

Labrador Sea convection blows life to the Northeastern Atlantic

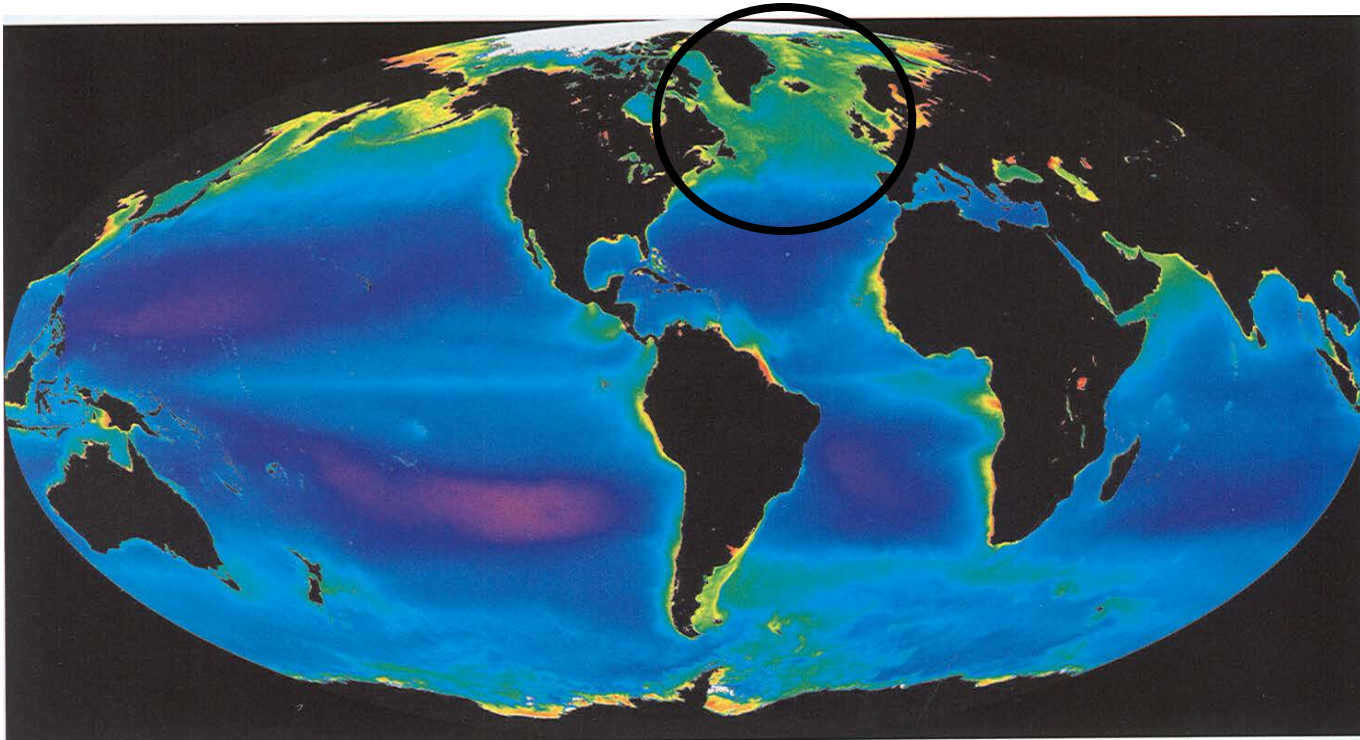
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Keywords:

Ocean-shelf exchange, sub-decadal variability,
Predictability,
Calanus finmarchicus

The energetic and productive North Atlantic Ocean

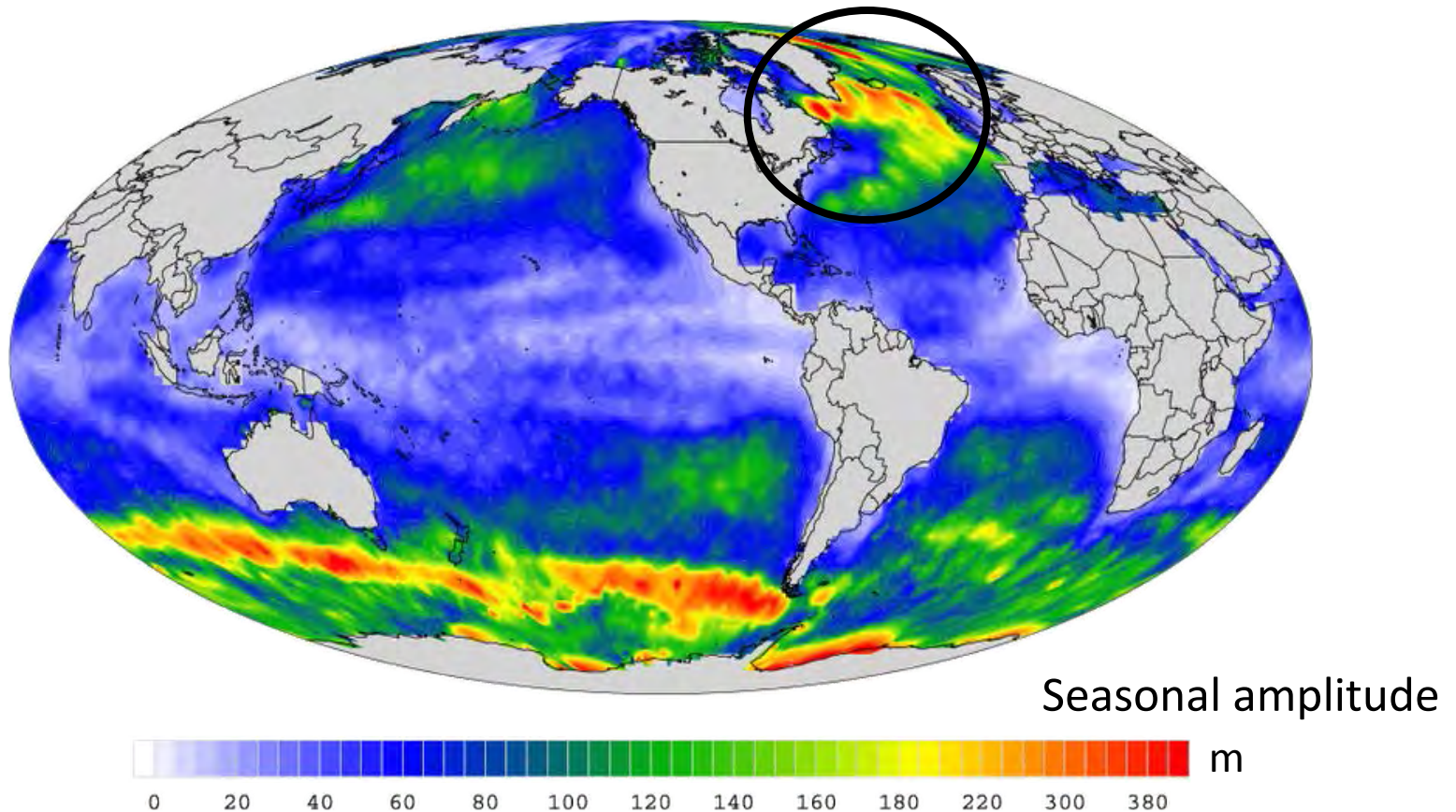
High (algae) concentrations



Ocean Color (chlorophyll-*a*)

The energetic and productive North Atlantic Ocean

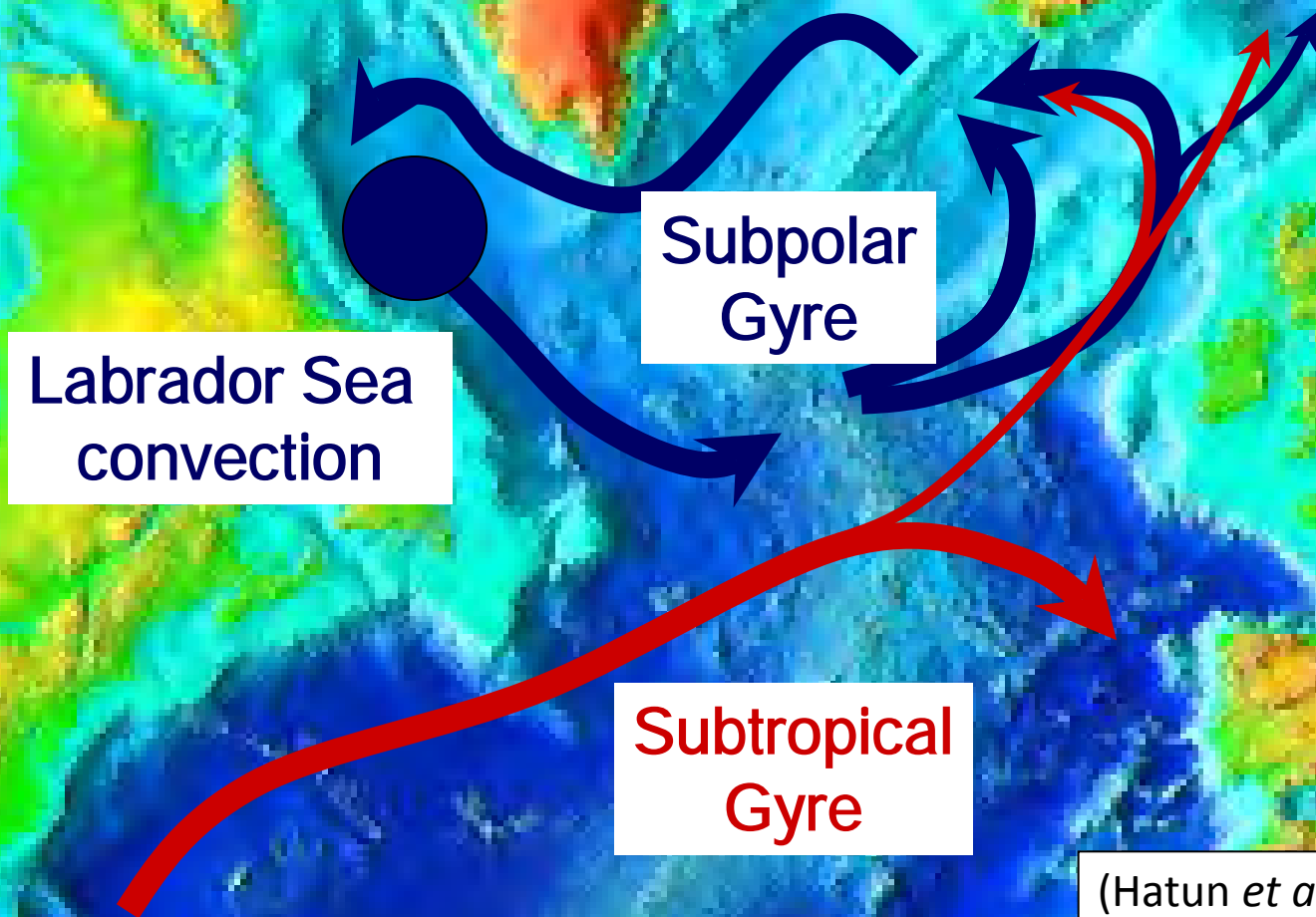
Winter mixed layer depths (MLD)



Outline

1. The subpolar gyre - a main food source
2. Remote forcing → from the Labrador Sea to the Irminger Sea
3. Mixed Layer Depth (MLD) - a critical driver
4. The *sub-arctic front*
5. Predictability

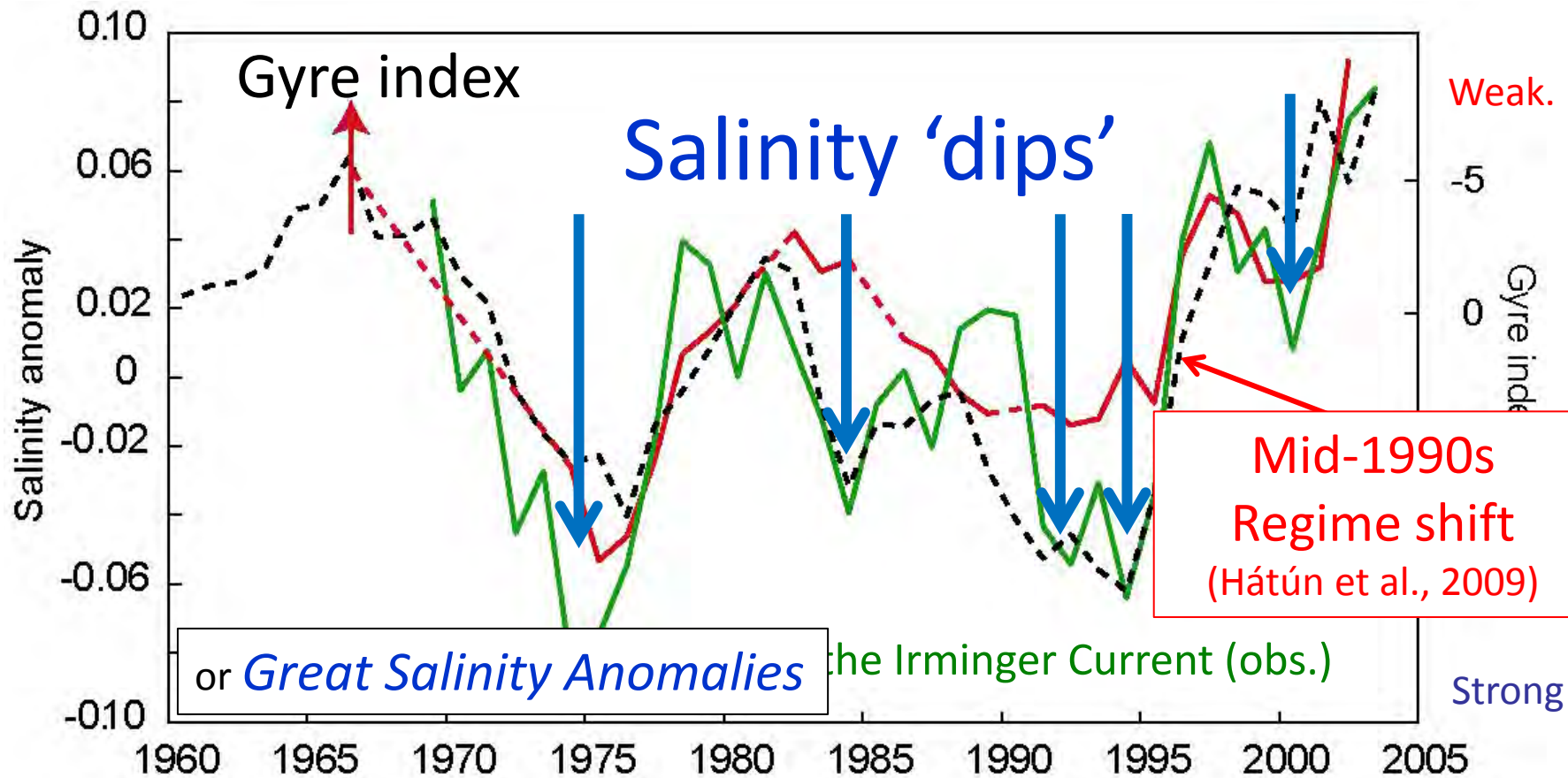
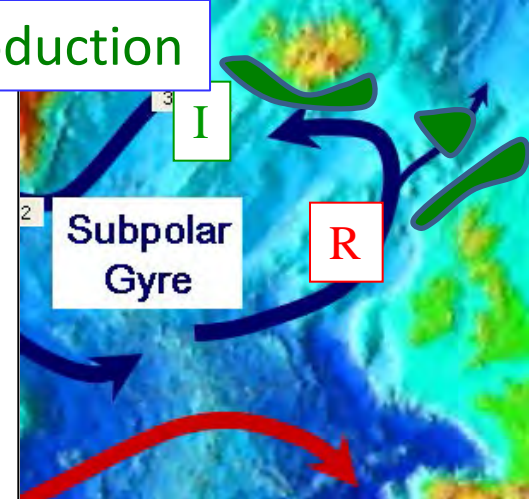
The subpolar gyre - a main food source



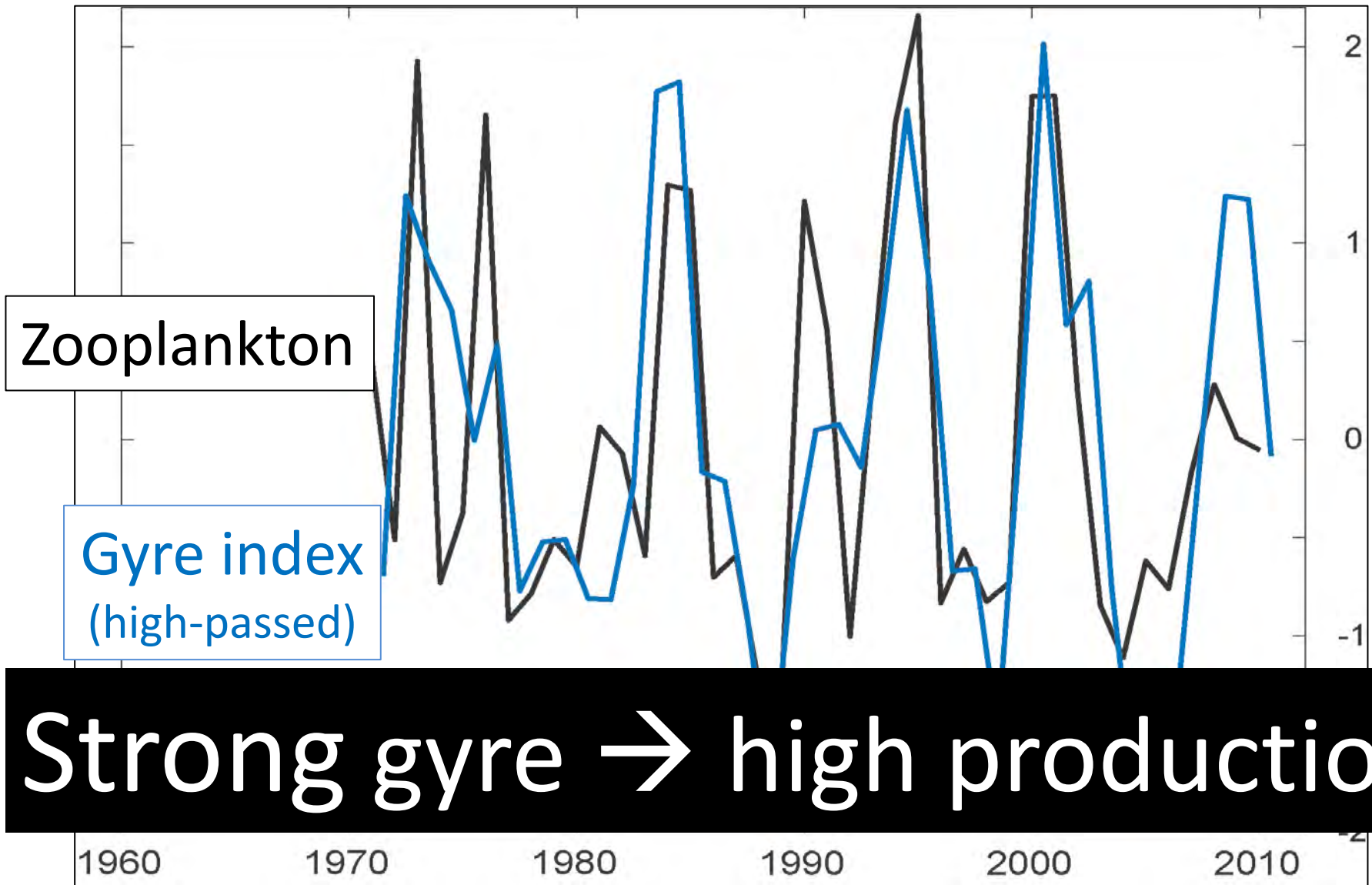
(Hatun *et al.*, Science 2005)

The Subpolar Gyre - salinity 'dips'

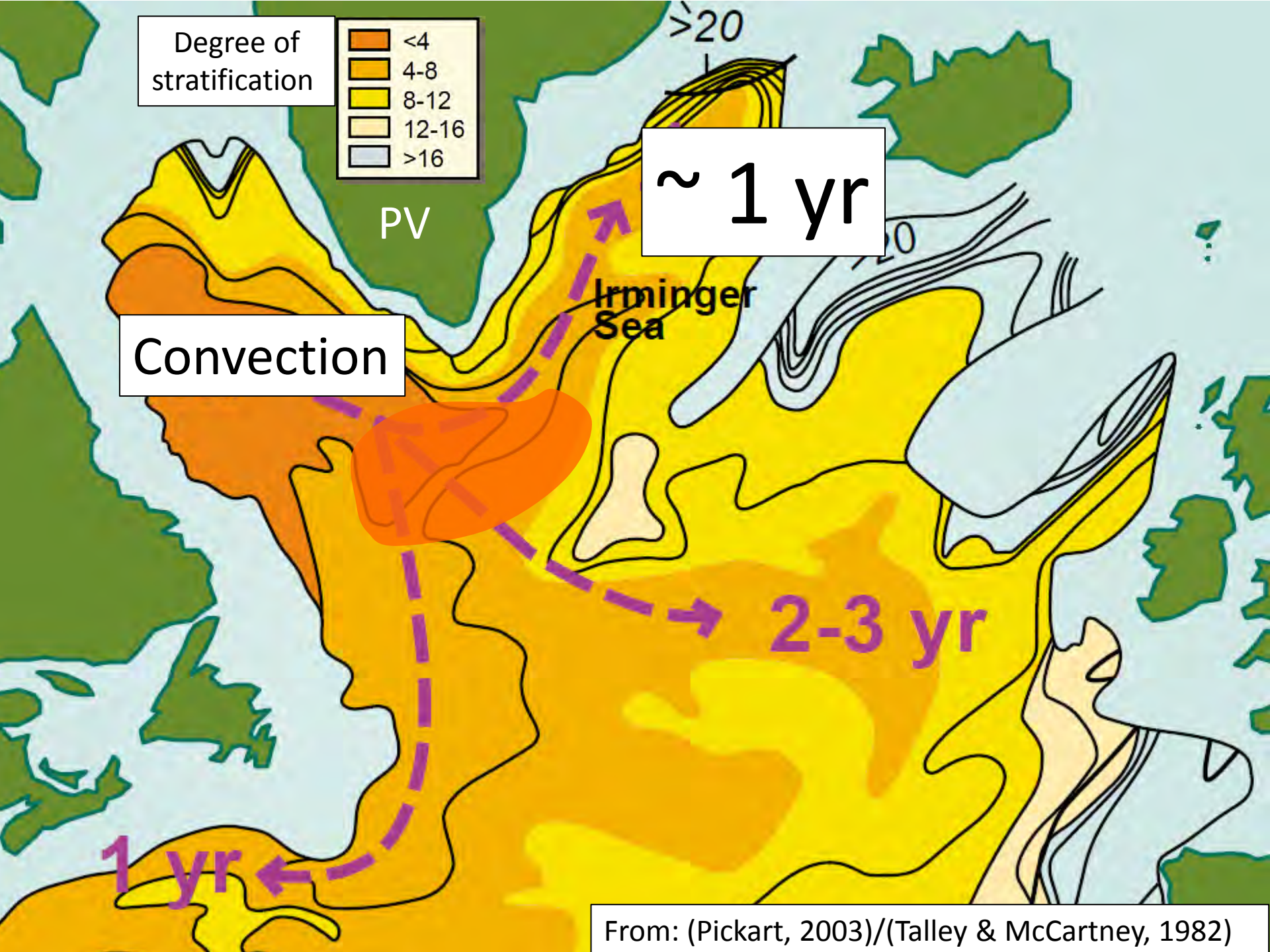
On-shelf biological production



The Subpolar Gyre and on-shelf biological production

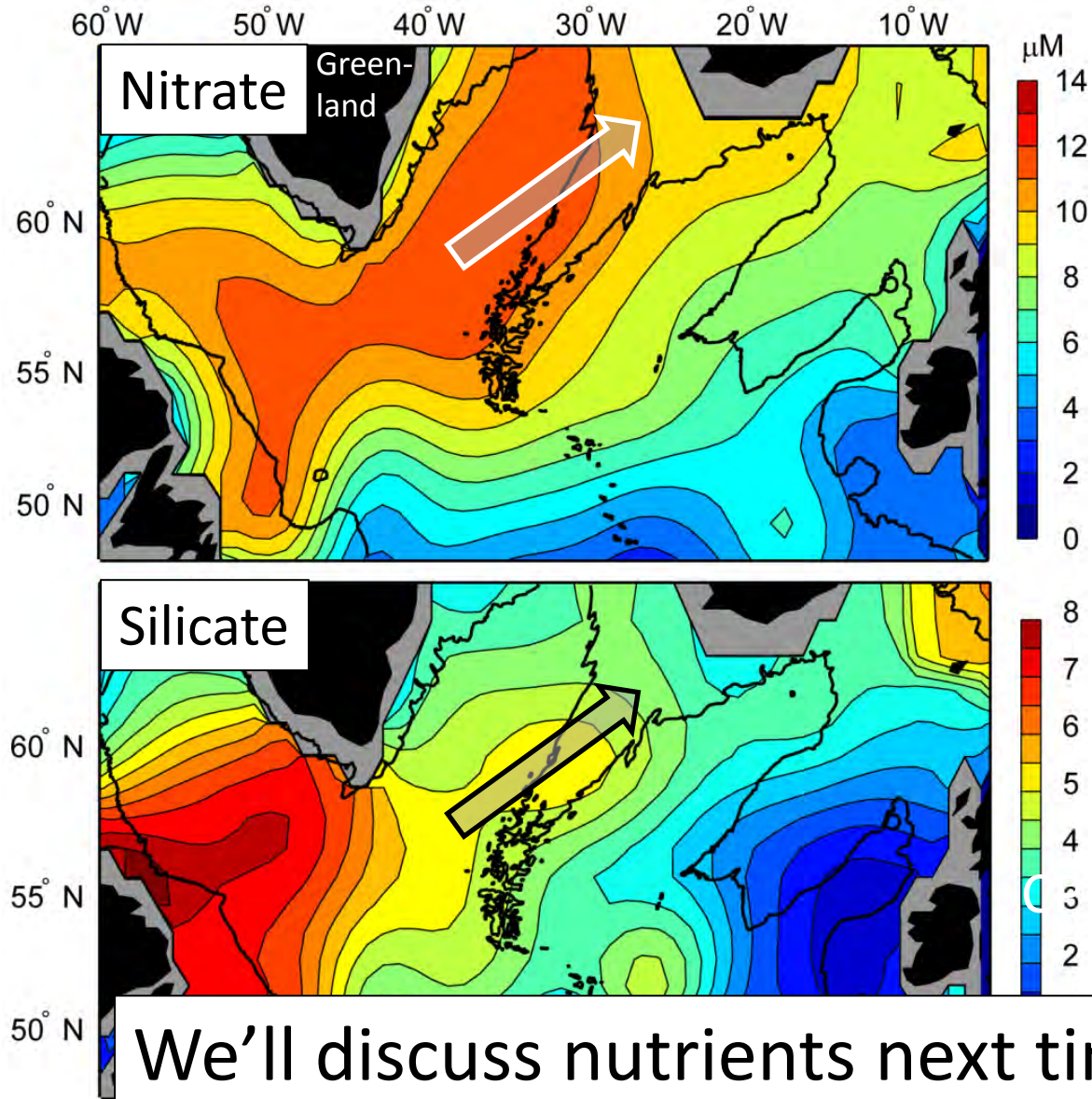


Strong gyre → high production



The Subpolar Gyre: A large **nutrient** source

(Concentrations
in June, 50m)

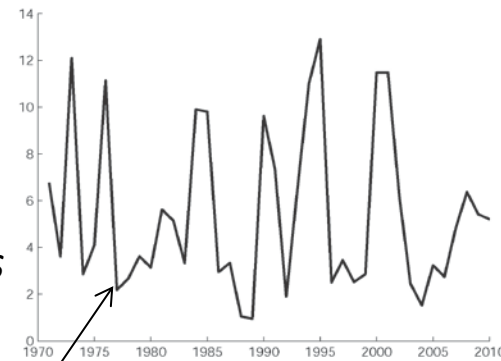


The Subpolar Gyre:

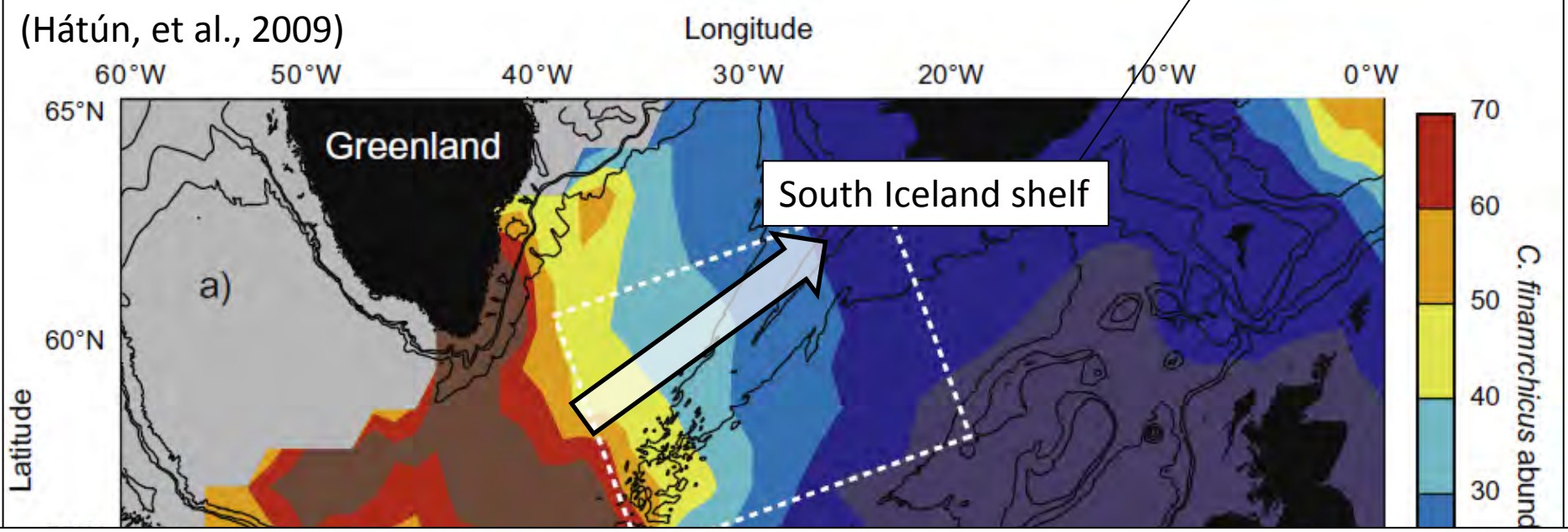
A large **zooplankton** source

- Continuous Plankton Recorder (CPR)

Mainly 
C. finmarchicus



(Hátún, et al., 2009)



Hypothesis:

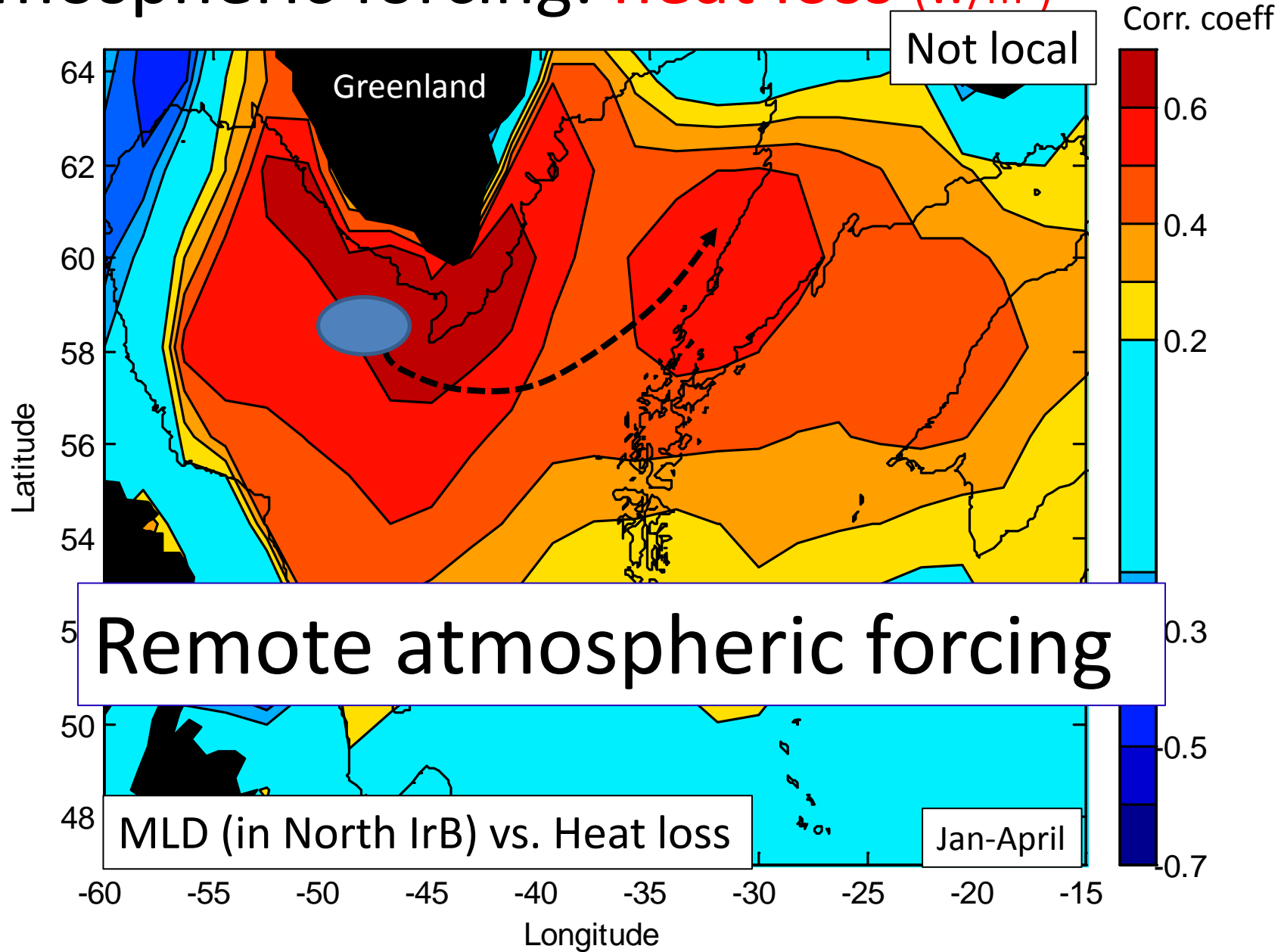
A north-eastward extended subpolar gyre limb in the Irminger Sea improves the biological productivity southwest of Iceland – both oceanic and potentially on the shelf.

Is the zooplankton simply related to the North Atlantic Oscillation (NAO)?

NÃO

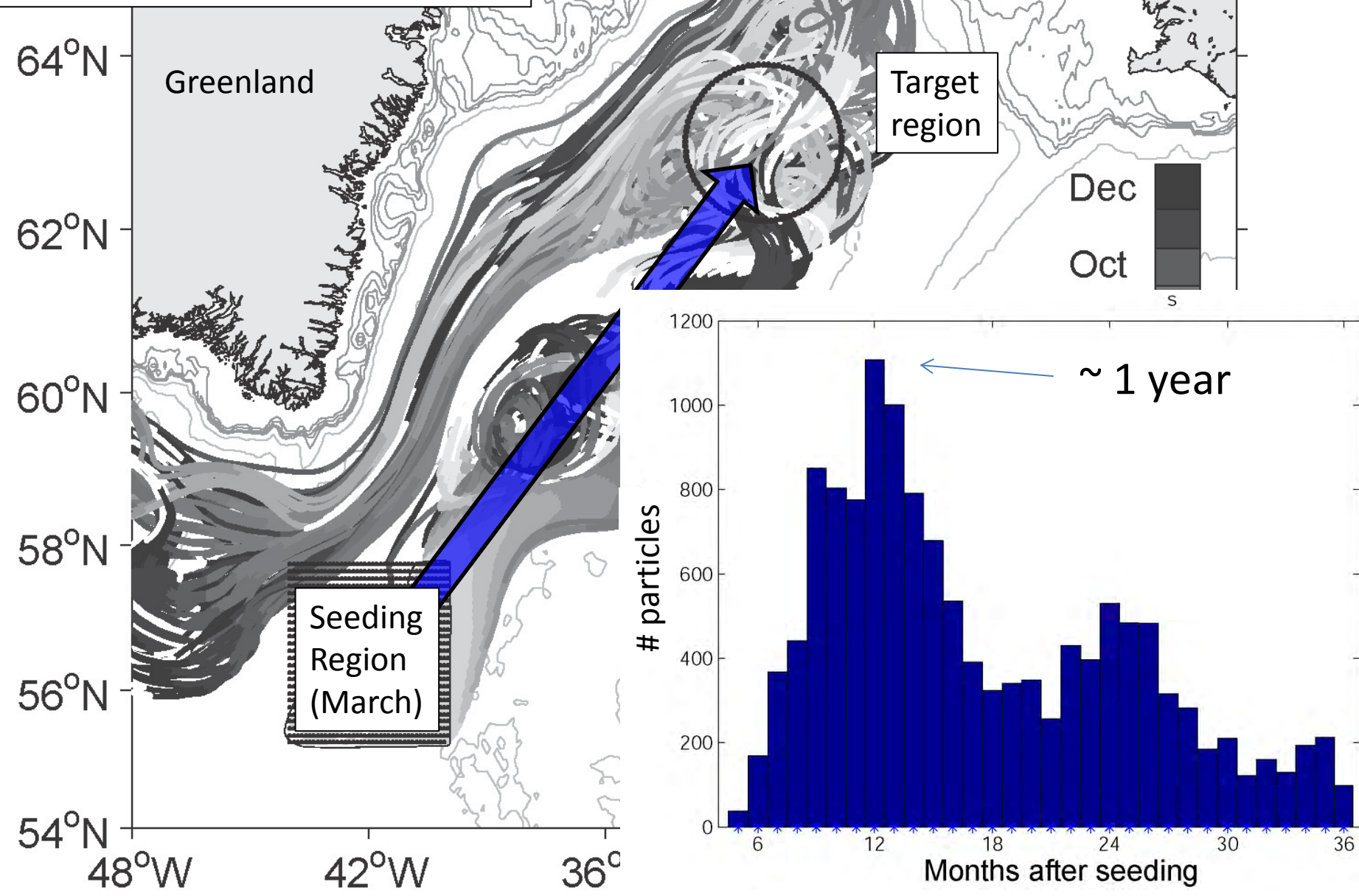
2. Remote forcing → advection from the Labrador Sea to the Irminger Sea

Atmospheric forcing: **heat loss** (W/m^2)



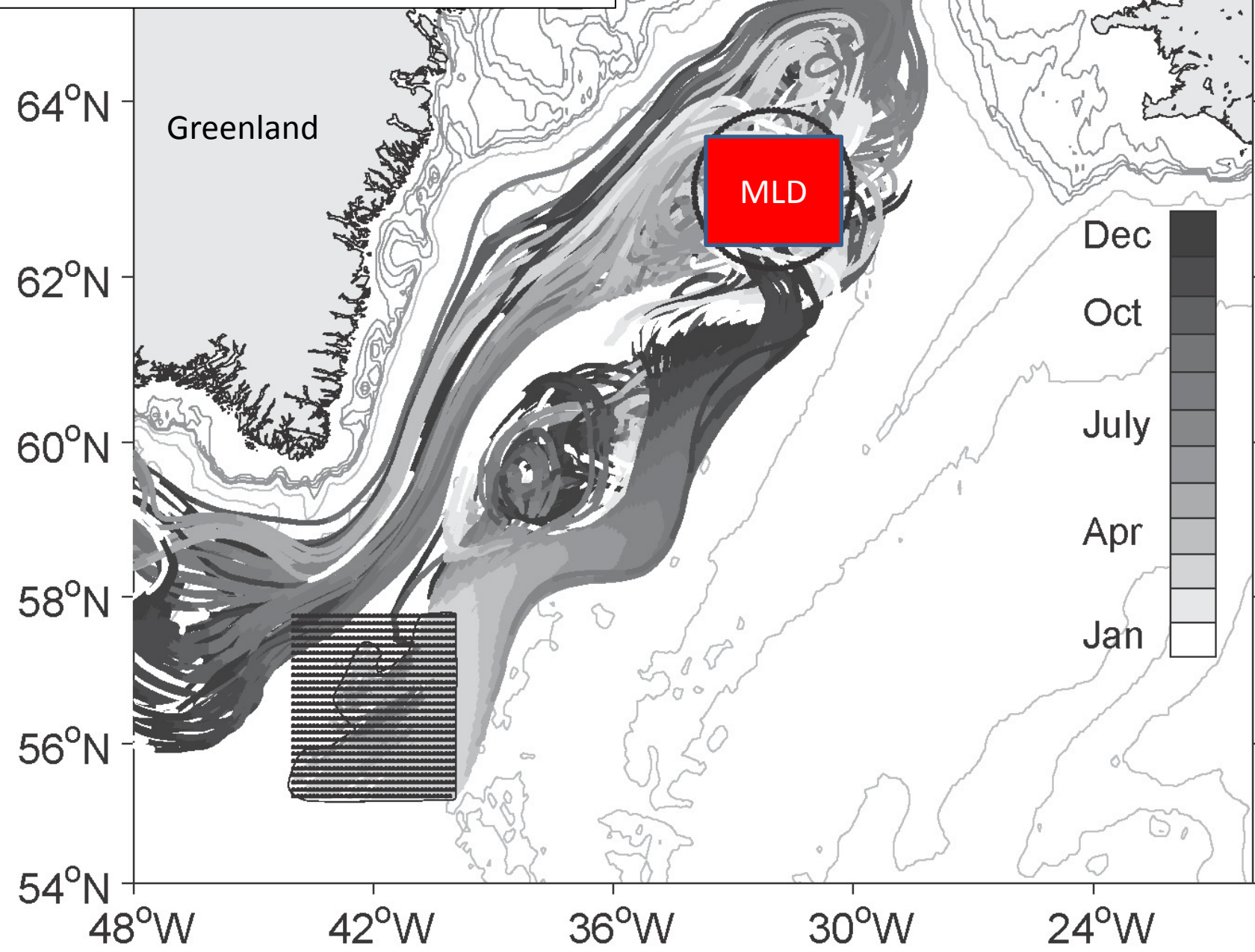
Particle tracking experiment

MPIOM



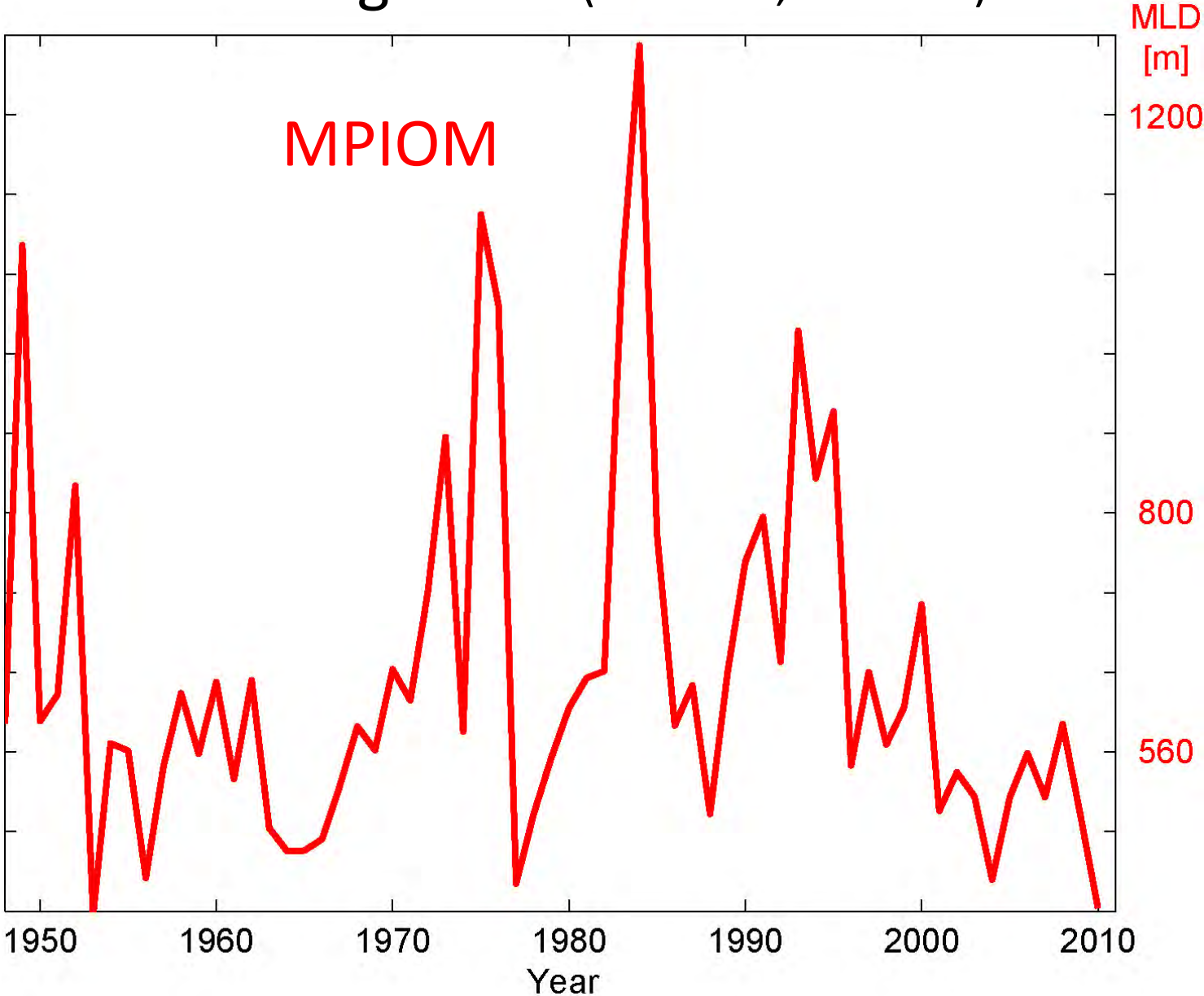
3. Mixed Layer Depth (MLD) a critical driver

Mixed Layer Depth

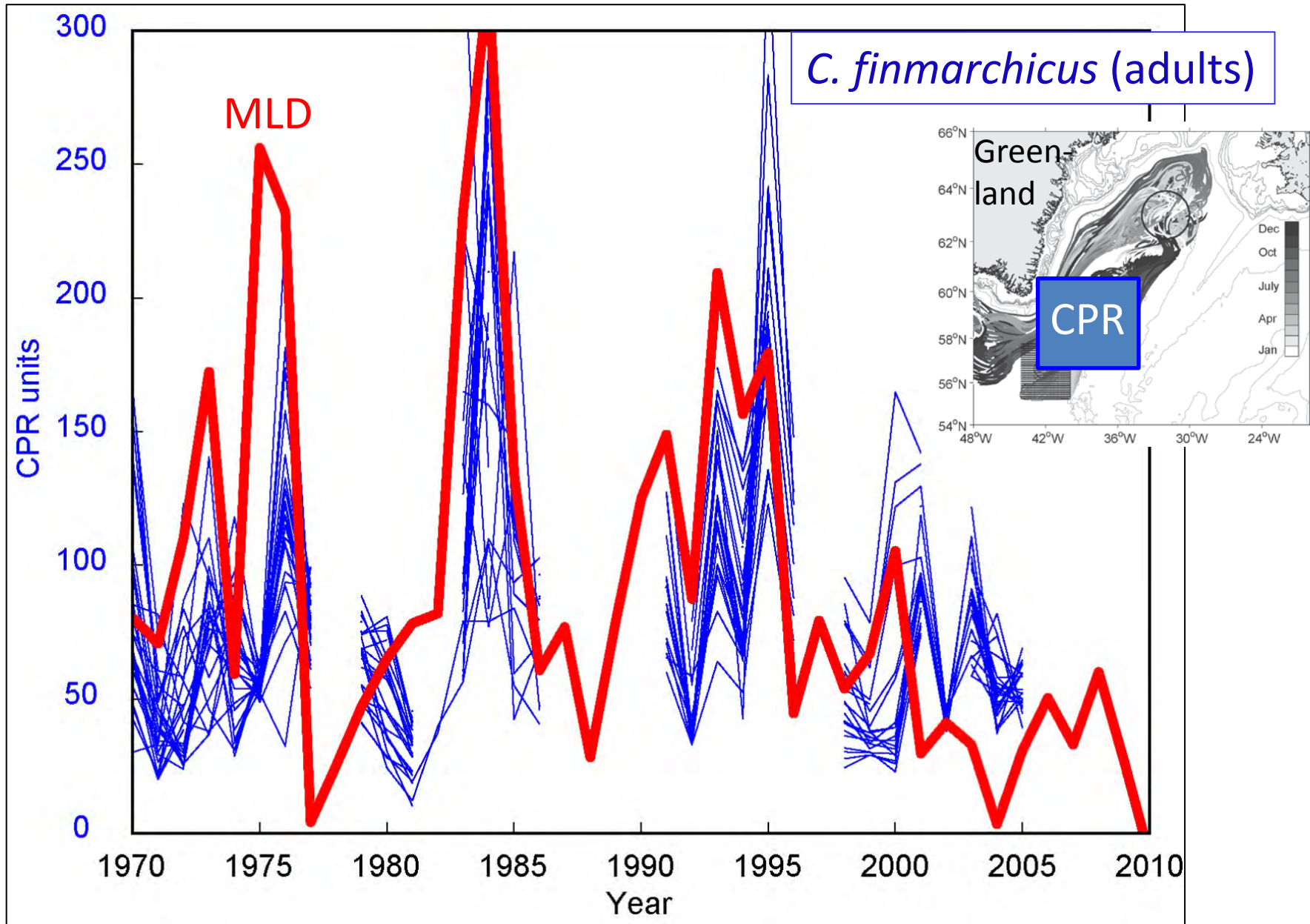


Simulated March Mixed Layer Depths (MLD)

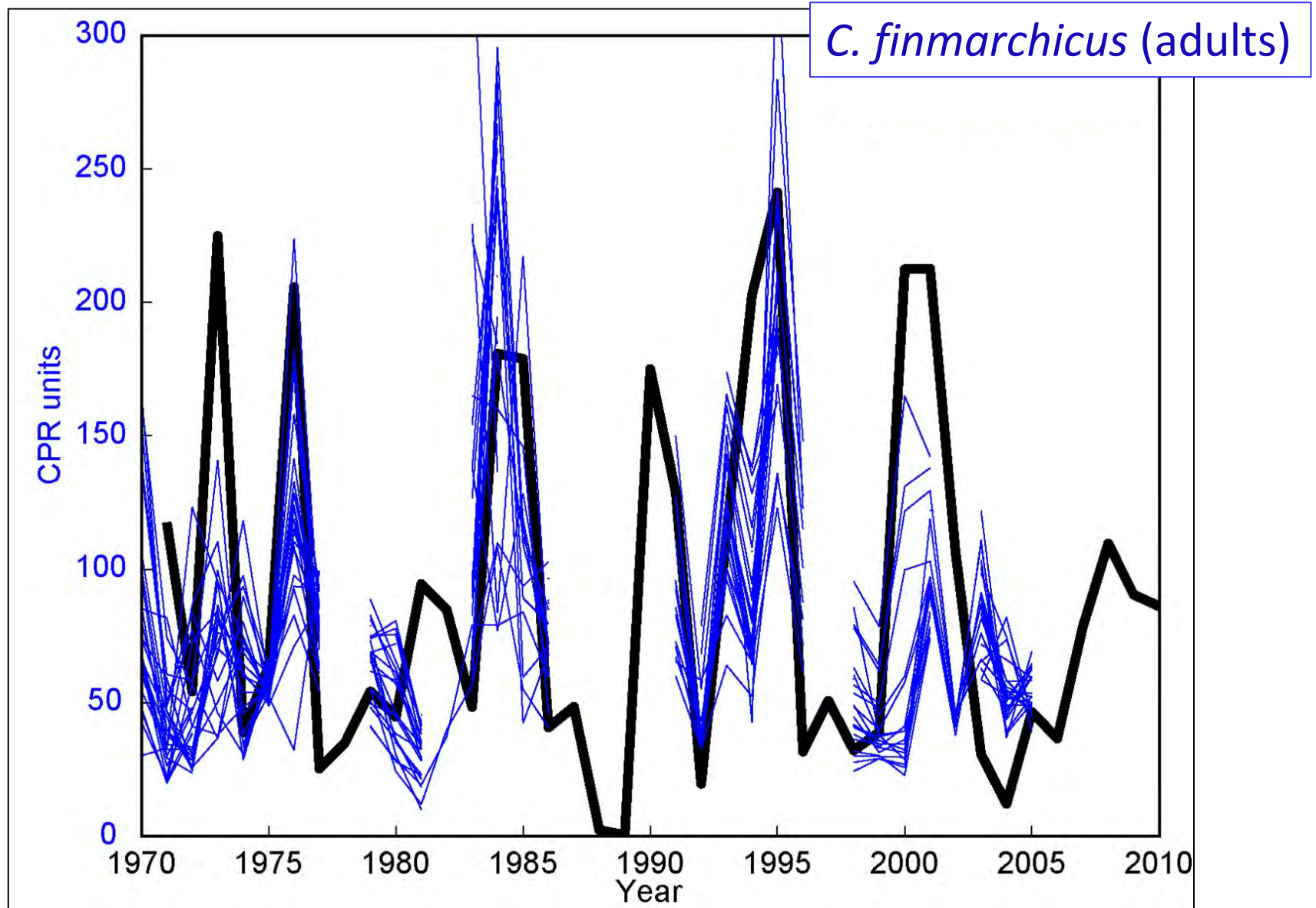
N. Irminger Sea (35-30°W, 61-63°N)



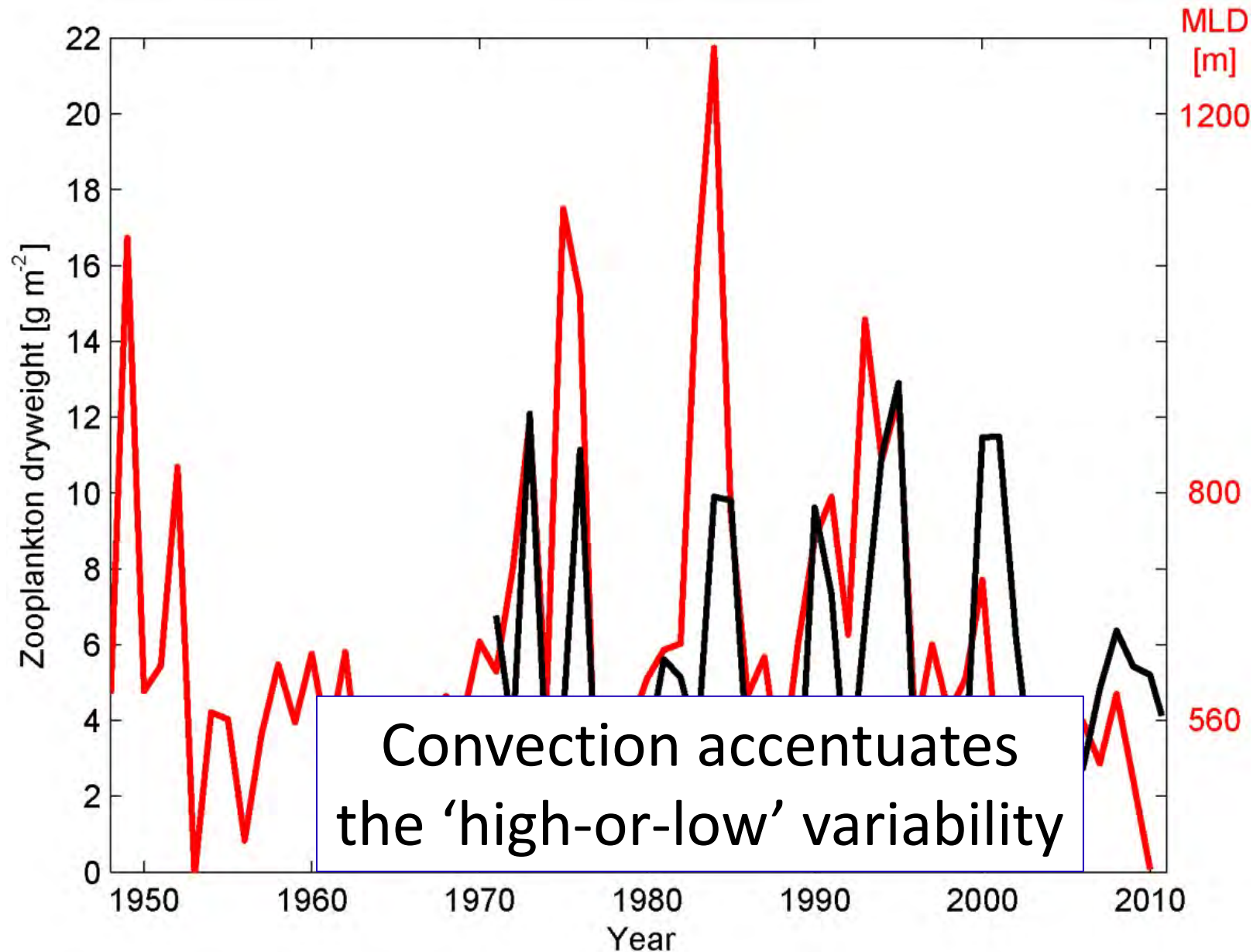
MLD and oceanic *Calanus finmarchicus*



Oceanic and on-shelf zooplankton



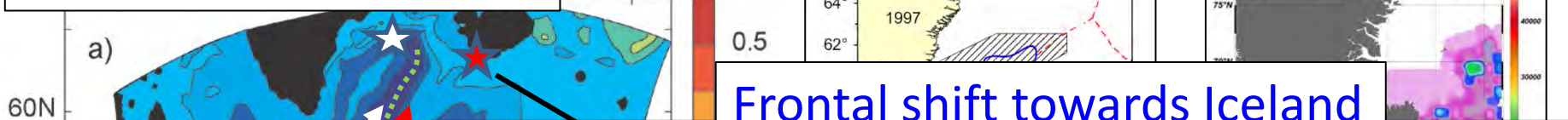
Simulated March MLDs and zooplankton on the south Iceland shelf



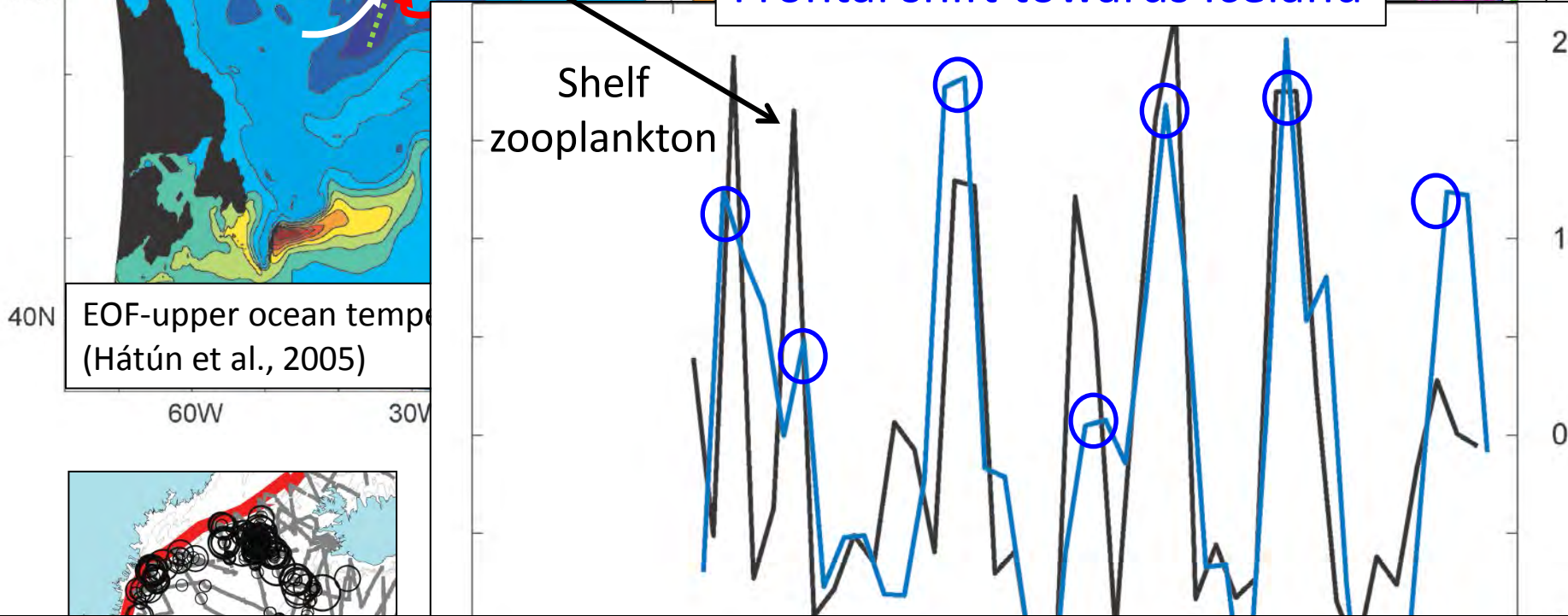
4. The biologically productive *sub-arctic front*

The biologically productive *sub-arctic front*

Bluefin tuna
(Mackenzie, Payne et al., 2014)

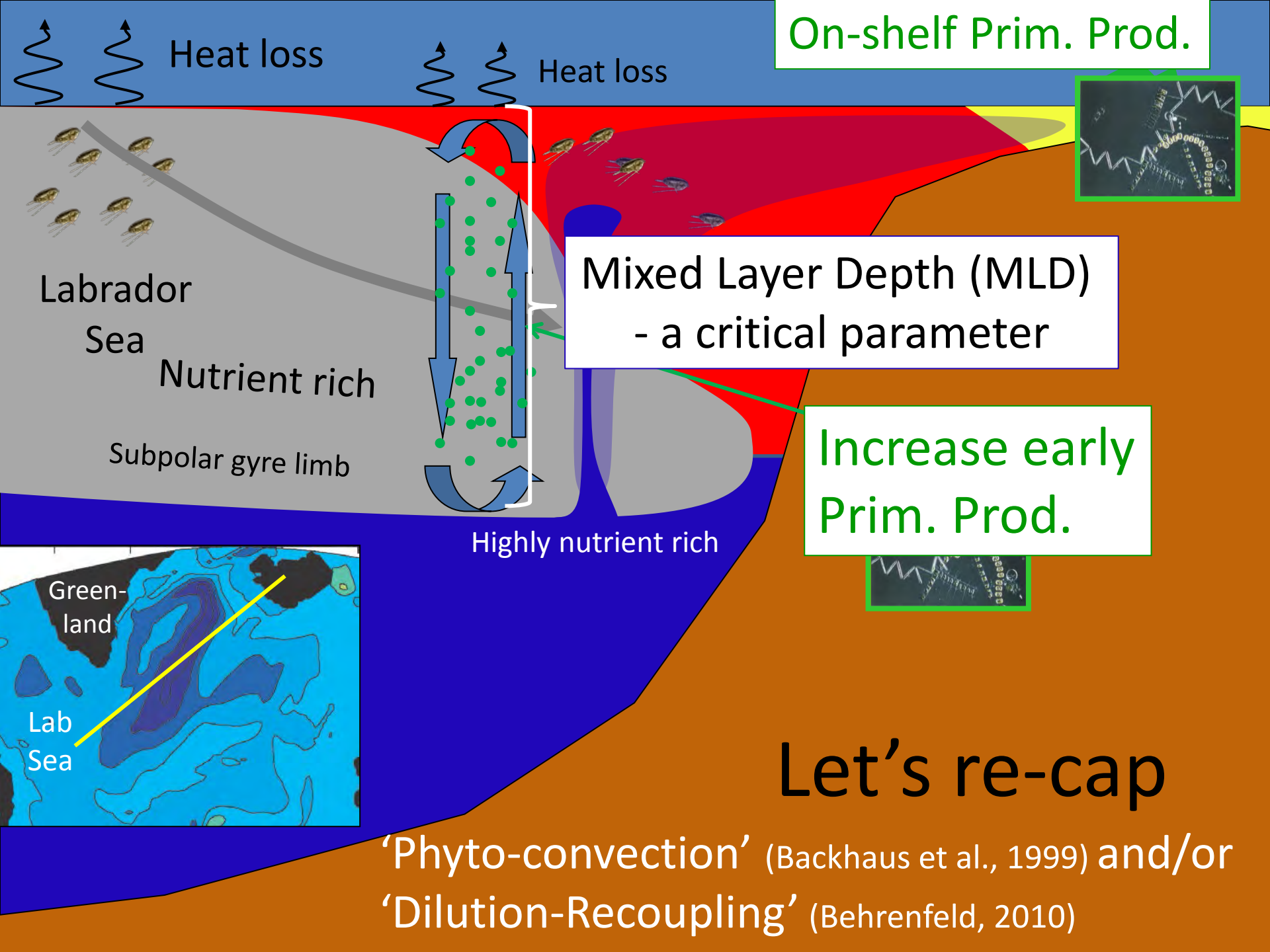


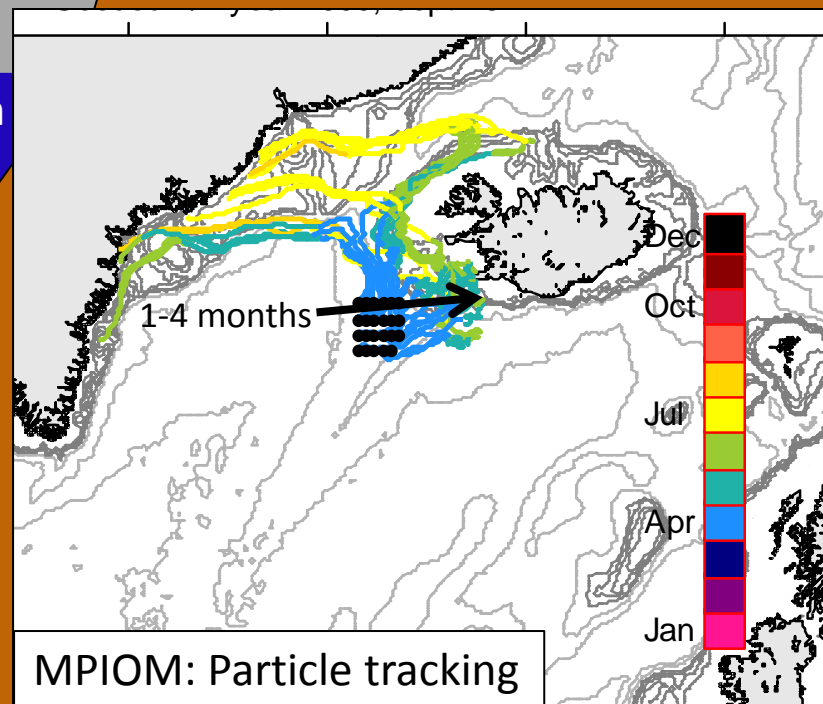
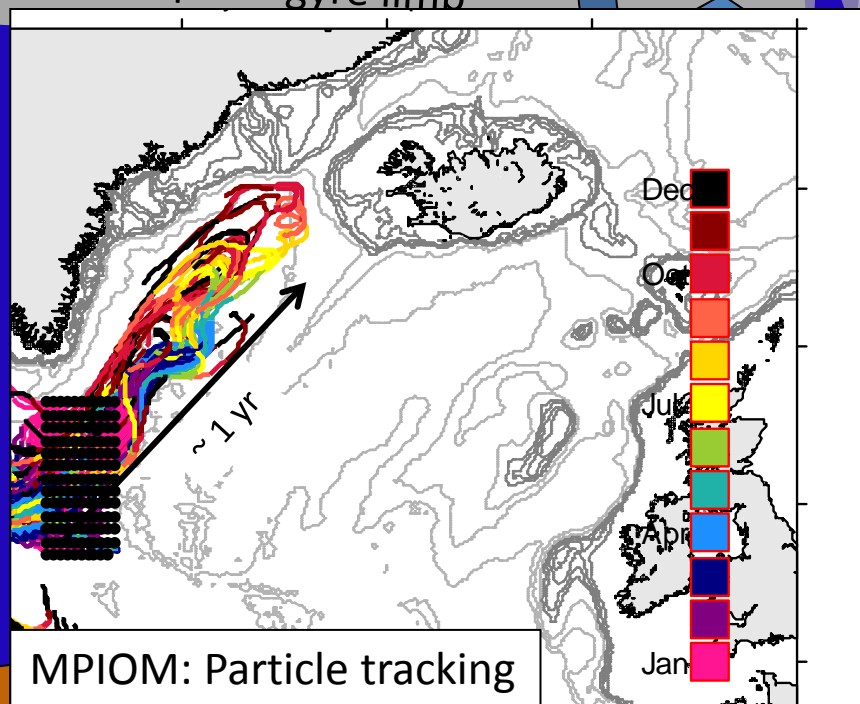
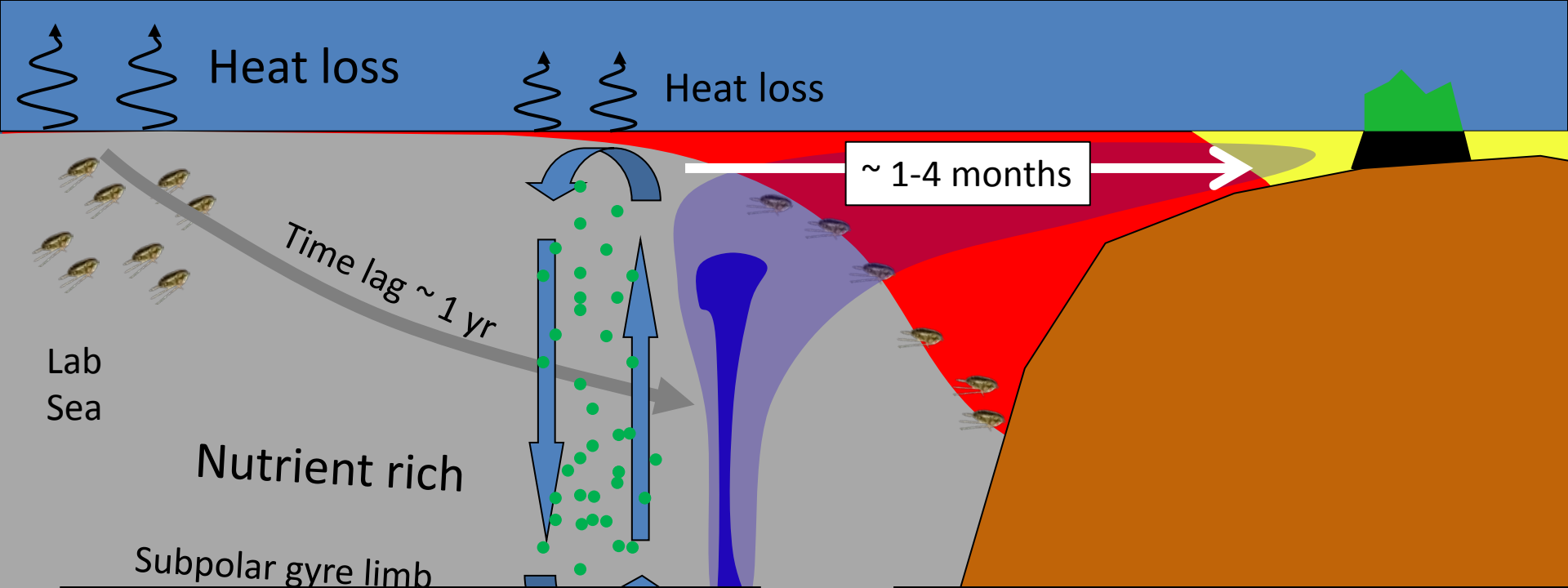
Frontal shift towards Iceland



Increased zooplankton abundance
when the *sub-arctic front* is shifted towards Iceland

1960 1970 1980 1990 2000 2010



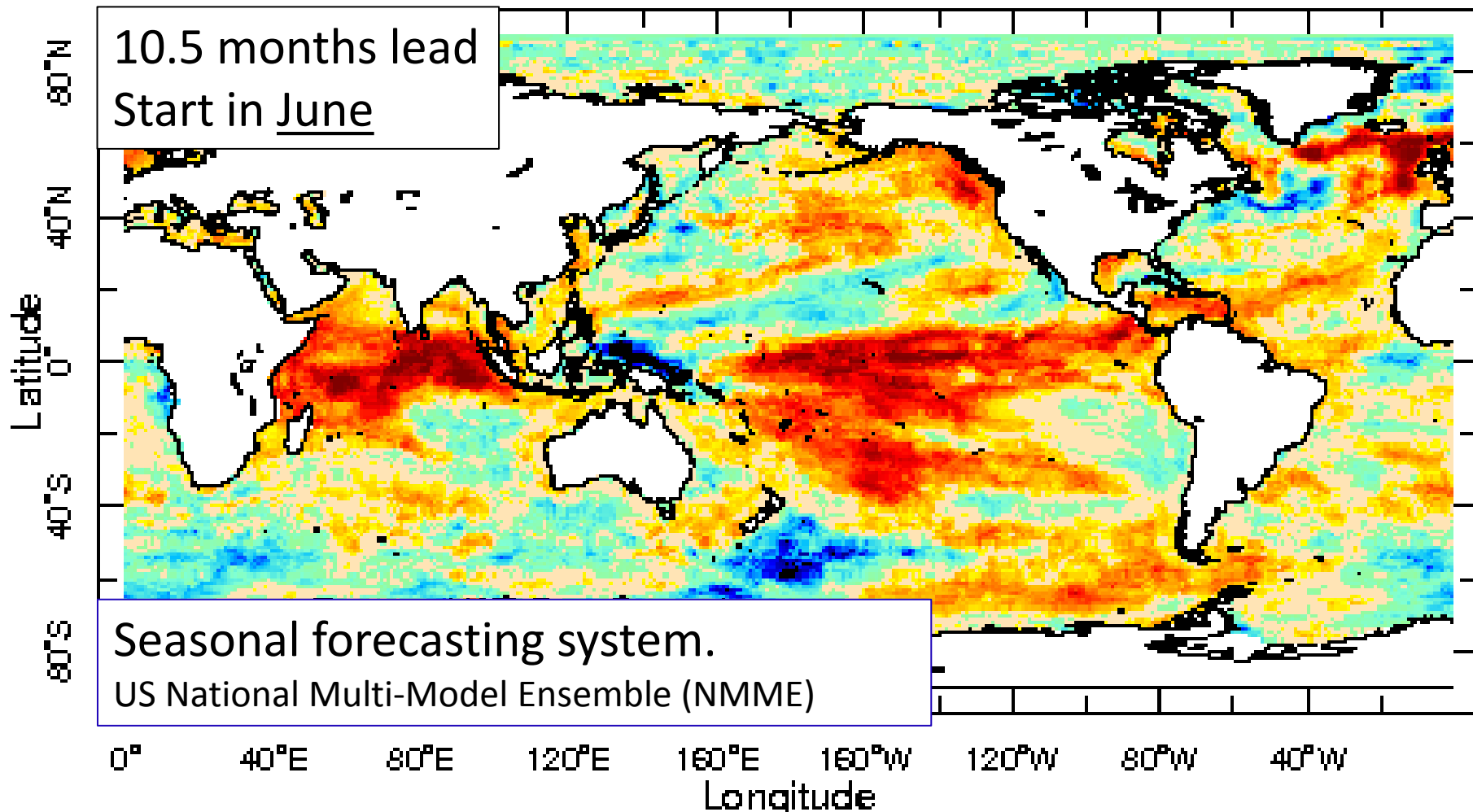
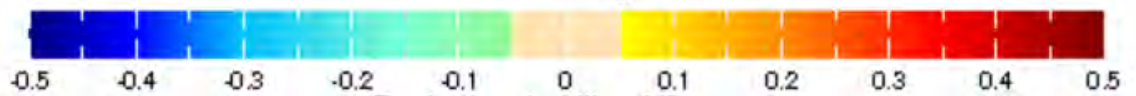


5. Predictability

SST Predictability

Intra-seasonal to inter-annual

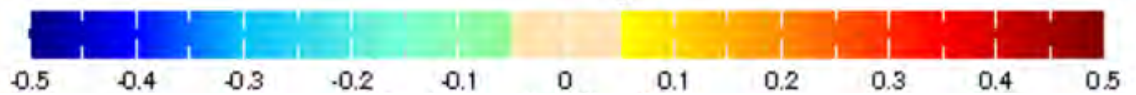
Ranked probability
skill score



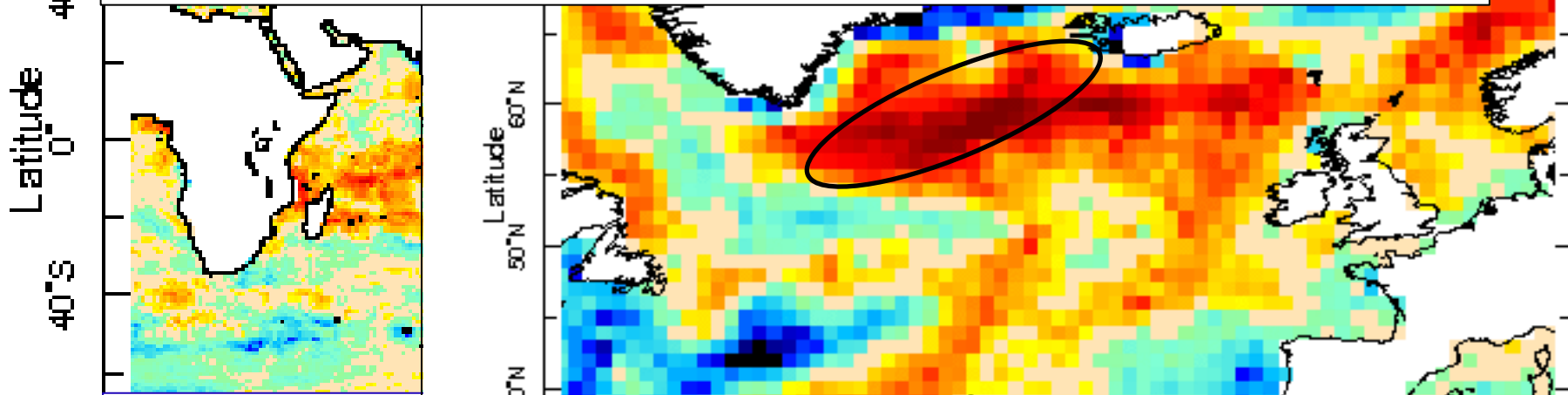
SST Predictability

Intra-seasonal to inter-annual

Ranked probability
skill score



Amongst the highest predictability potential in the World



Stronger convection again in 2012 and 2014:
We predict(ed) increased production 😊

Messages

- A north-eastward extended subpolar gyre limb in the Irminger Sea improves the biological productivity southwest of Iceland – both oceanic and potentially on the shelf
- Mechanistic understanding → potential for prediction (0.5 to 1.5 years ahead)



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