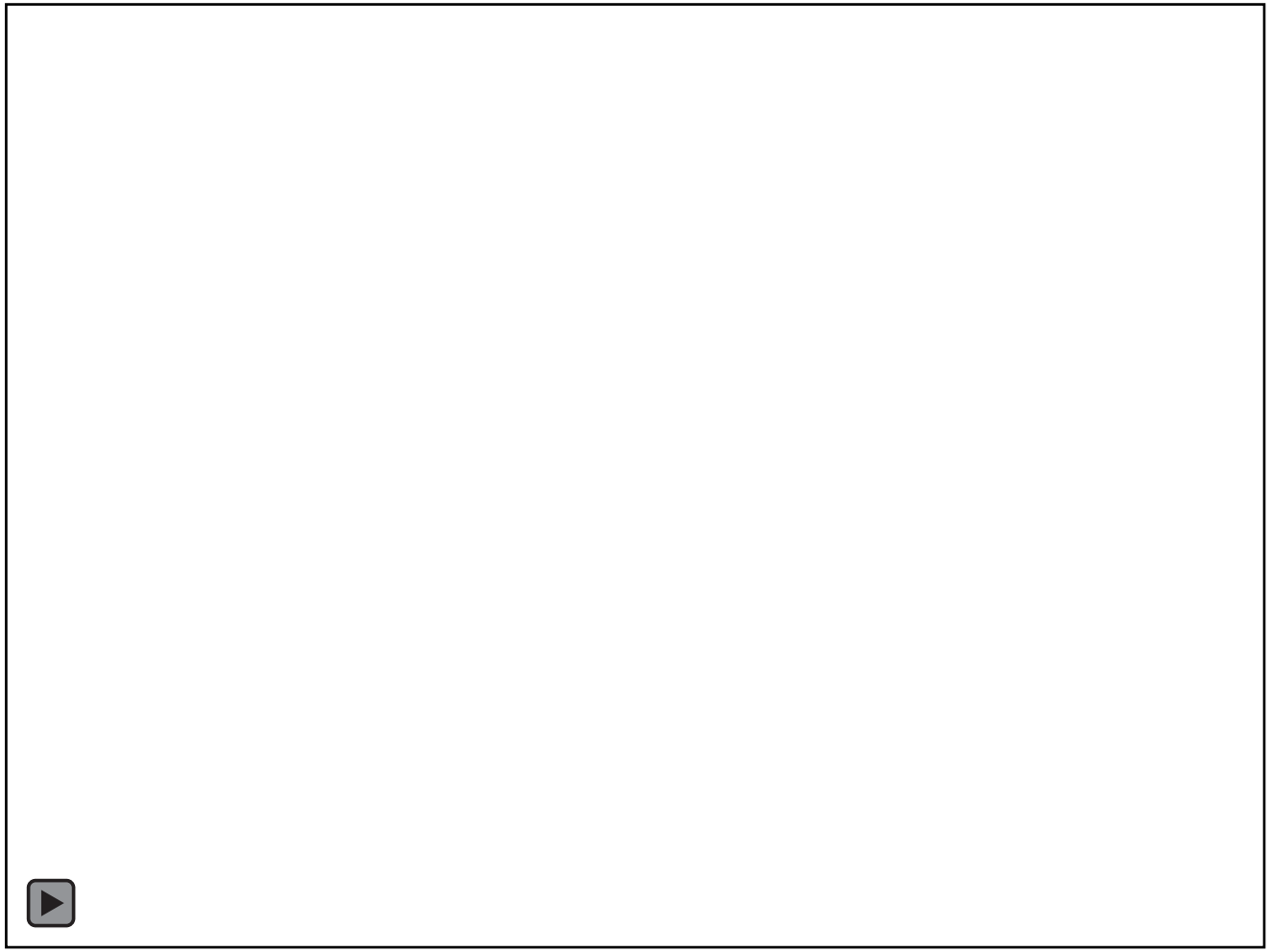
Mooring data: Woodgate, 2018

Primary productivity is related to sea ice dynamics in the spring/summer.

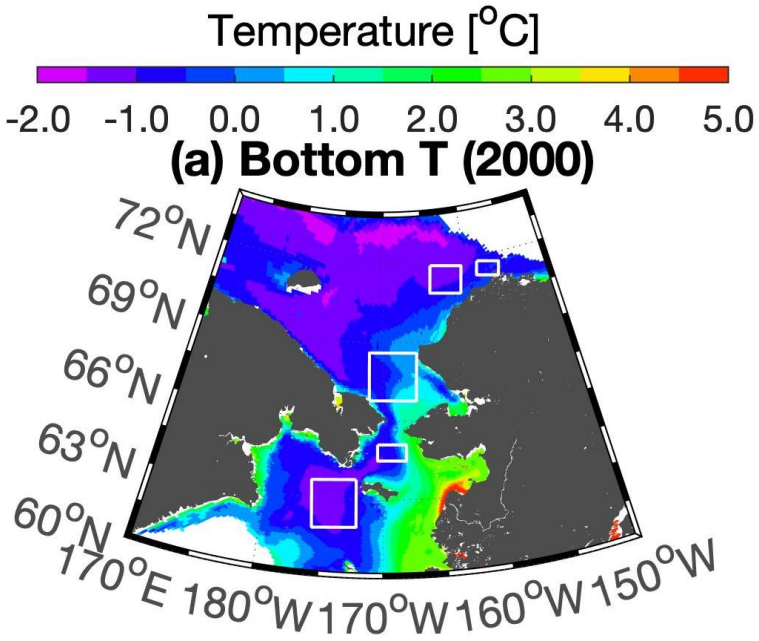
Year-2000
(more ice)

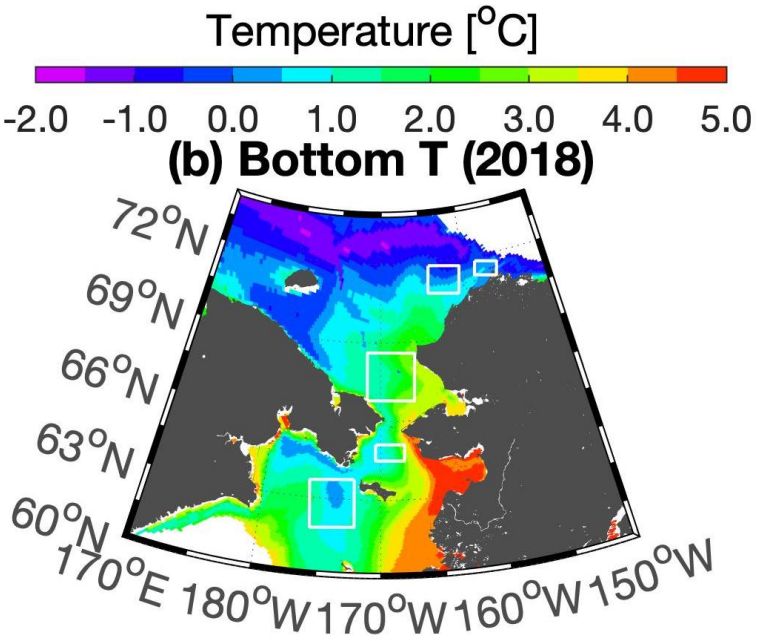
vs.

Year-2018
(less ice)



Significant warming of bottom water in recent years was represented in the model.





Strong inter-annual variability in NPP.
In 2018, NPP decreased at SLIP but increased at NECS & BC.