

Sub-decadal variations in the Irminger Sea and South Iceland shelf ecosystem: mechanisms and potential for predictability

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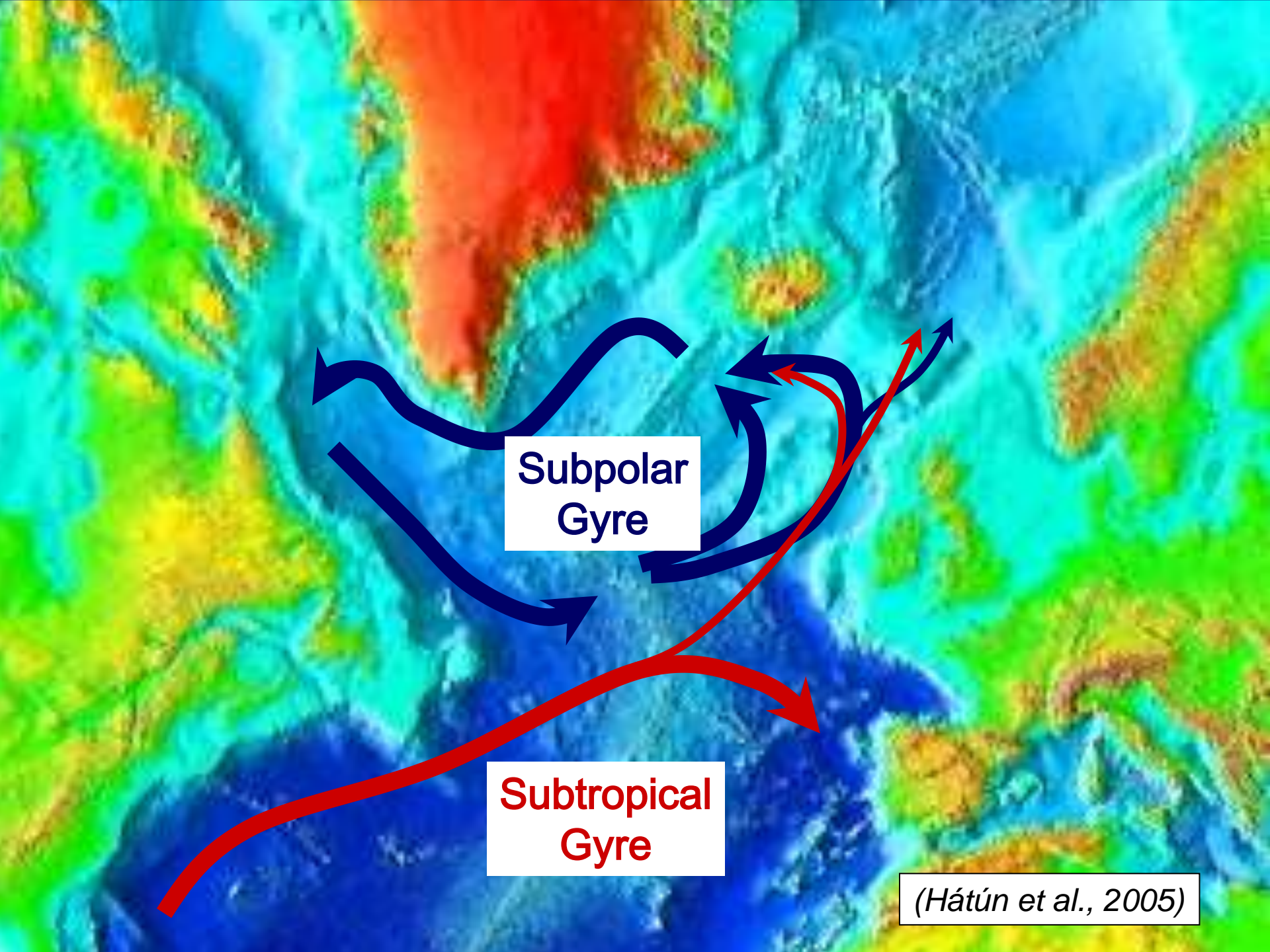
ASOF Meeting, AWI , Bremerhaven, 17.03.2015



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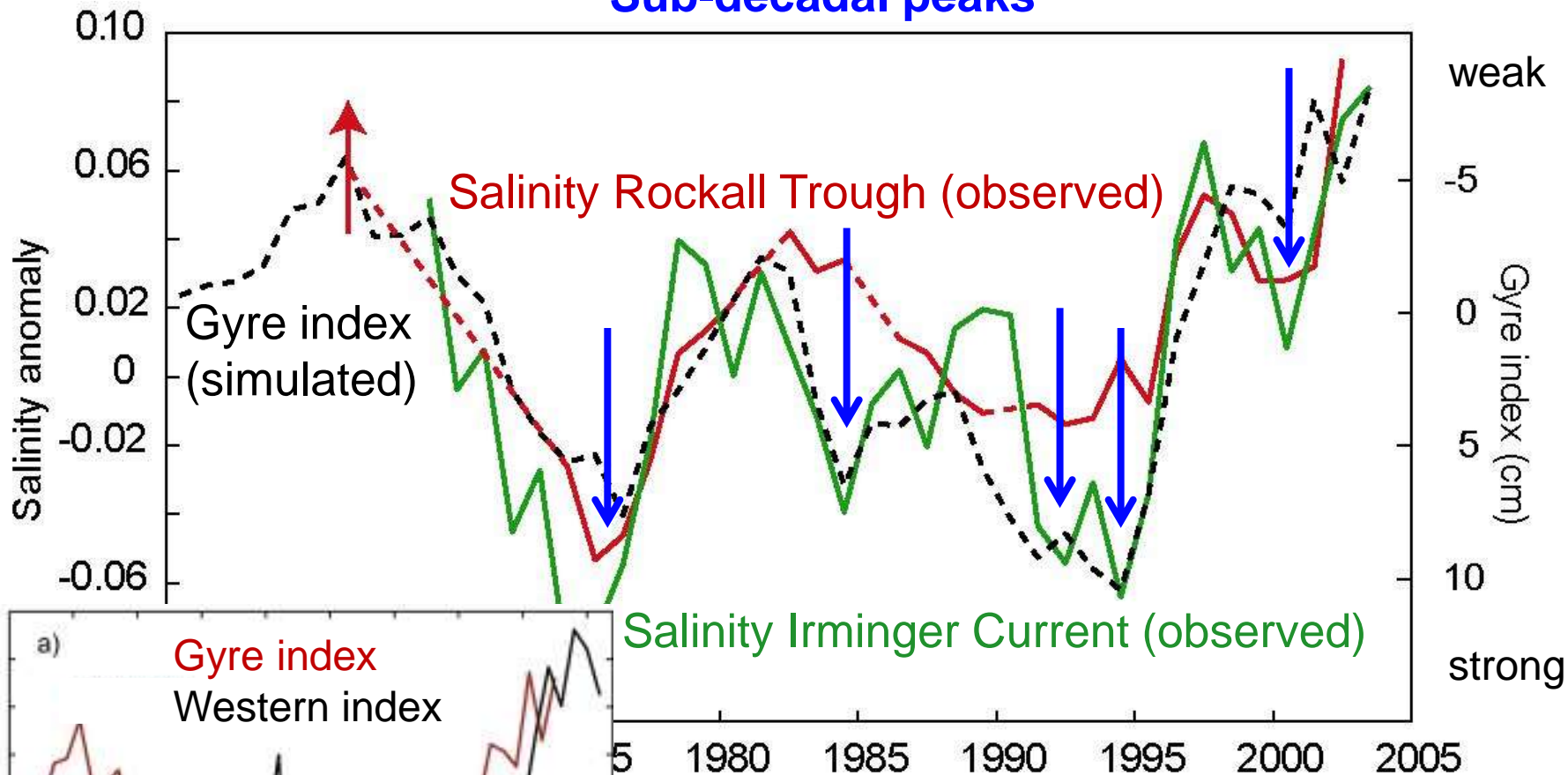


**Subpolar
Gyre**

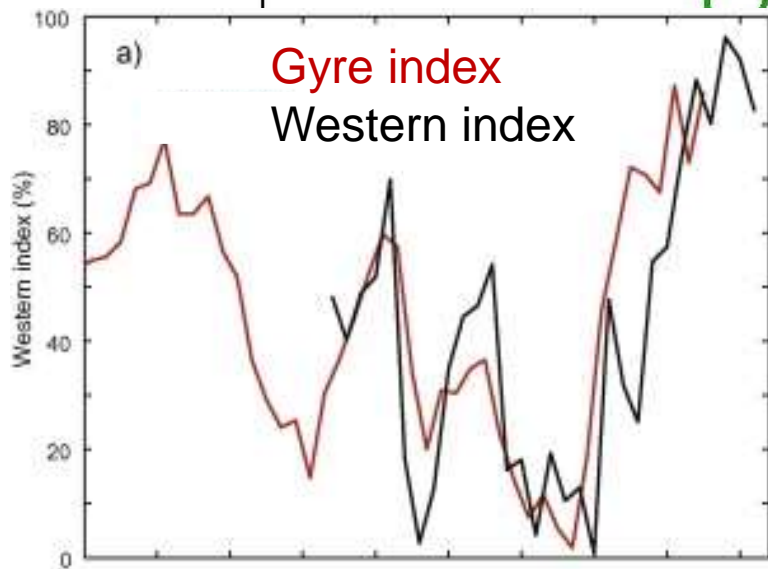
**Subtropical
Gyre**

(Hátún et al., 2005)

Sub-decadal peaks

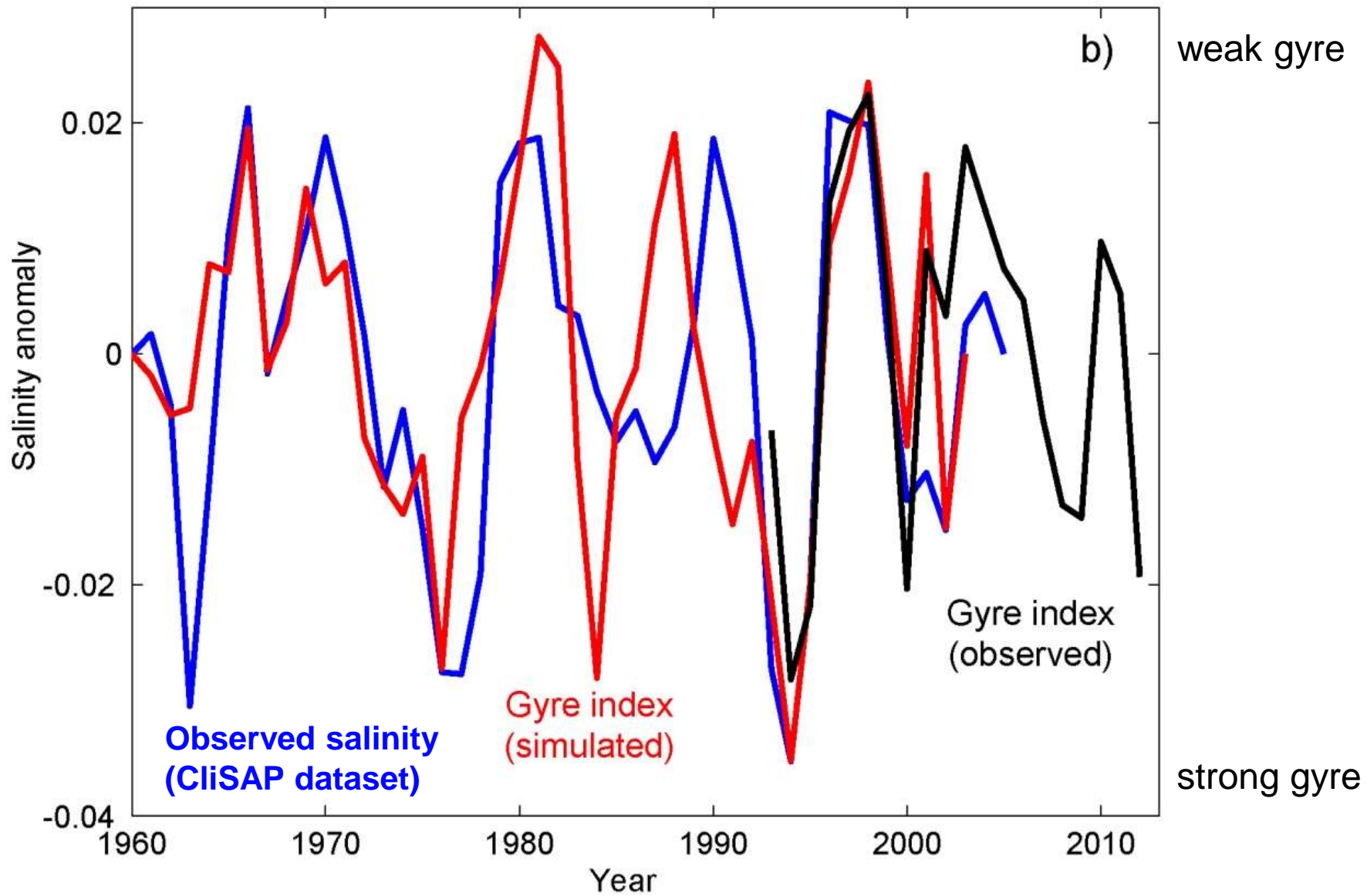


(Hátún et al., 2005)



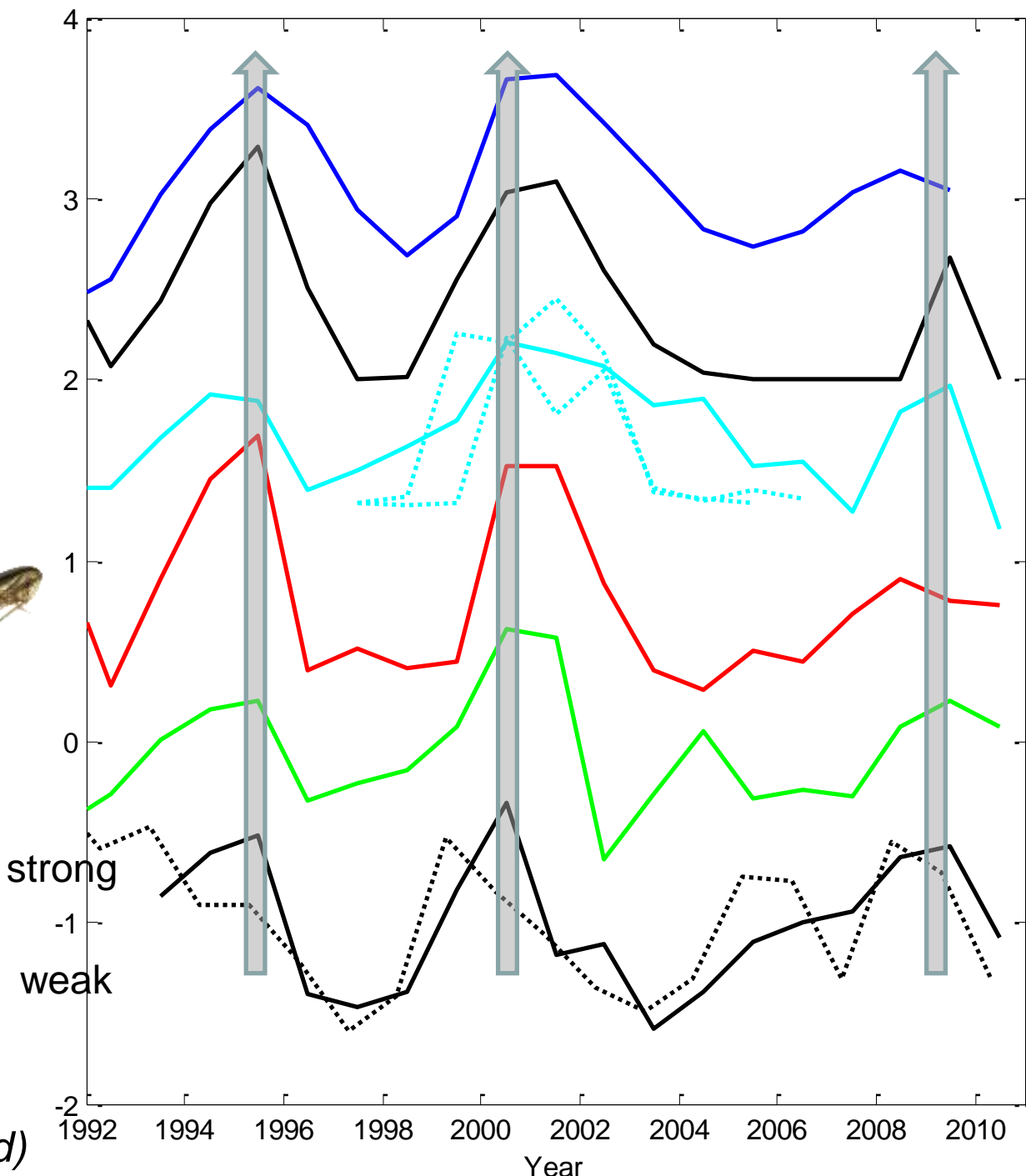
Blue whiting catches
(Hátún et al., 2009)

Sub-decadal variations



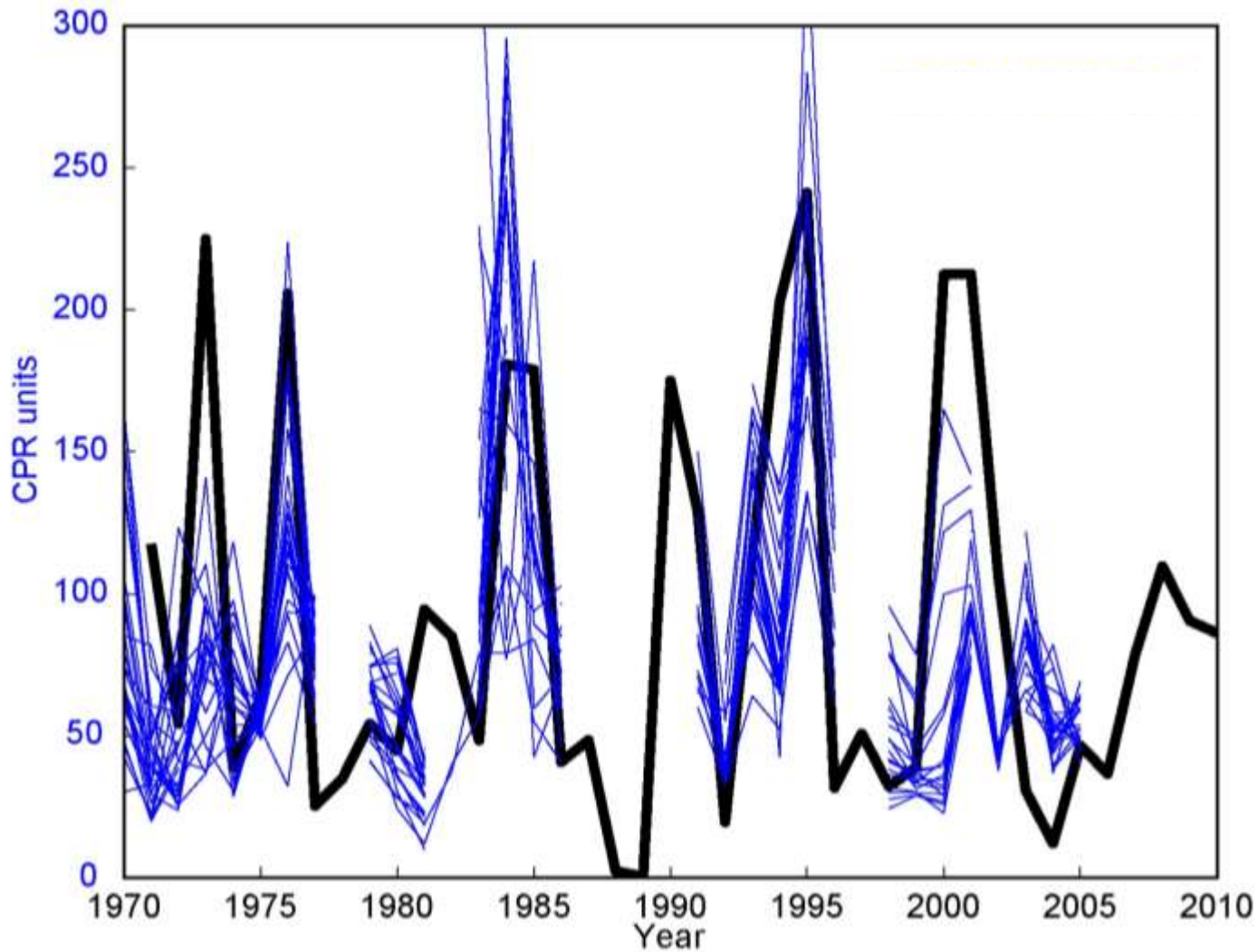
Sub-decadal peaks in shelf ecosystems

Cod growth
Kittiwakes
(breeding success)
Sandeel
Zooplankton on
South Iceland shelf
(mainly *Calanus finmarchicus*)
Primary production
Gyre index
(de-trended)



(courtesy: Astthor Gislason, Bergur Olsen and Eilif Gaard)

Zooplankton abundance on South Iceland shelf and in Irminger Sea



What drives this variability?

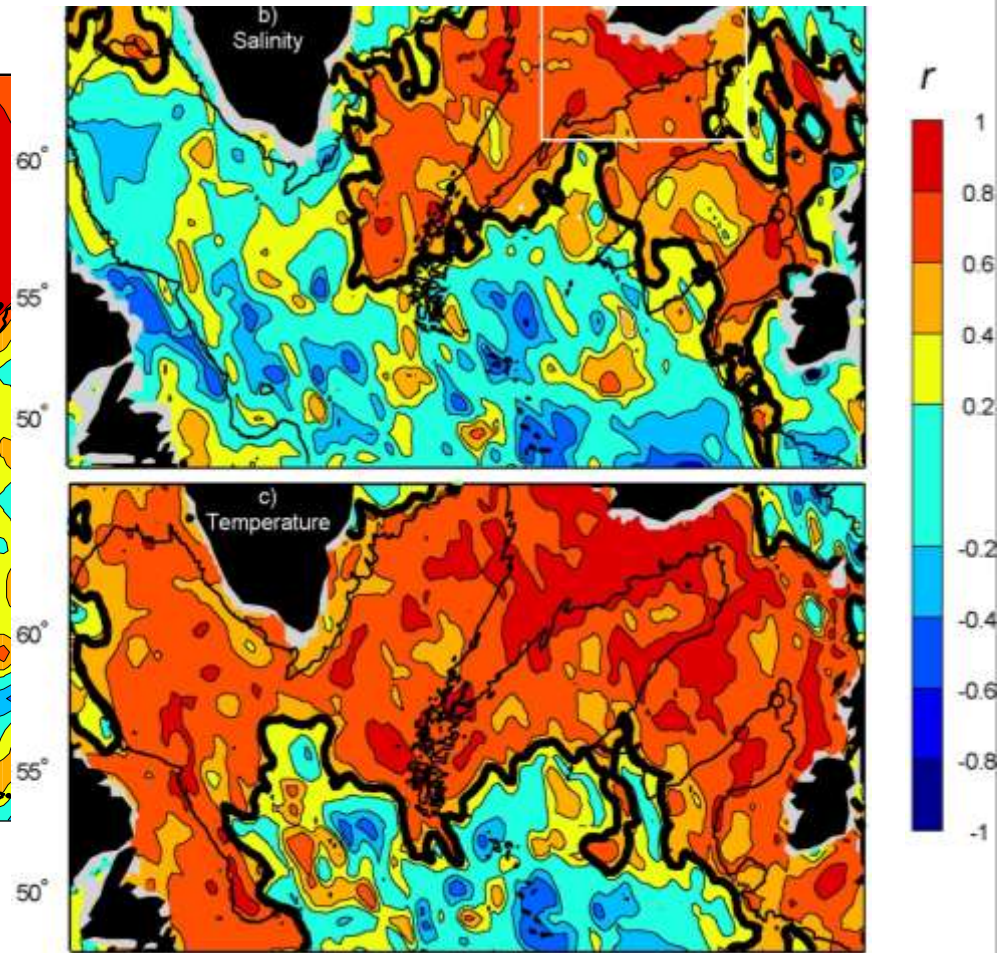
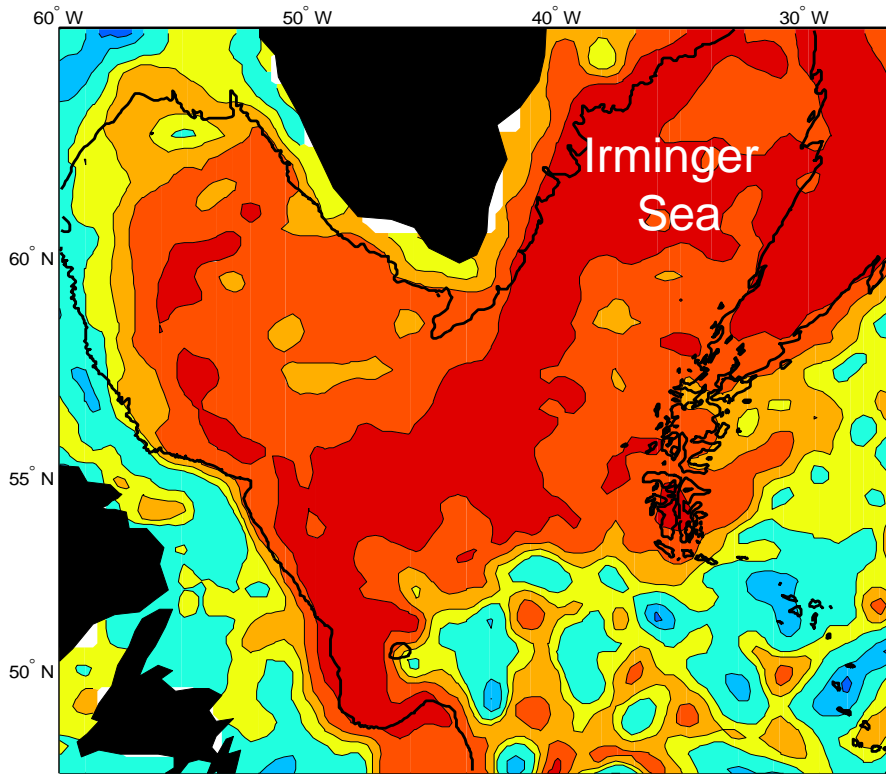
Ocean model simulation

- Max Planck Institute ocean model (MPI-OM) forced with NCEP/NCAR reanalysis fields for the period 1948 to 2010
- Conformal mapping grid with the northern grid pole located over Greenland, featuring a nominal resolution of 1.5°
- Horizontal resolution of 15-100 km in North Atlantic
- 40 vertical levels

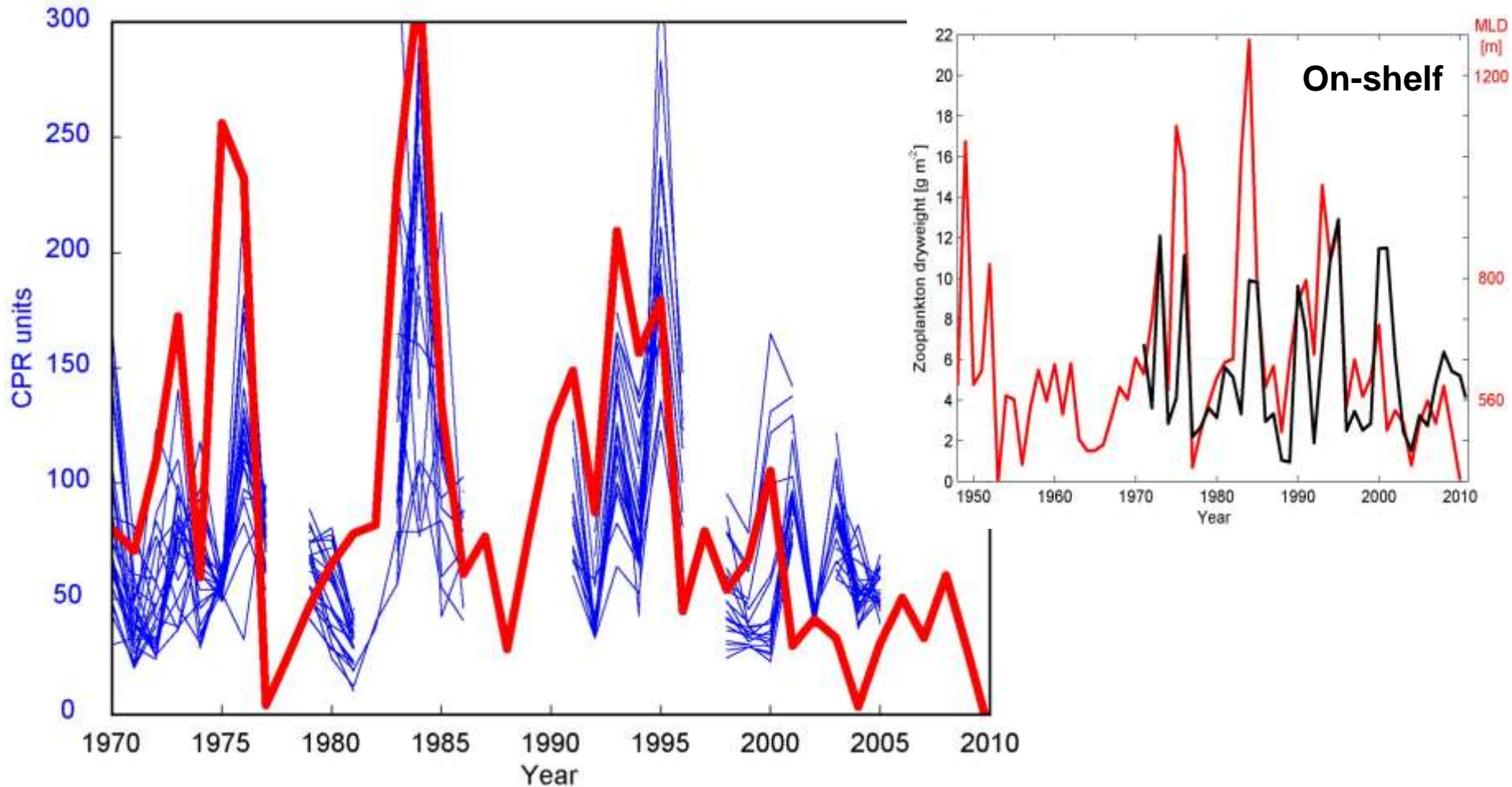
Matei et al. (2012a): Multiyear prediction of monthly mean Atlantic meridional overturning circulation at 26.5N. Science, 355, 76-79

Matei et al. (2012b): Two tales of initializing decadal climate prediction experiments with the ECHAM5/MPI-OM model. Journal of Climate, 25, 8502-8523

Correlation altimetry - simulated sea surface height

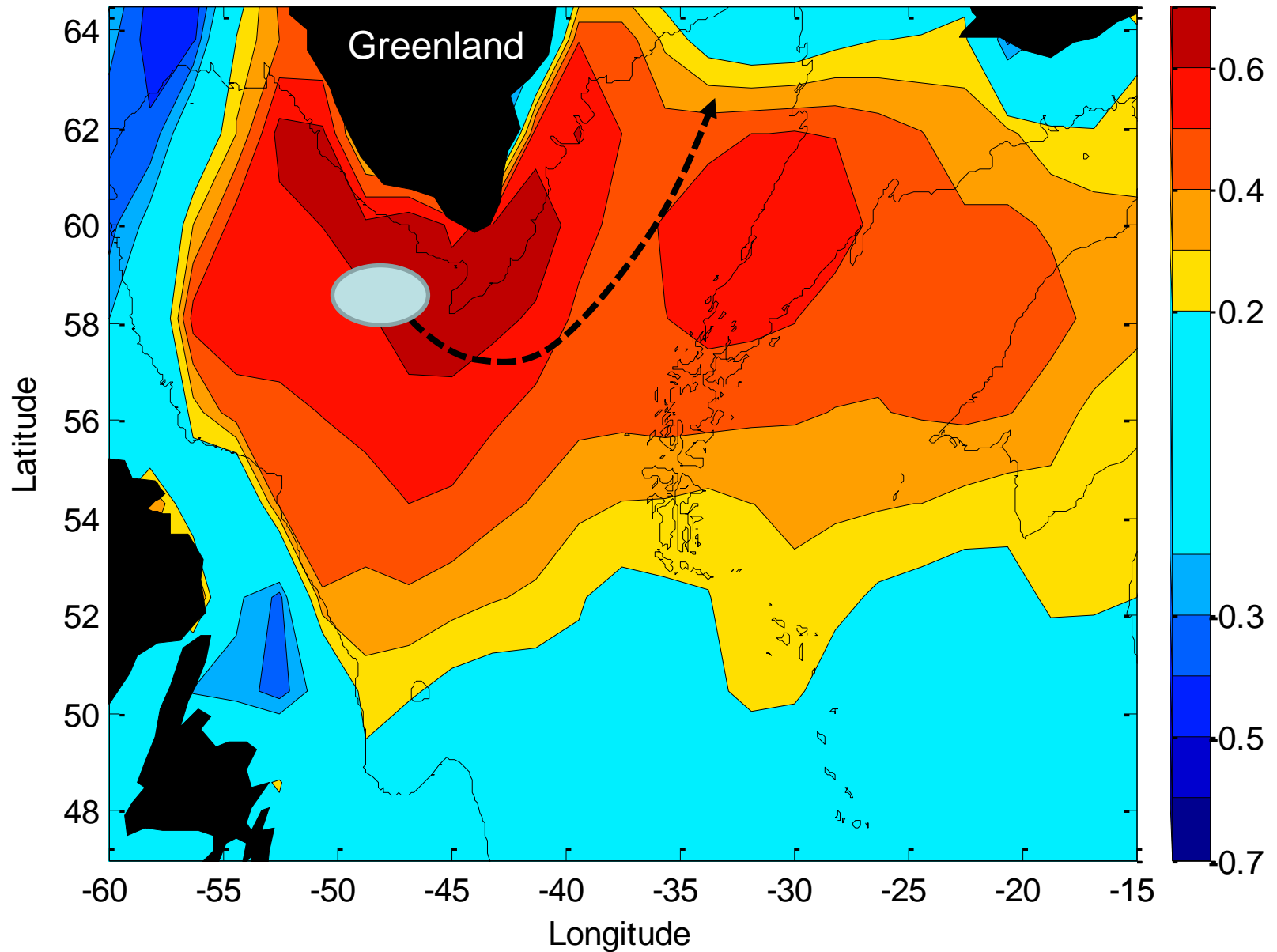


Zooplankton abundance and March mixed layer depth in Irminger Sea

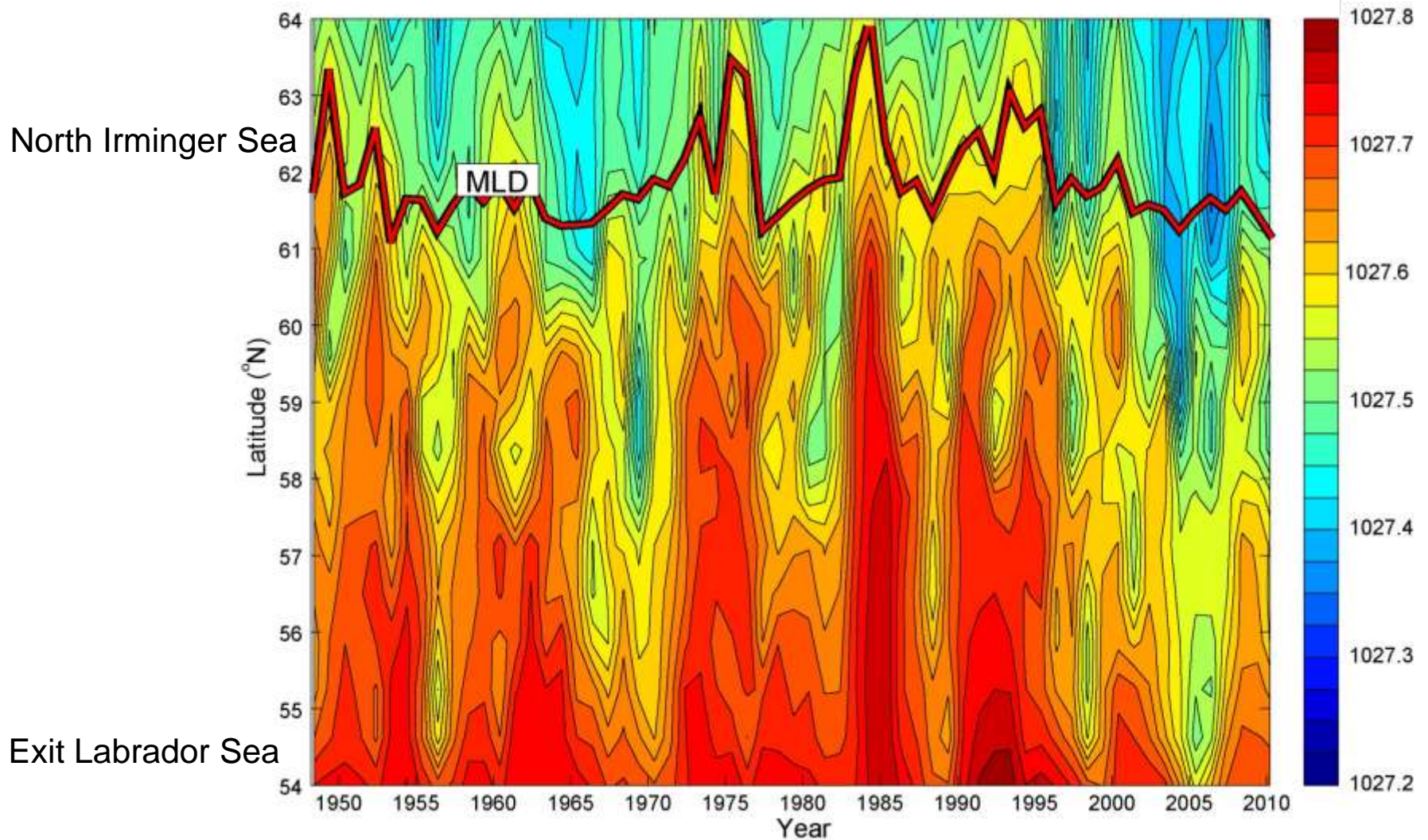


- Mixing up of nutrients
- Support ascending of zooplankton
- Phyto-Convection (Backhaus et al., 1999)

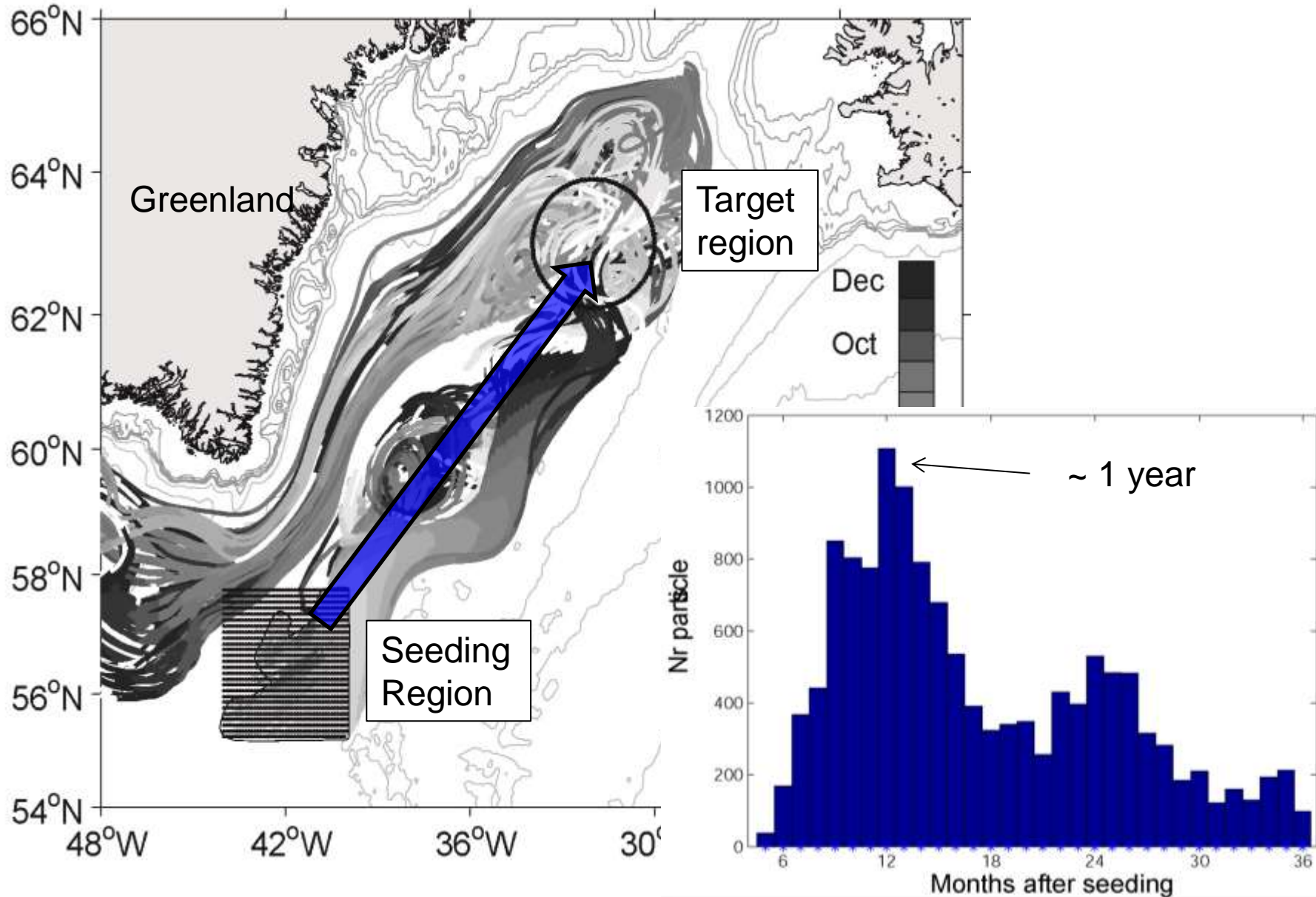
Correlation mixed layer depth - winter surface heat loss



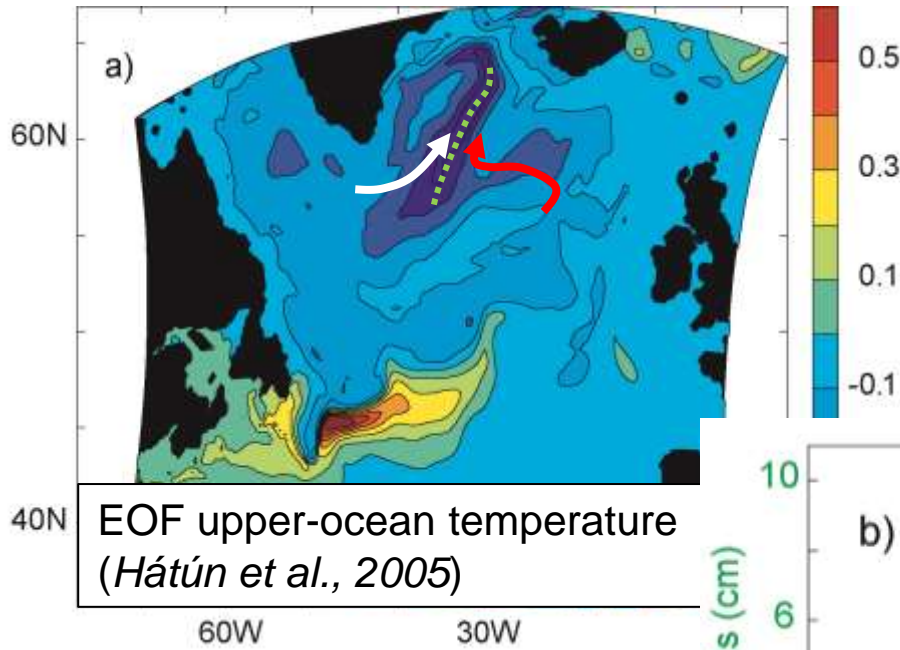
Advection of weakly stratified water masses



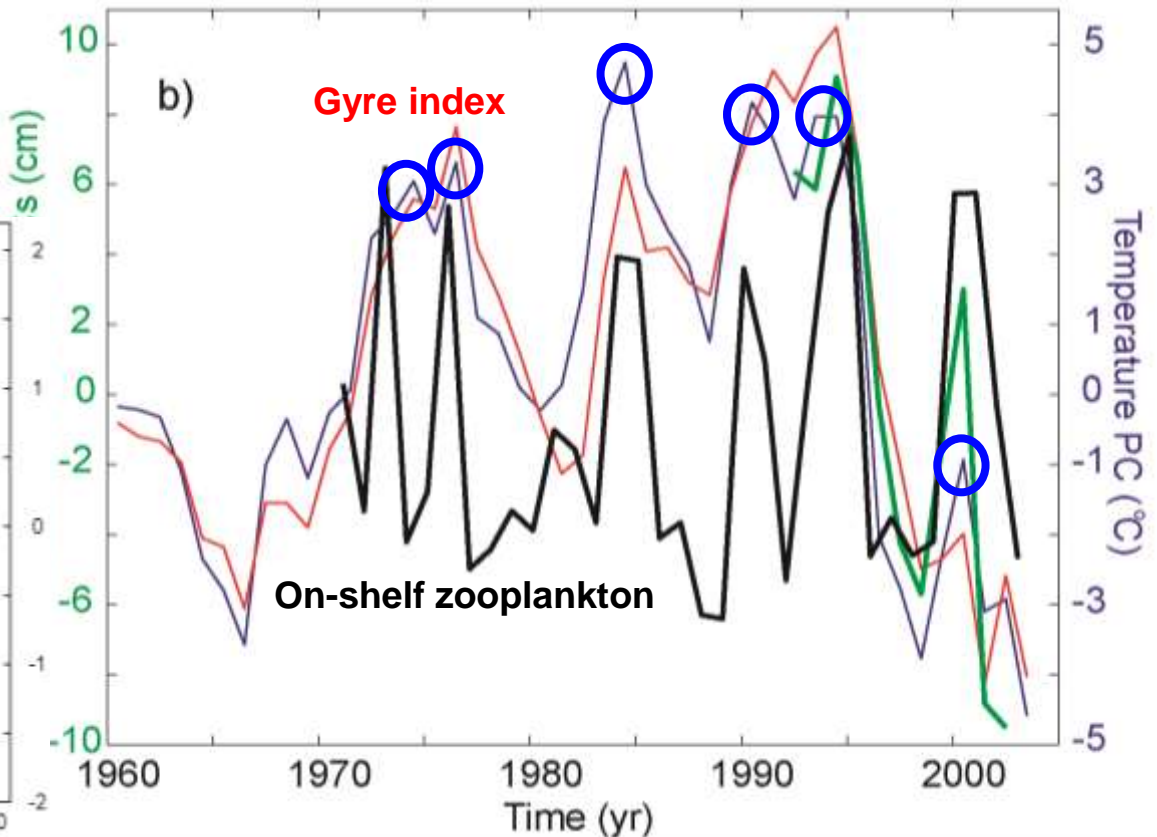
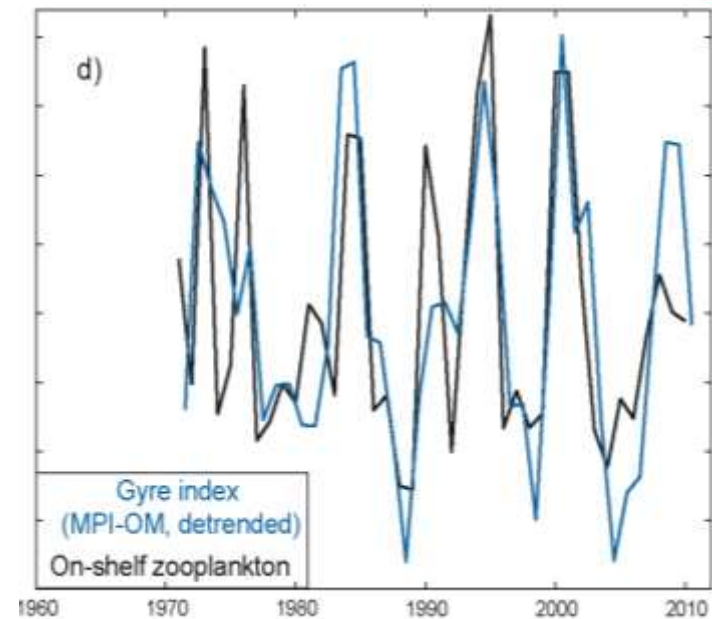
Particle tracking experiment based on simulated flow field



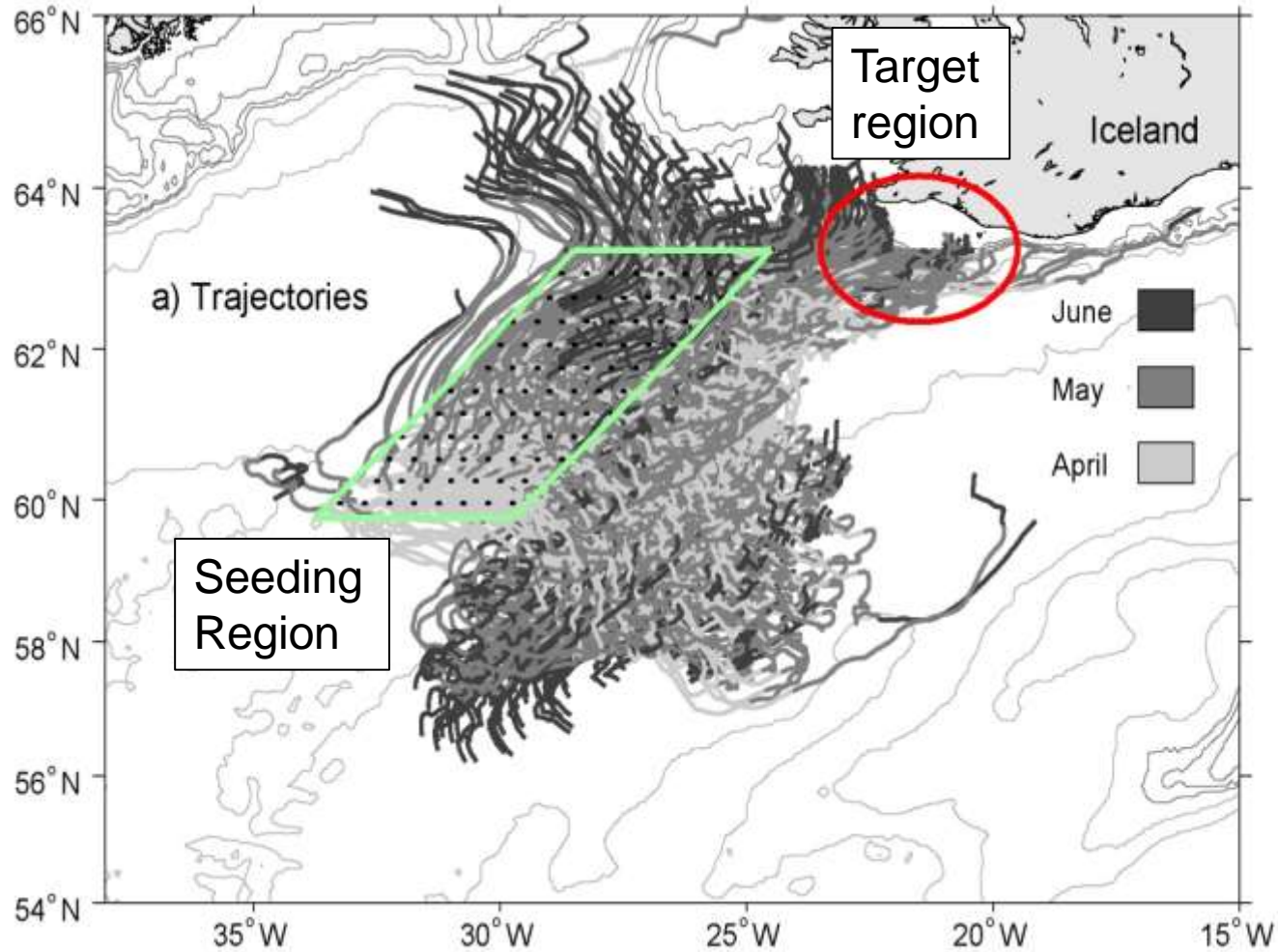
The biologically productive subarctic front



Frontal shifts towards Iceland



Particle tracking experiment based on simulated flow field

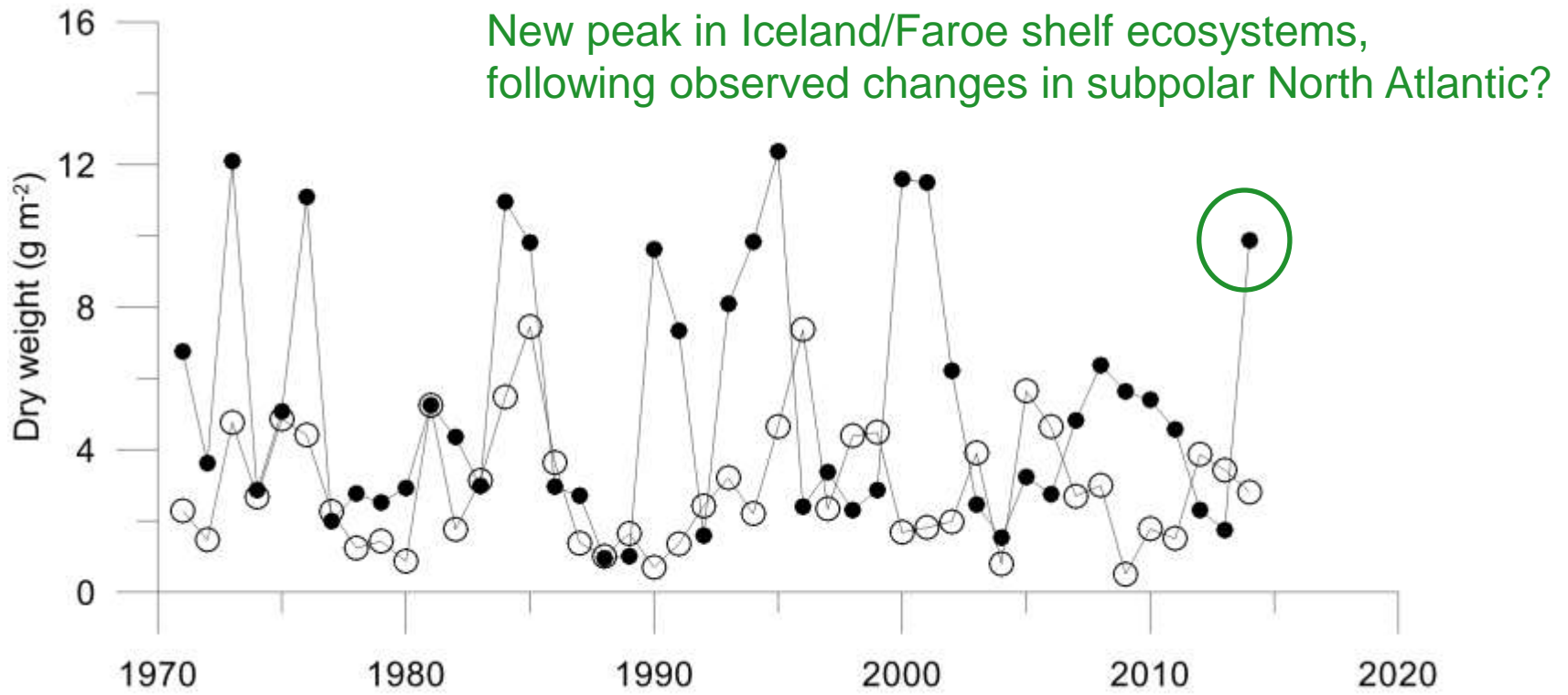


Conclusions

- Shelf ecosystems in northeastern North Atlantic characterized by sub-decadal variations
- Zooplankton abundance on South Iceland shelf covaries with zooplankton abundance in Irminger Sea
- Convection in Irminger Sea increases oceanic abundance of zooplankton
- Advection of weakly stratified waters produced by convection in the Labrador Sea favours convection in Irminger Sea
- Possible influx of zooplankton from Irminger Sea onto South Iceland shelf
- Sub-decadal peaks in abundance of zooplankton and potentially higher trophic levels potentially predictable by couple of months (local winter convection to subsequent summer production); advective time-lag from Labrador Sea might induce even longer predictability potential



Updated zooplankton abundance on South Iceland shelf

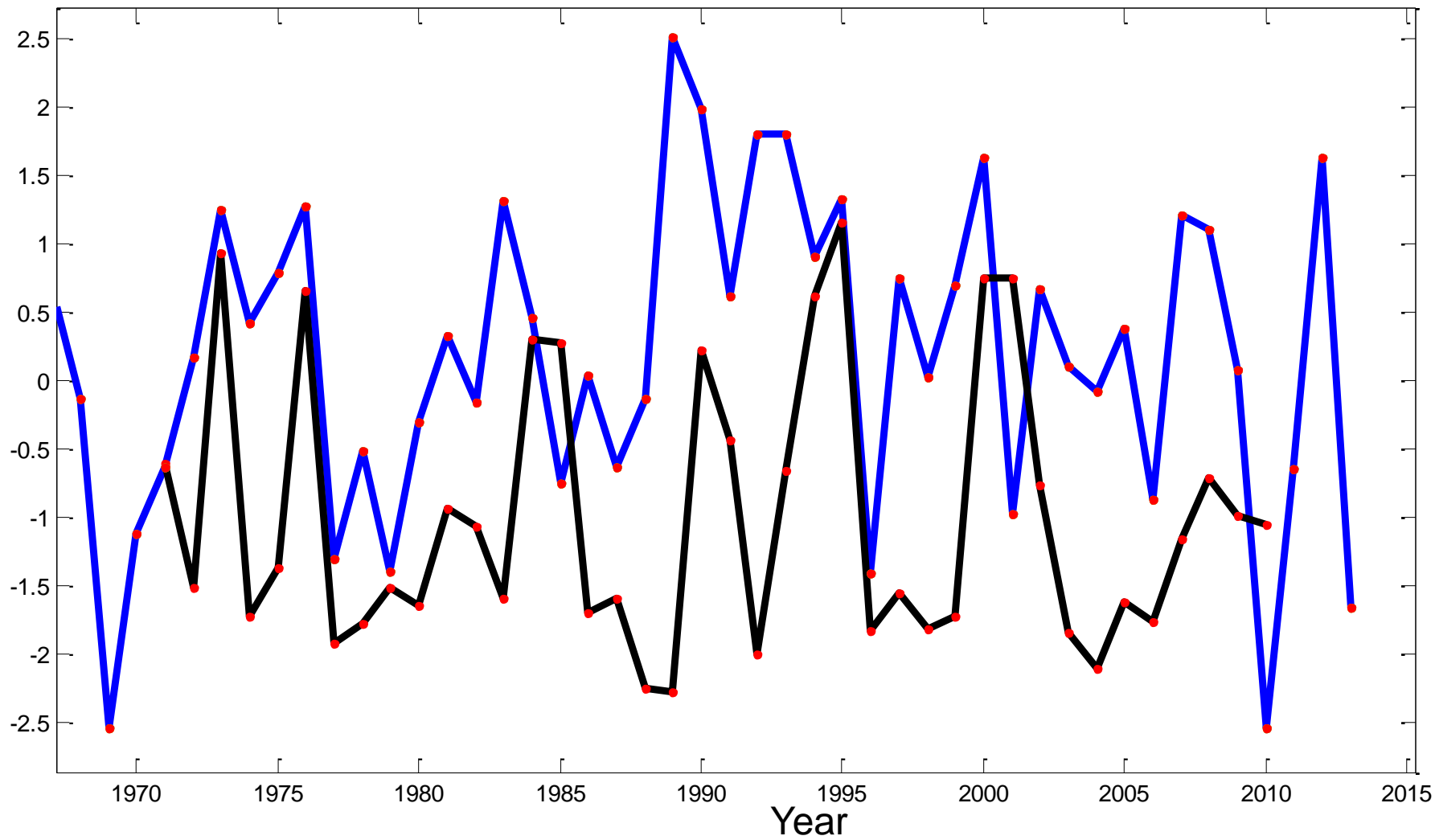


Thank you!

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Zooplankton abundance on South Iceland shelf and North Atlantic Oscillation index



Correlation mixed layer depth - winter atmospheric forcing

