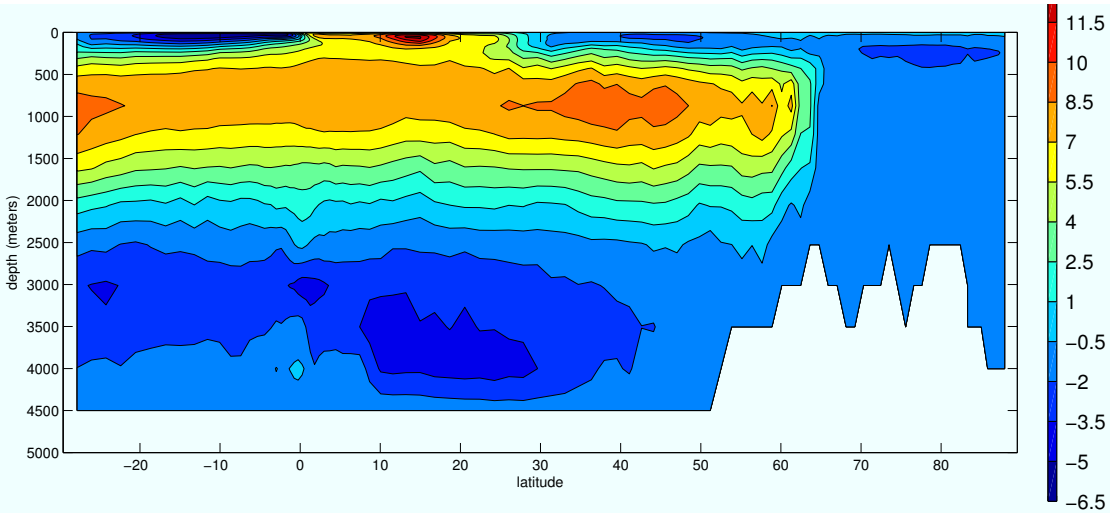
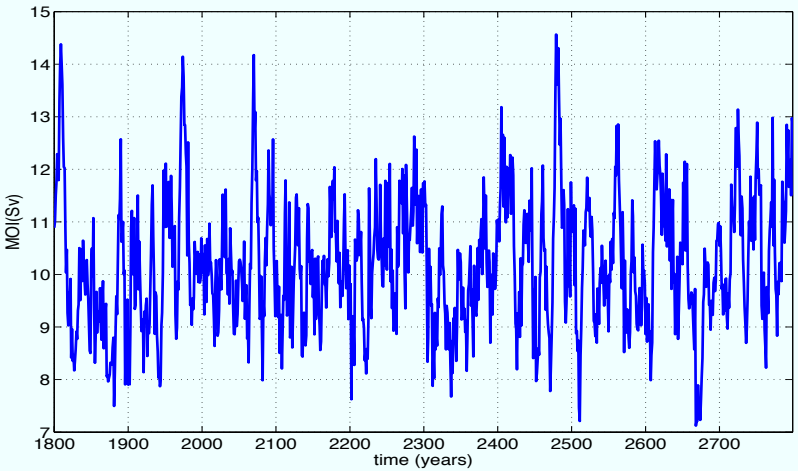
Variabilité et prévisibilité dans l'Atlantique Nord dans IPSLCM5A

Juliette Mignot, Didier Swingedouw, Romain Escudier, Aurélie Persechino

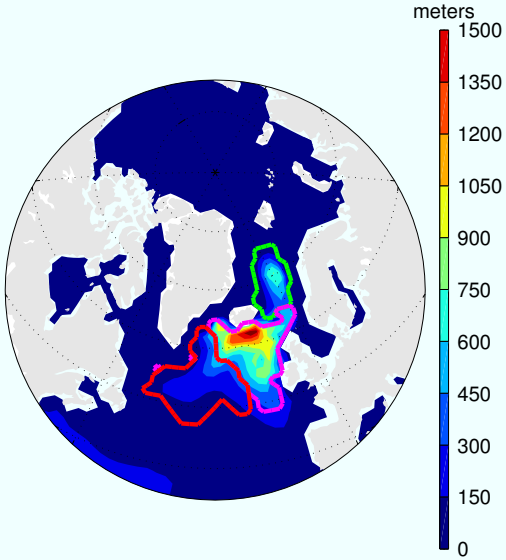
A 20-yr coupled ocean atmosphere sea-ice coupled mode in the subpolar North Atlantic in IPSLCM5A

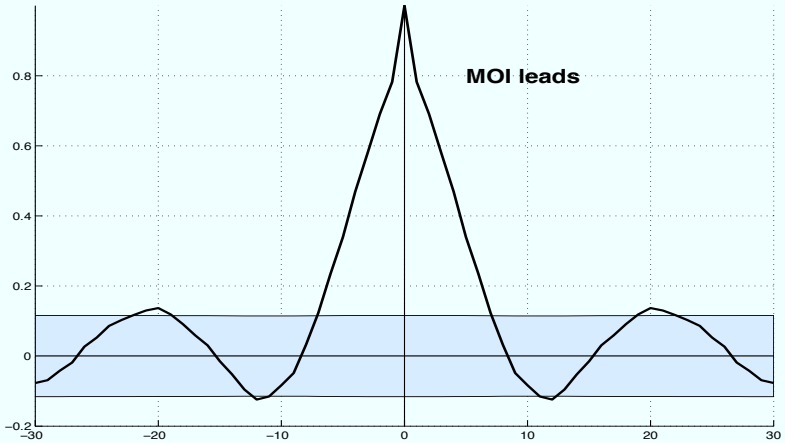
Escudier R., Mignot J. and Swingedouw D.





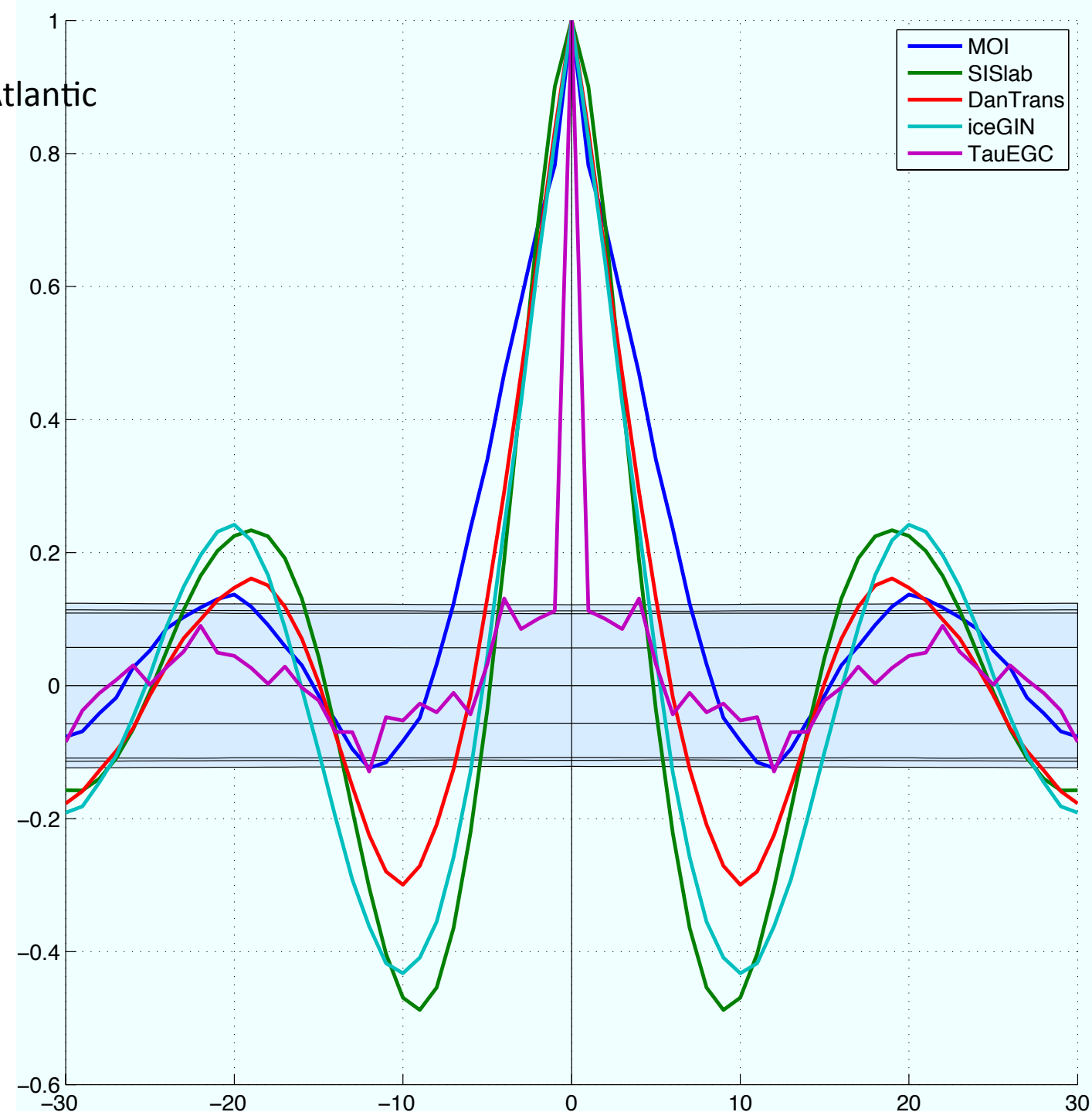
(a)



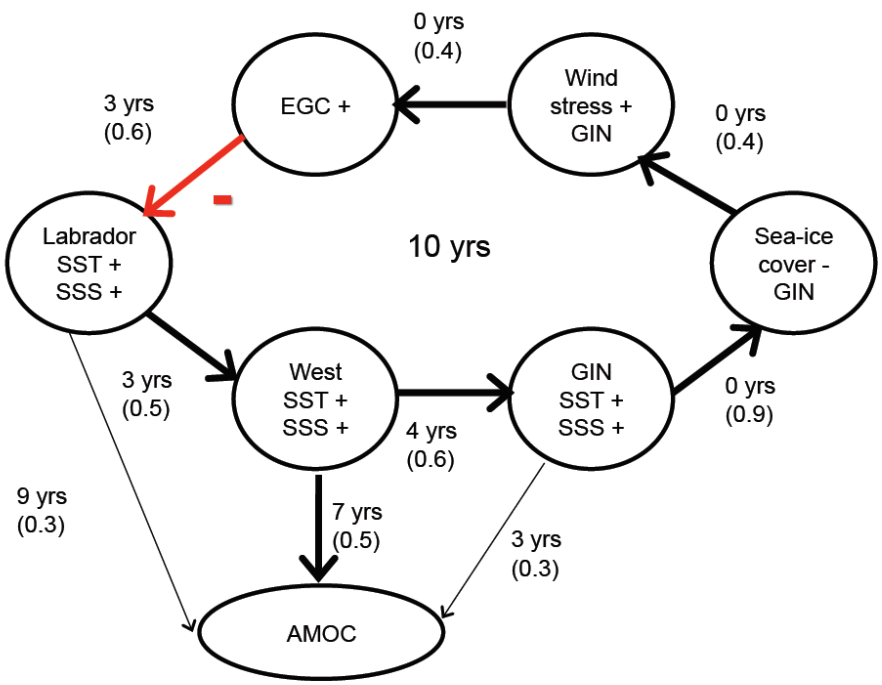


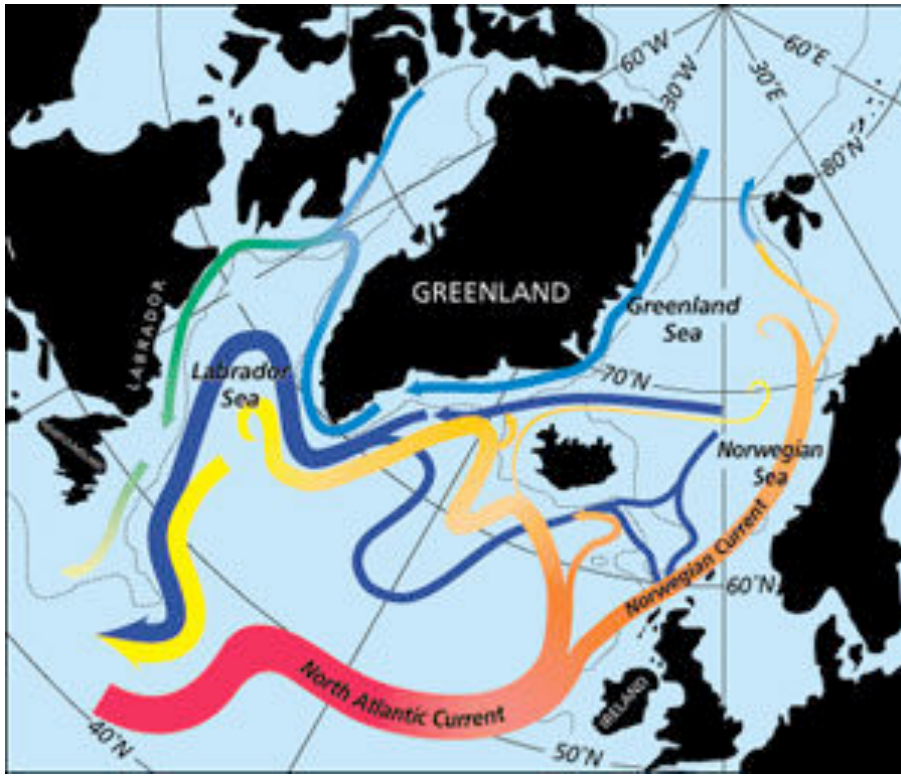
(b)

20-yr periodicity
in the subpolar North Atlantic
in piControl2



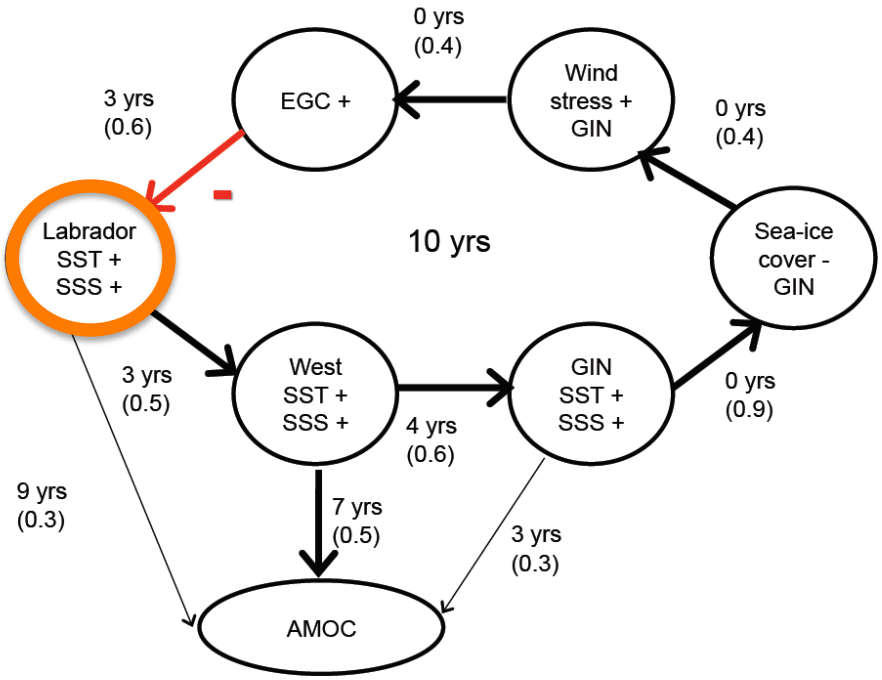
20-yr cycle mechanisms

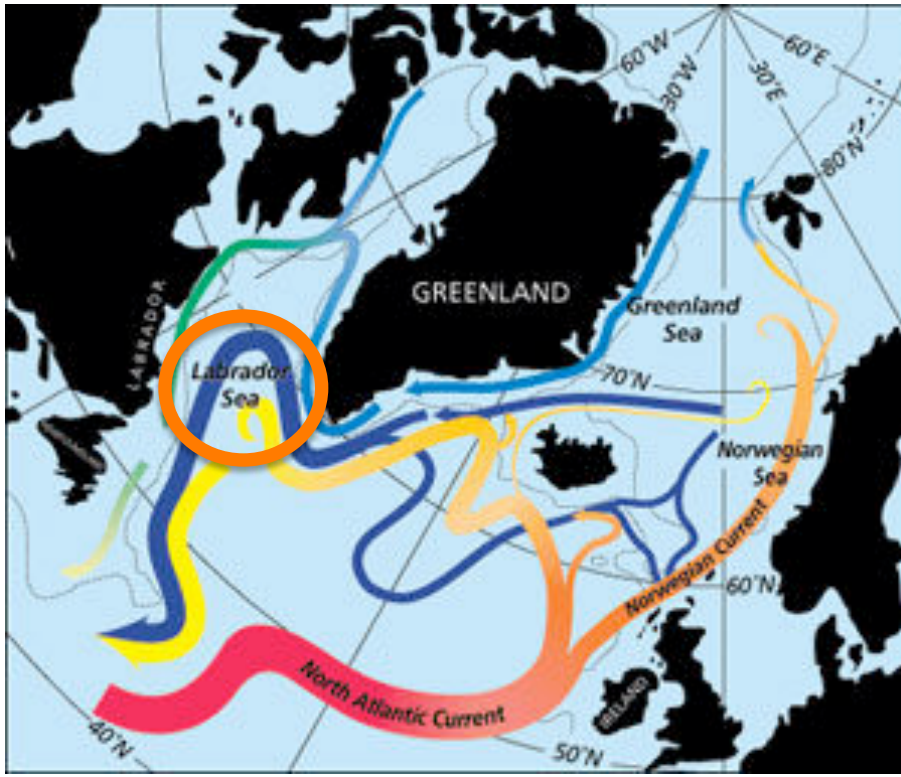




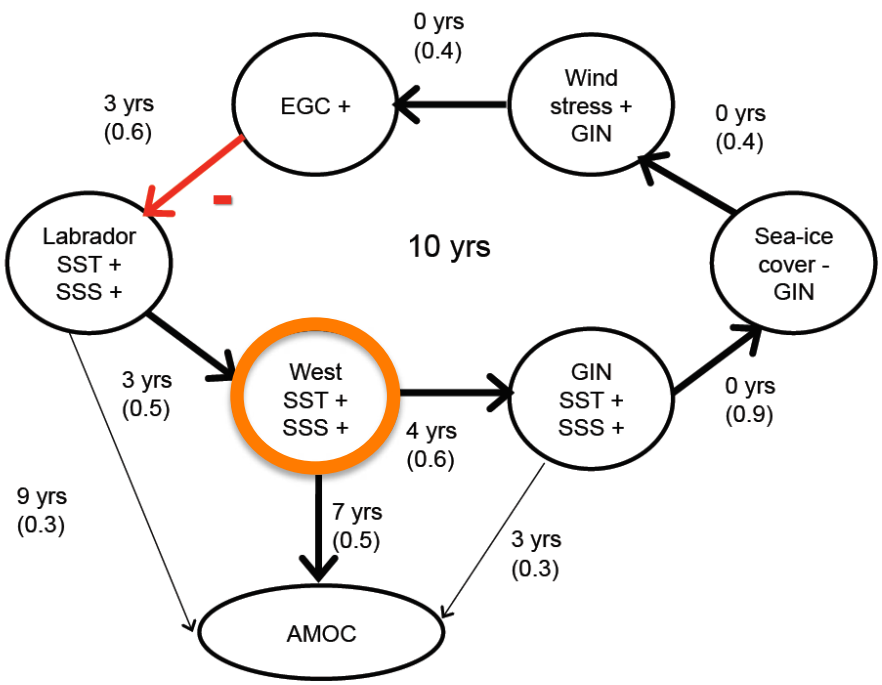
Escudier et al. in prep.

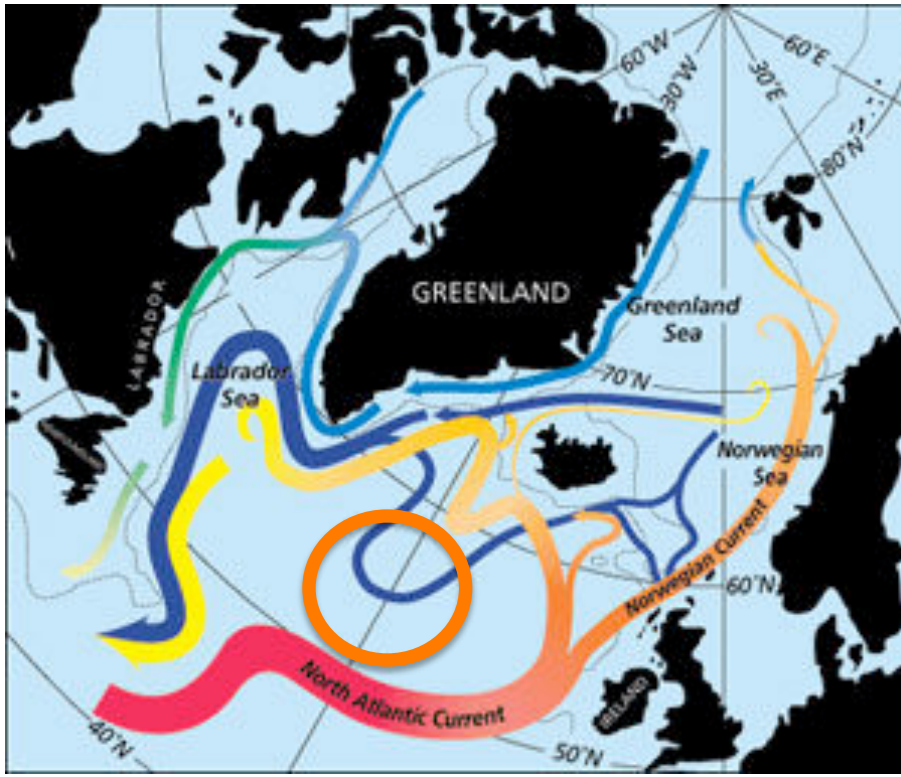
20-yr cycle mechanisms



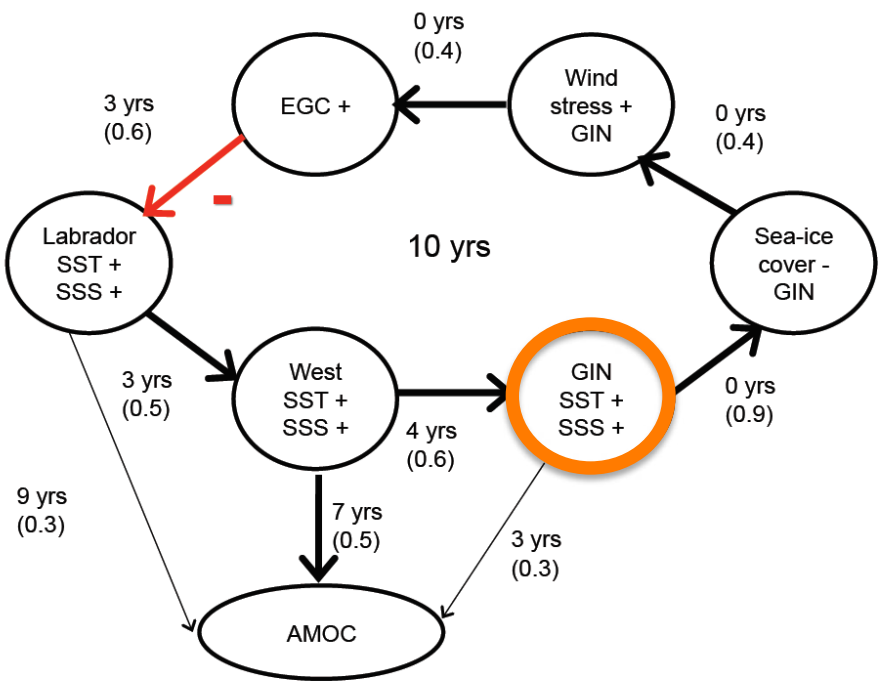


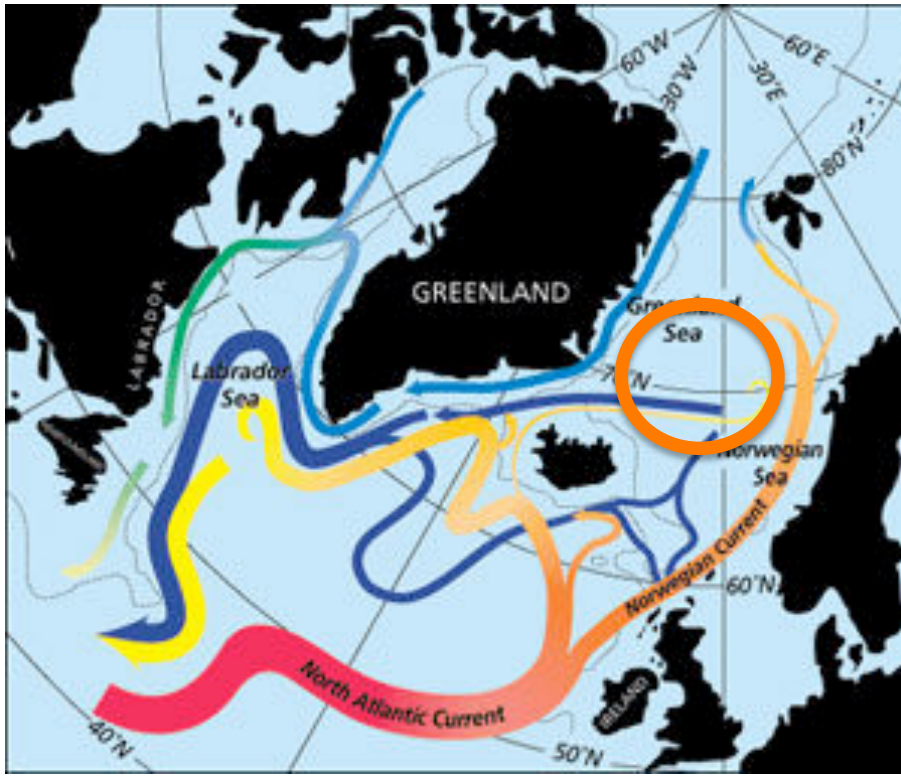
20-yr cycle mechanisms



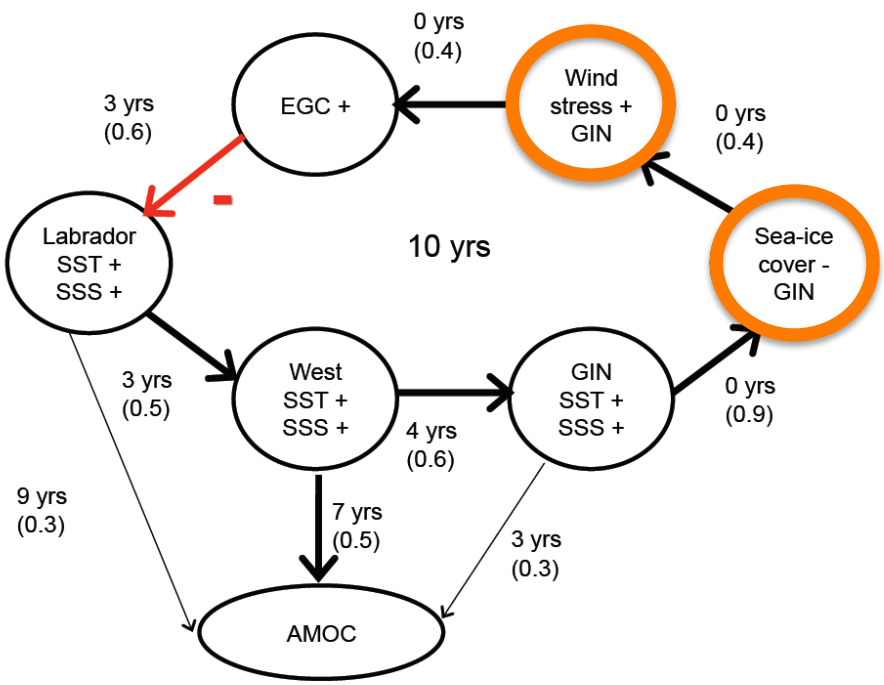


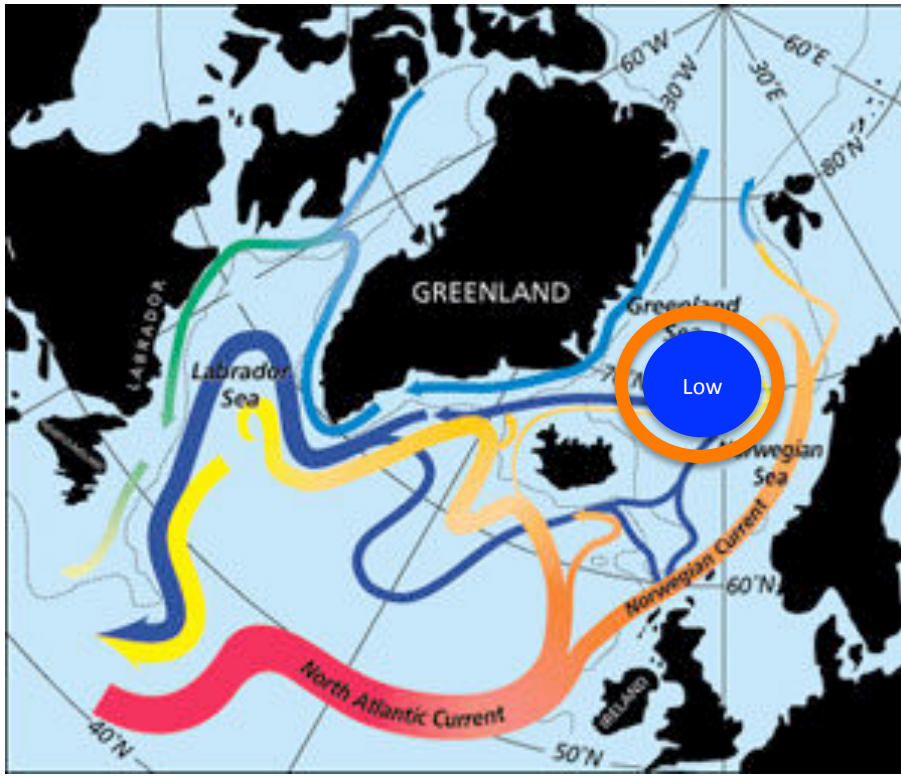
20-yr cycle mechanisms



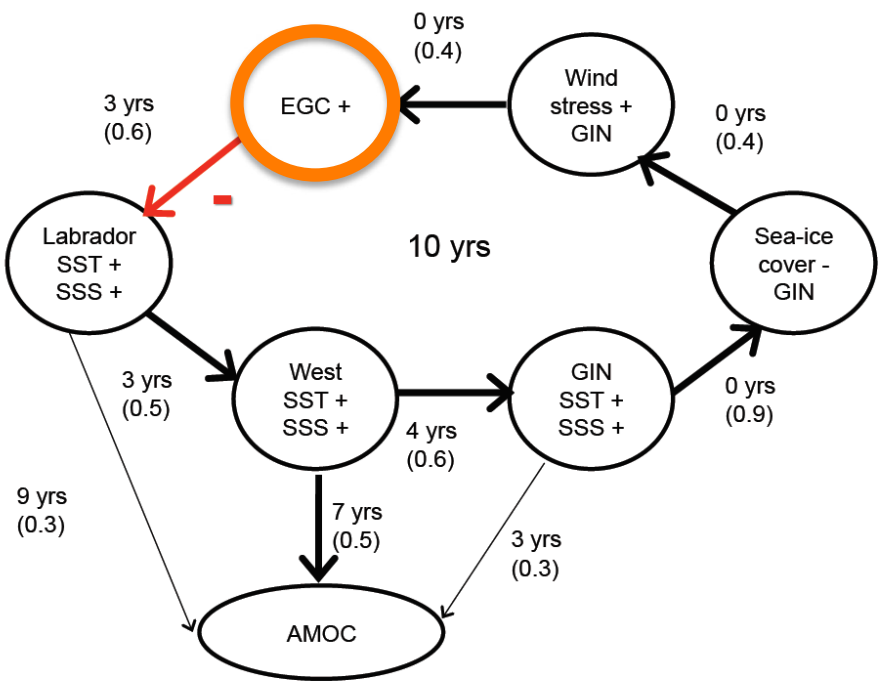


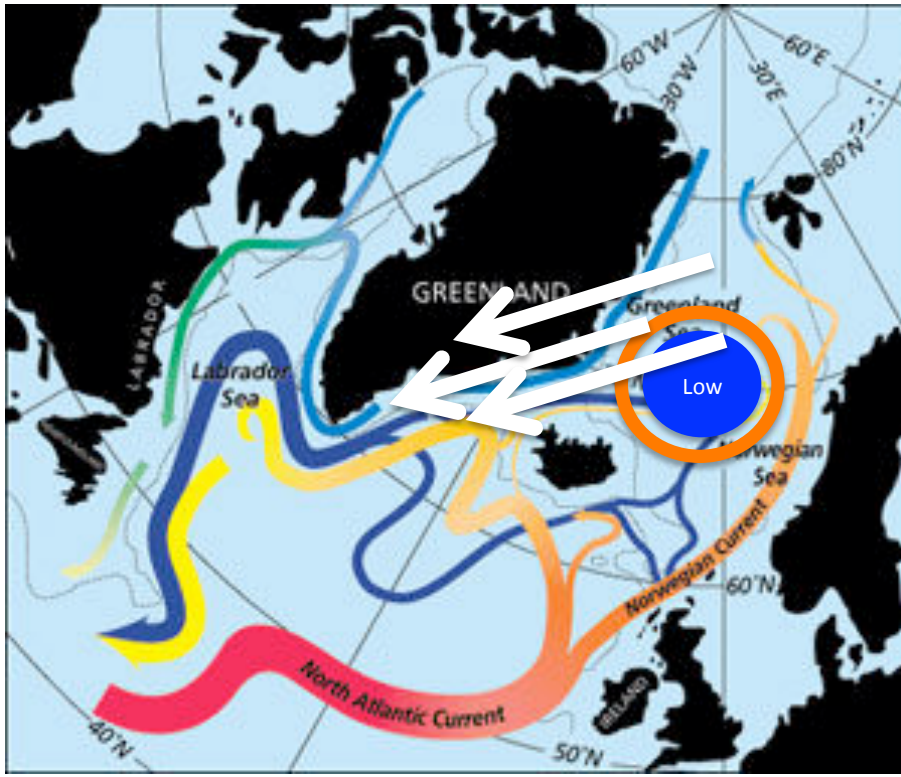
20-yr cycle mechanisms



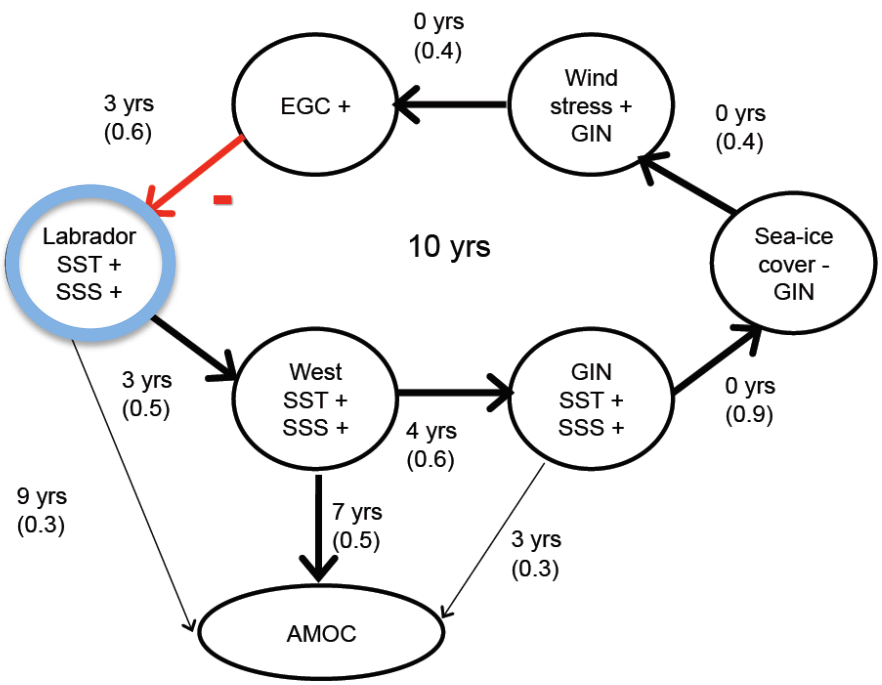


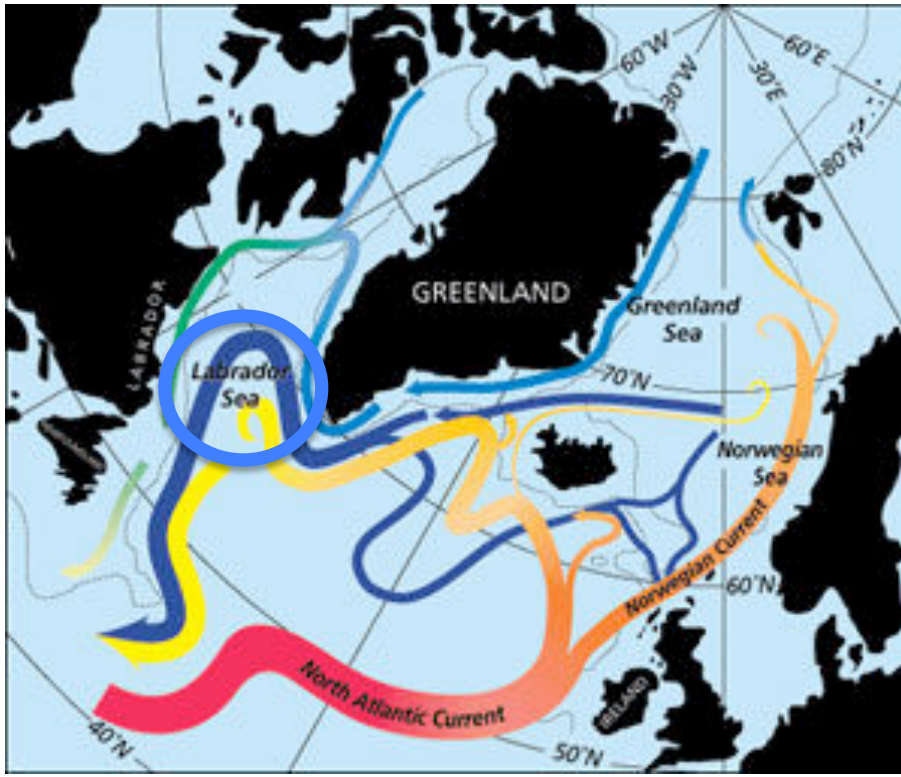
20-yr cycle mechanisms





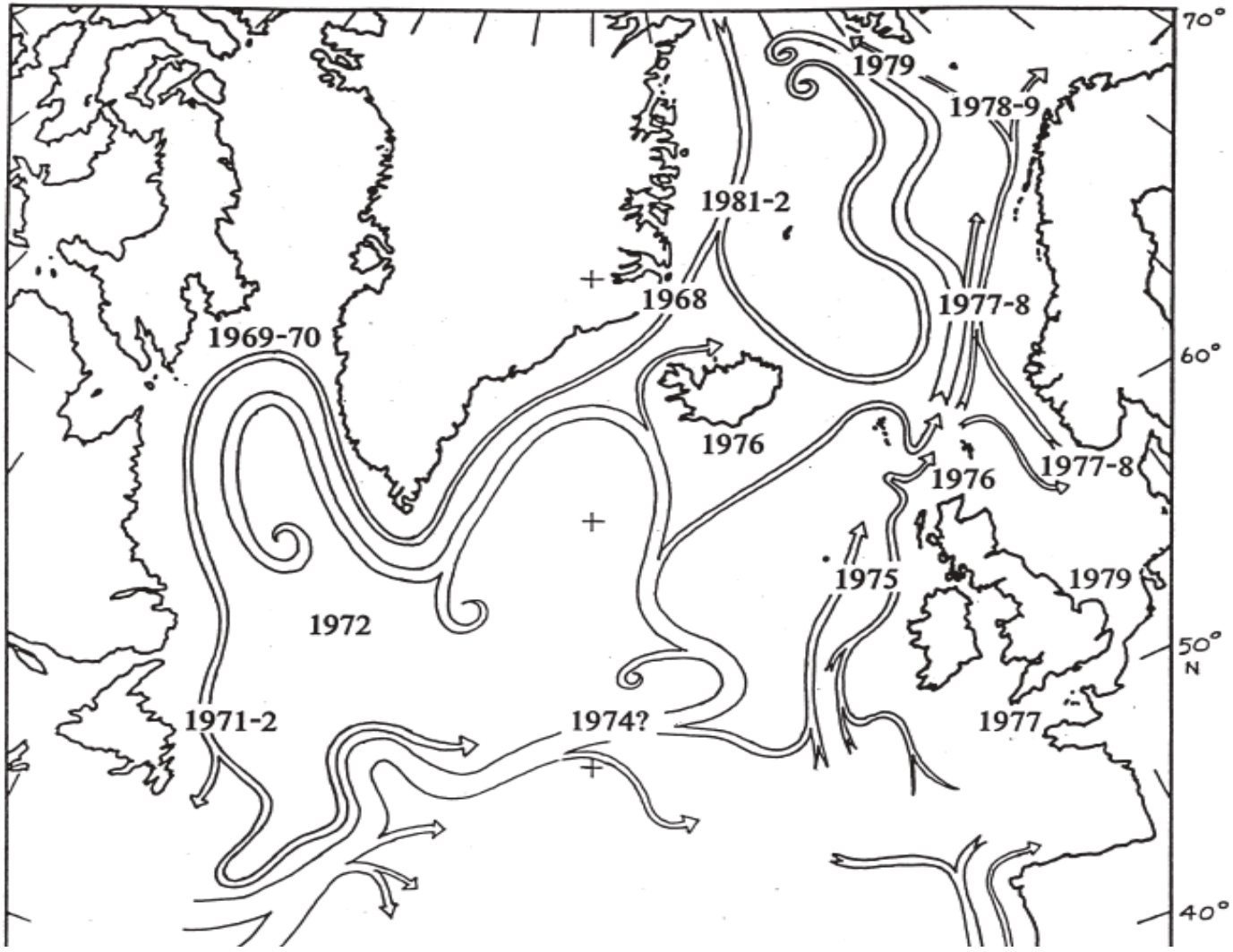
20-yr cycle mechanisms





Agreement with GSAs anomalies?

Propagation of the "Great Salinity Anomaly" of the 1970s



Decadal predictability in the thermohaline circulation and climate in the IPSLCM5A model

Persechino A., Mignot J., Swingedouw D., Labetoulle S. and Guilyardi E.

Diagnostic potential predictability in IPSLCM5A

$$ppvf(X) = \frac{\sigma_N^2(X) - \frac{1}{N}\sigma^2(X)}{\sigma^2(X)}$$

σ_N^2 : Variance of *N-year* means

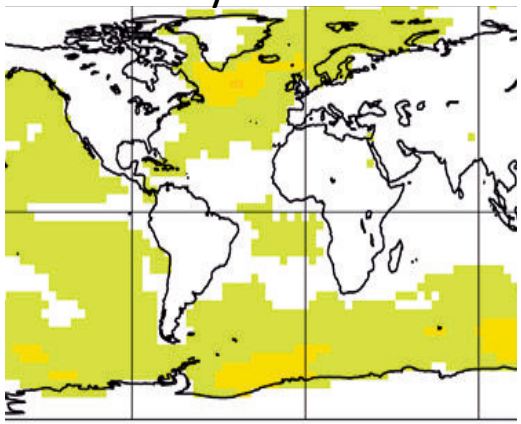
σ^2 : Interannual variance

0 ---------- ***ppvf*** ---------- 1

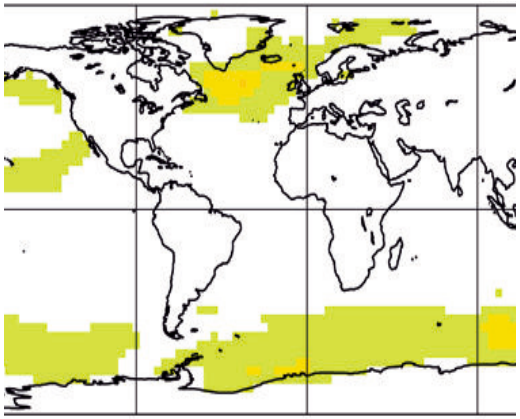
No potential predictability — **Potential predictability**

Fig. 5 Geographical distributions of ensemble potential predictability variance fractions $\hat{b}$(as percentages) for *pentadal*, *decadal* and *25-year means*

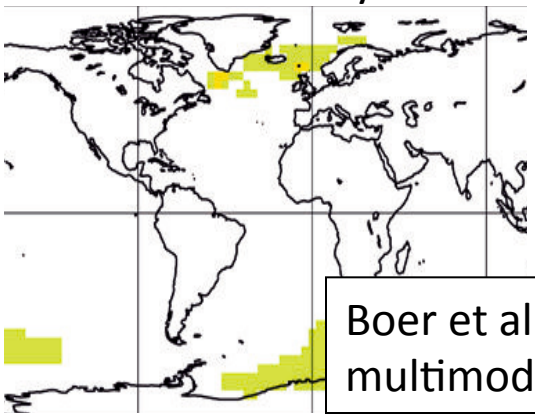
N=5 yrs



N=10 yrs

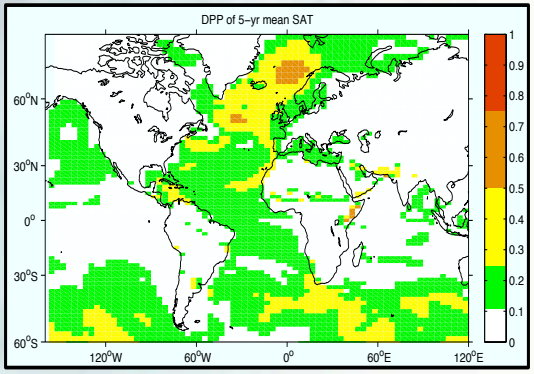


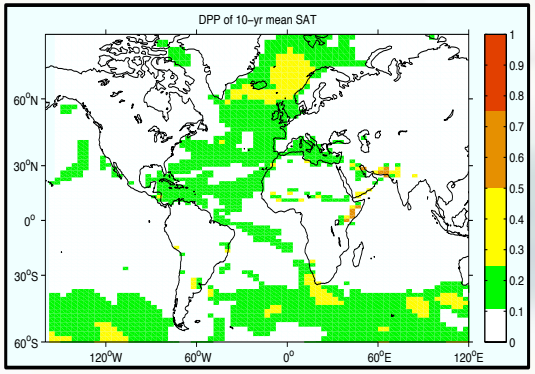
N=25 yrs

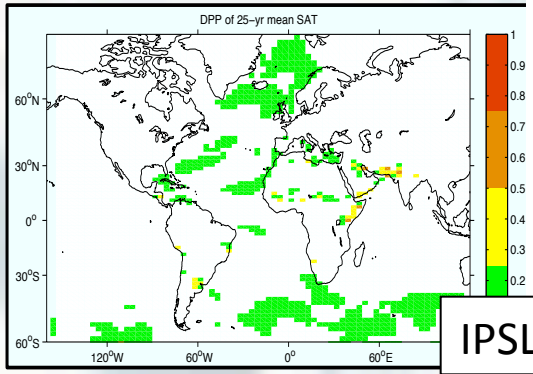


Boer et al. 2004 multimodel analysis

SAT



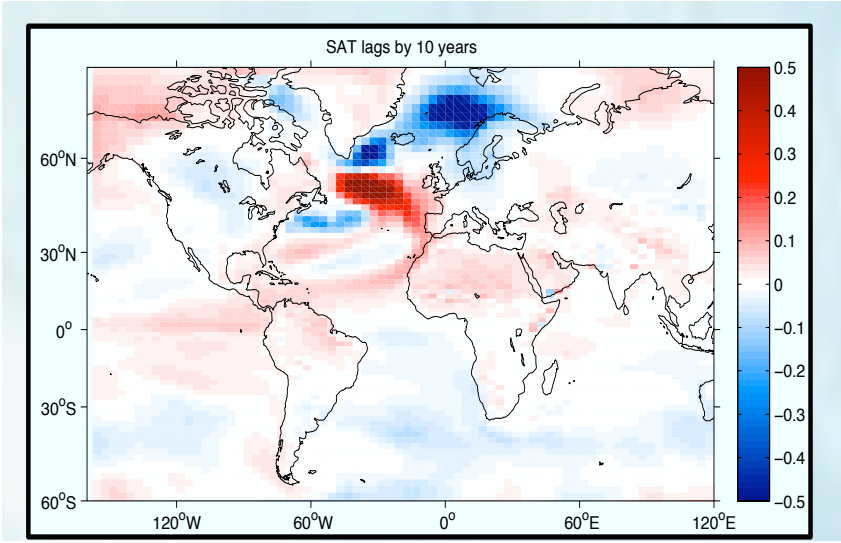


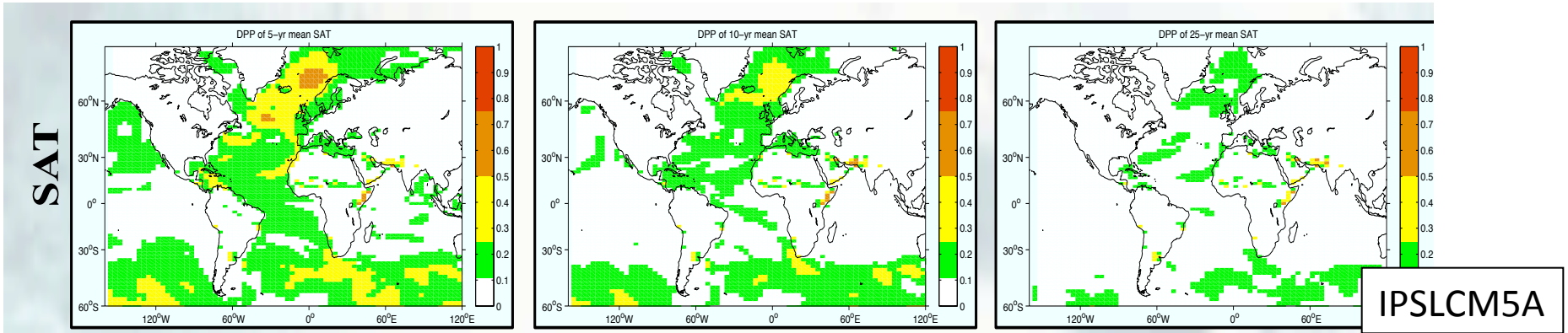


IPSLCM5A

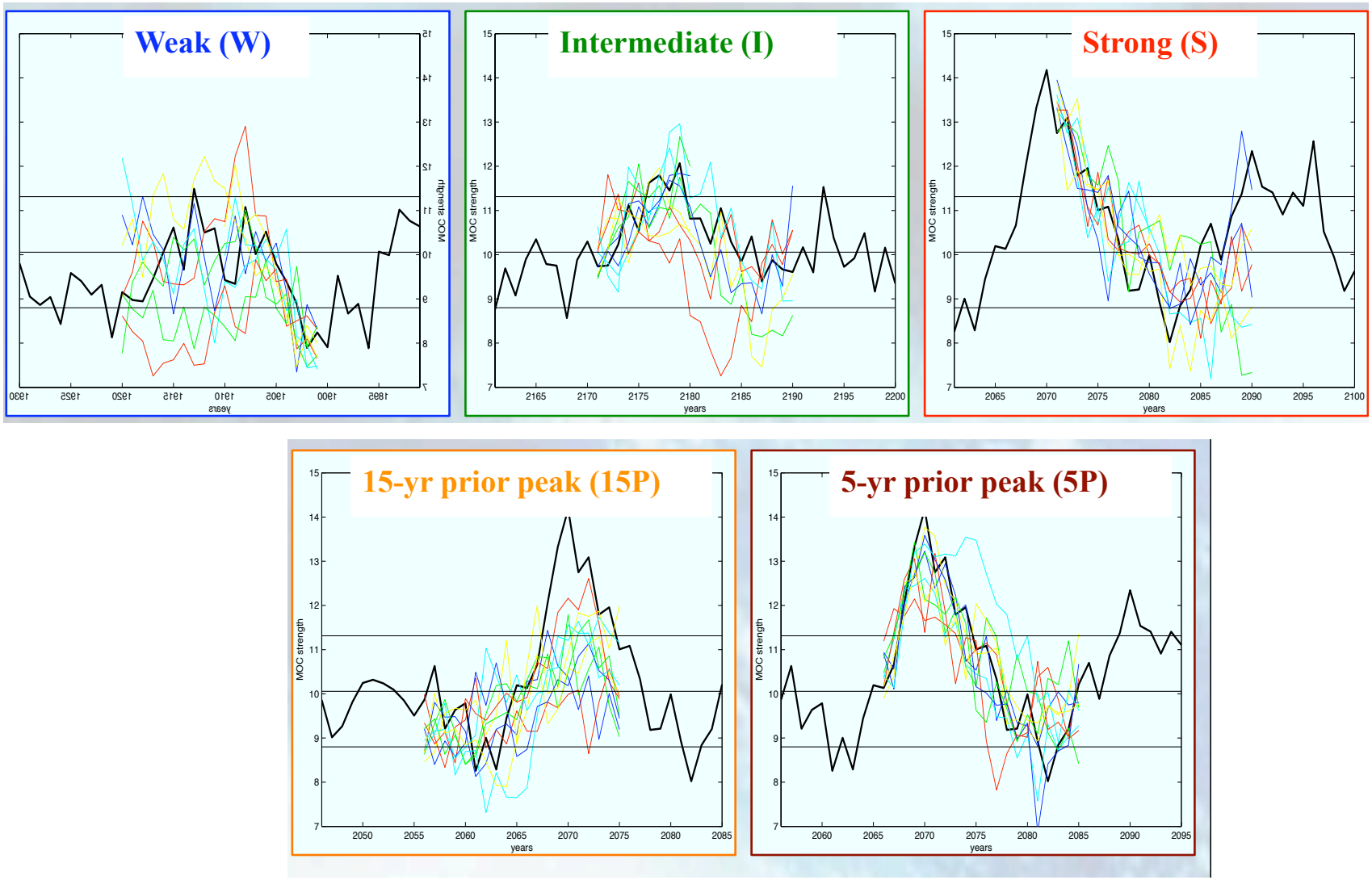
Link to AMOC fingerprints ?

SAT regression onto AMOC (lag 10 yrs)

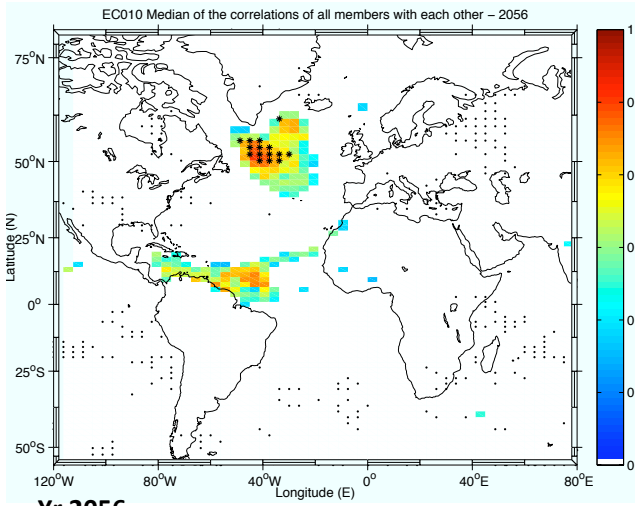




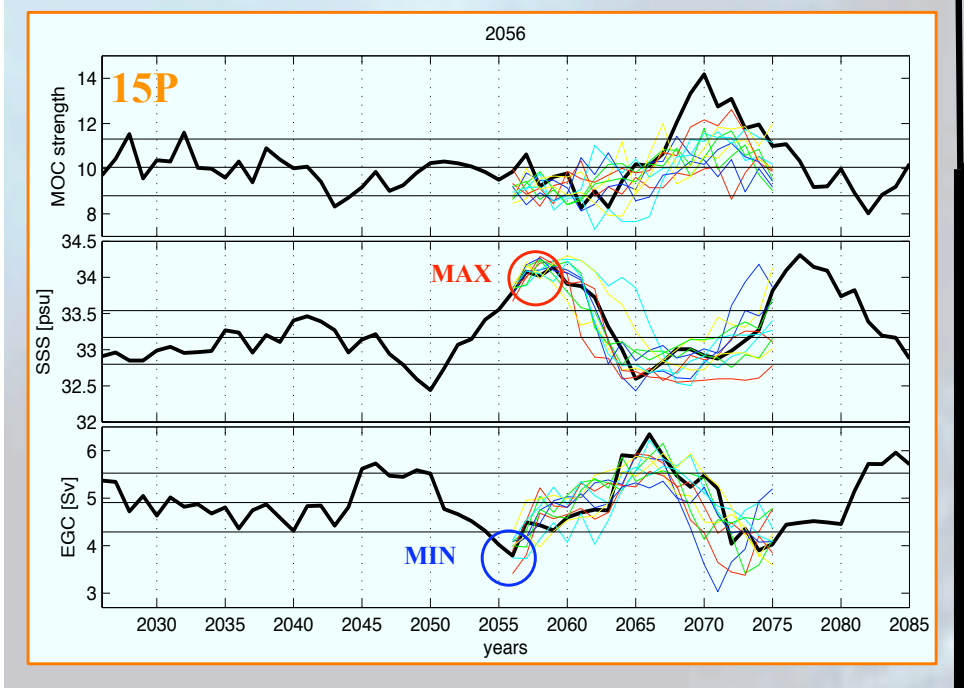
Prognostic potential predictability in IPSLCM5A



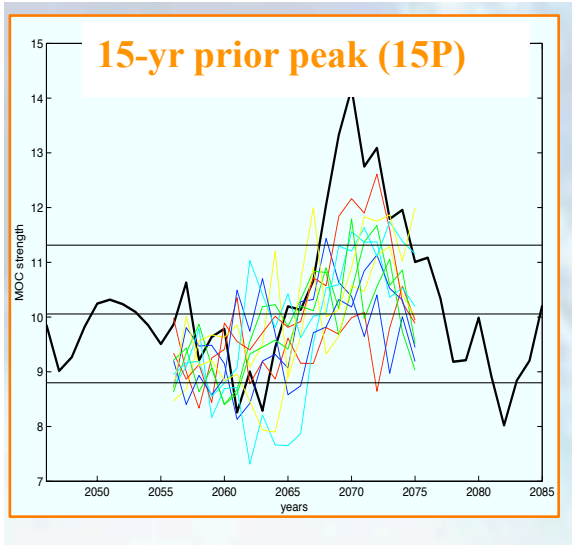
Mechanism for this predictability?
Link to precursors of the 20-yr cycle?



Yr 2056
[as Collins]



SAT predictability skill
(correlation and ensemble spread)
lead time 0- 10 yrs



Mechanism for this predictability?
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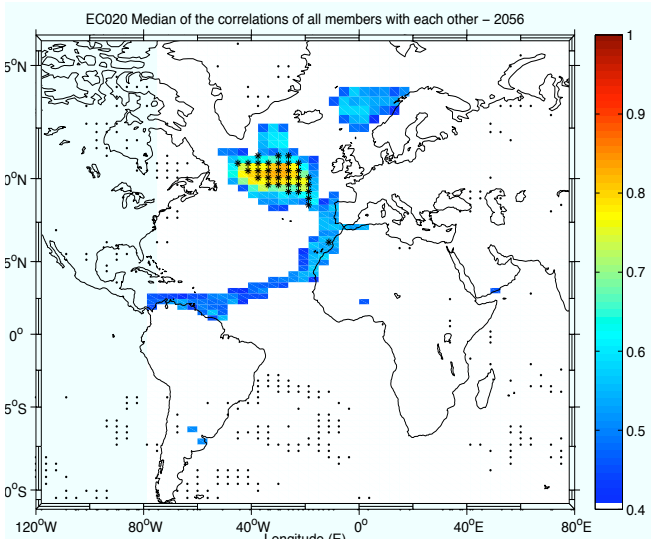
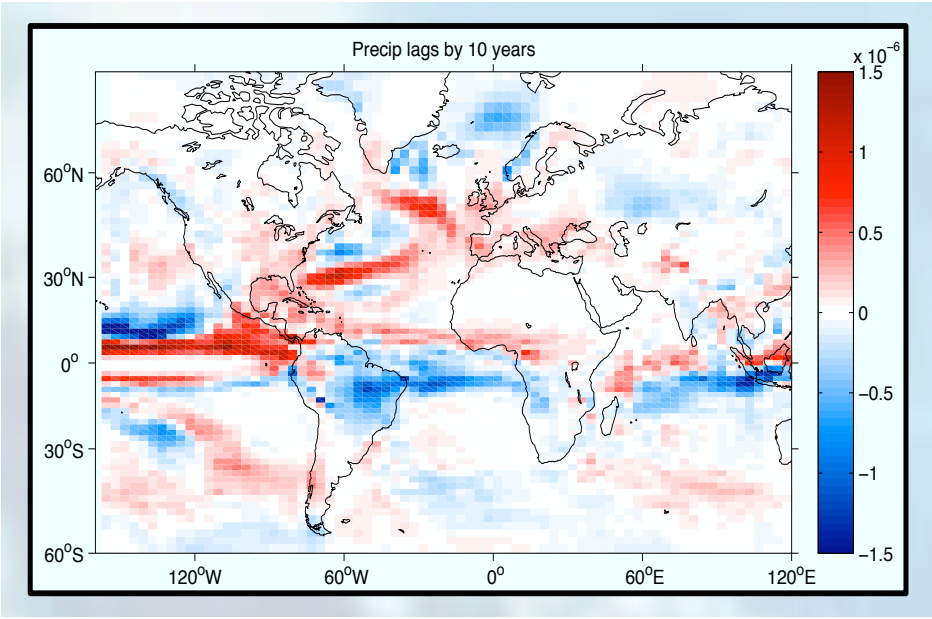
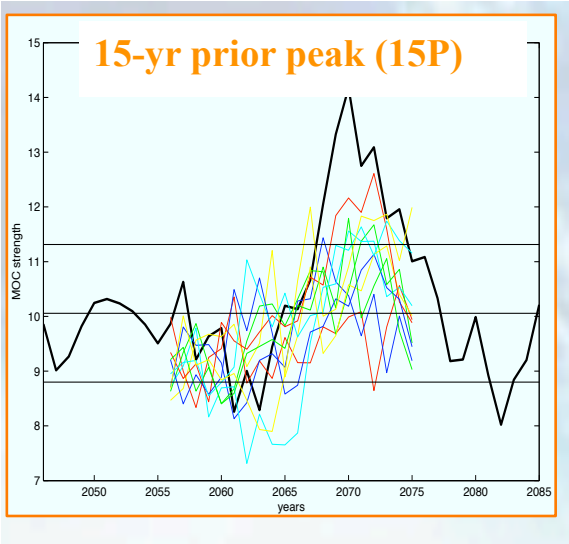




SSS predictability skill
(correlation and ensemble spread)
lead time 0- 10 yrs

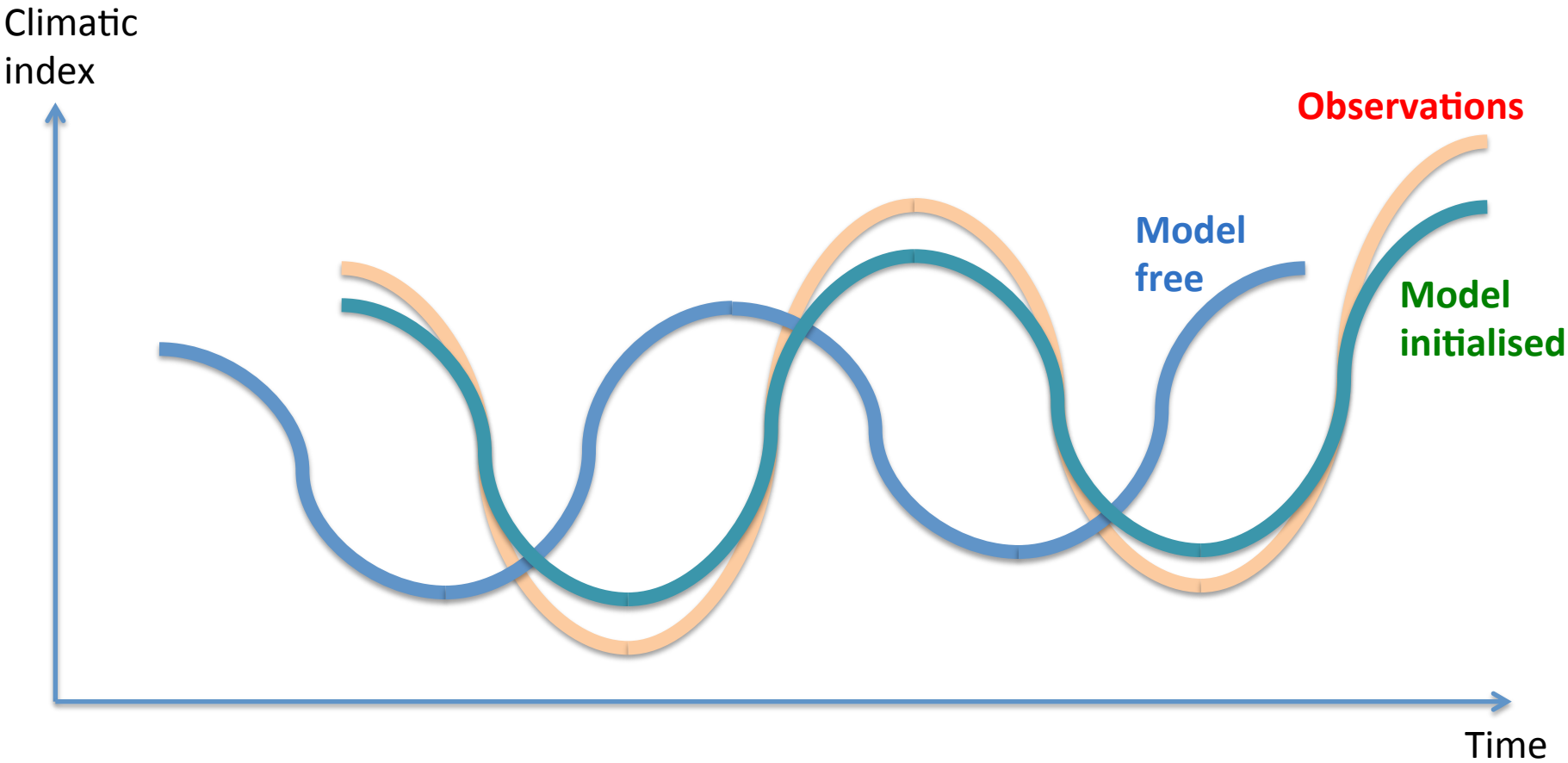
precipitation regression onto
AMOC (lag 10 yrs)



Initialisation and predictabilty of the AMOC in the IPSL-CM5 model over the last 60 years

Didier Swingedouw, Juliette Mignot, Sonia Labetoule, Eric Guilyardi

What do we expect from initialisation?

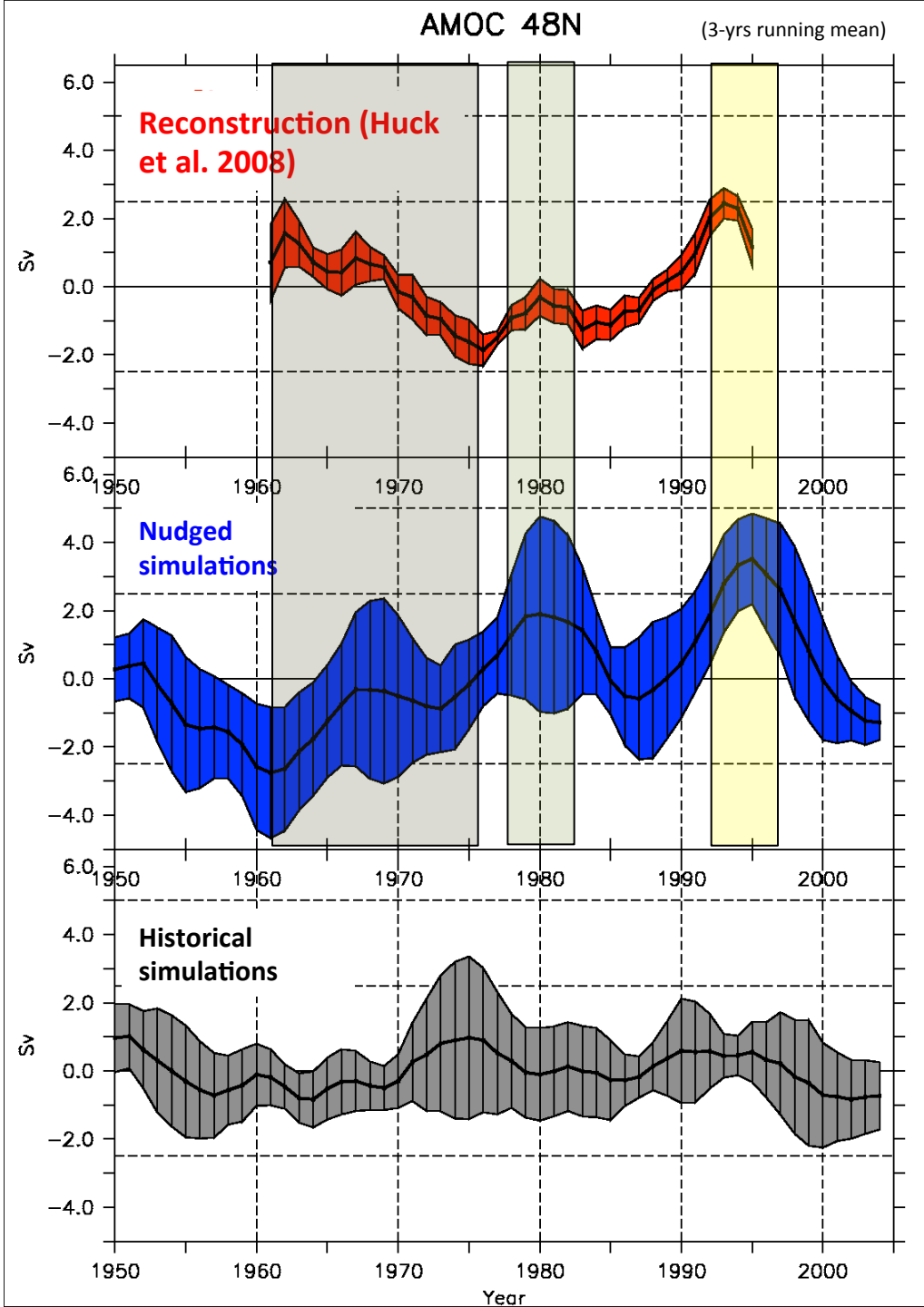


Assumptions:

1. **Climatic oscillations correctly represented in model (frequency, amplitude)?**
2. **There exist ways to phase the two signals using coupled models?**

AMOC Initialisation

- Reconstruction of the AMOC using NODC hydrographic data (Huck et al. 2008)
- 5-members ensemble of nudged simulations and control-historical ones
- 5-members historical simulations as control
- Agreement apart from 1980



Mechanisms

⇒ GIN seas SST

⇒ GIN seas ice cover

⇒ Wind stress

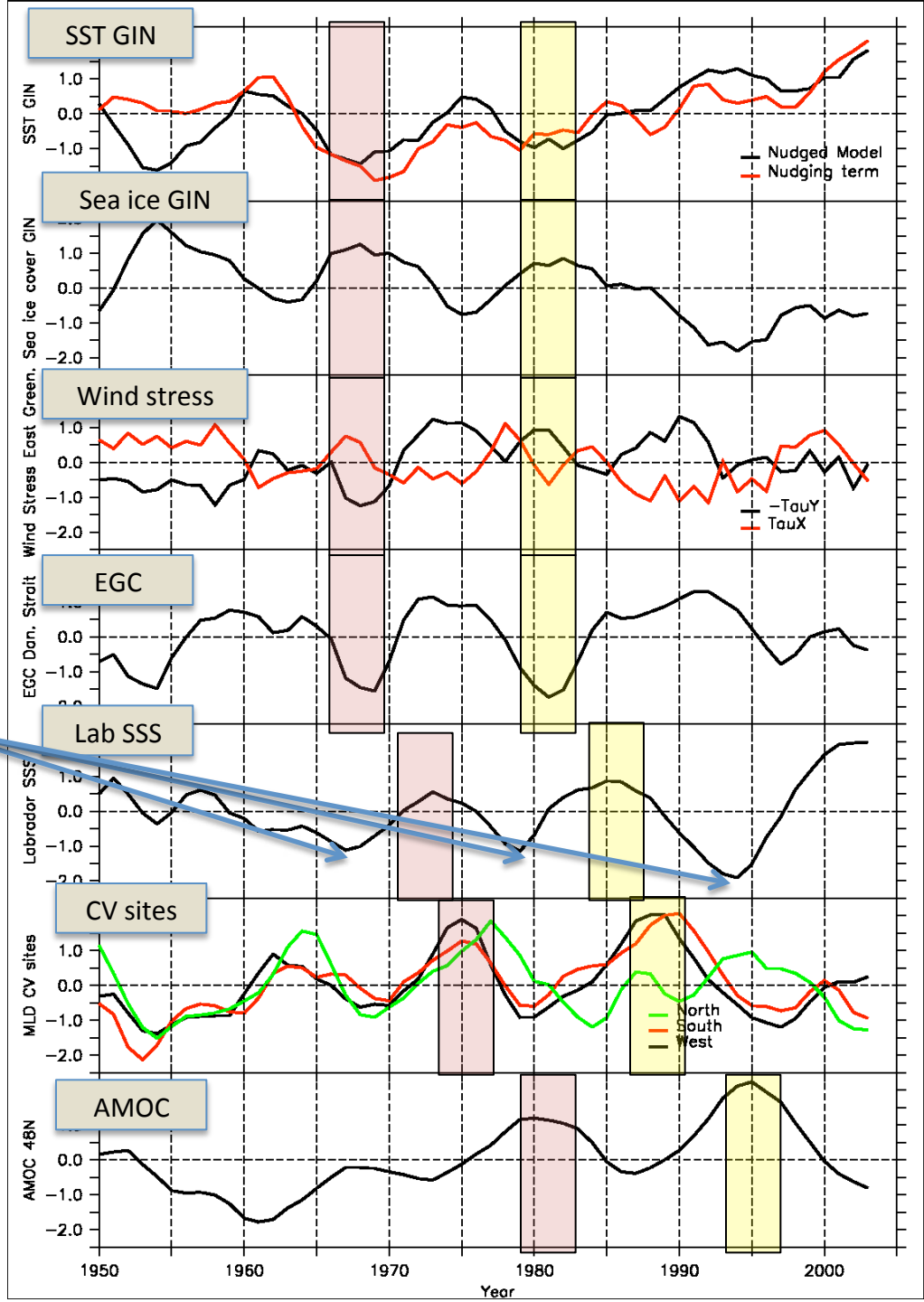
⇒ EGC

⇒ SSS Labrador Sea

⇒ CV sites

⇒ AMOC

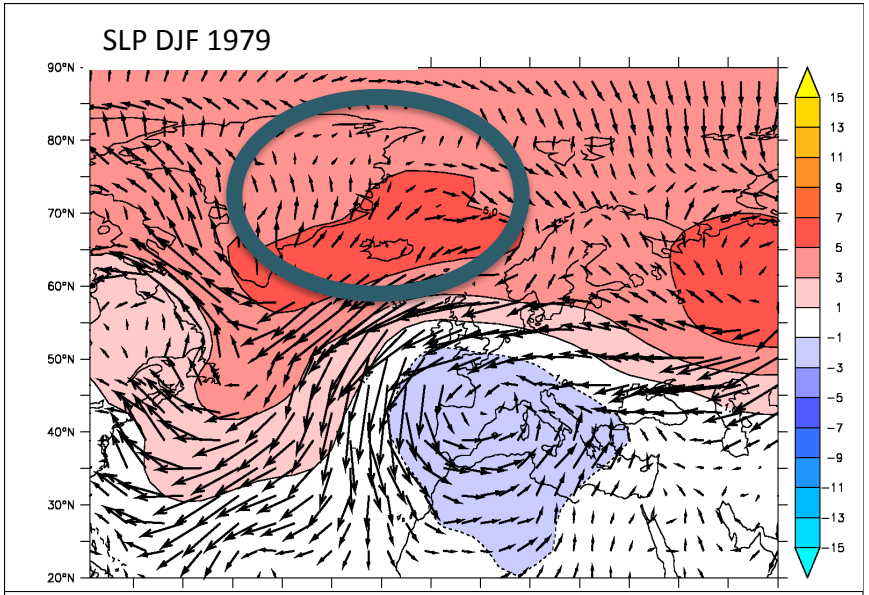
GSAs!
(1970, 82, 90 Sundby & Drinkwater 2007)

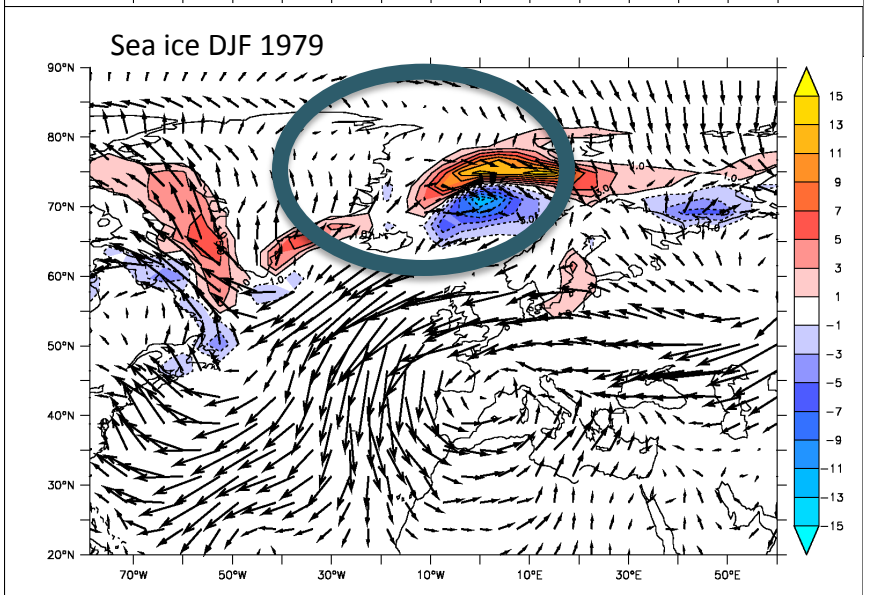


- Labrador Sea SSS = 7-10 years predictor of the AMOC
- EGC = more than 10 years predictor

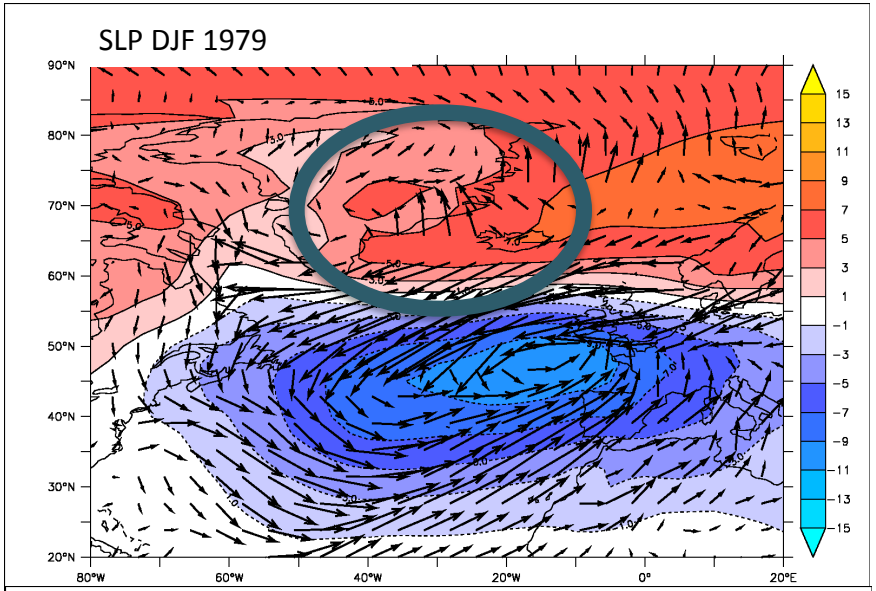
Air-sea ice interactions in 1979-80

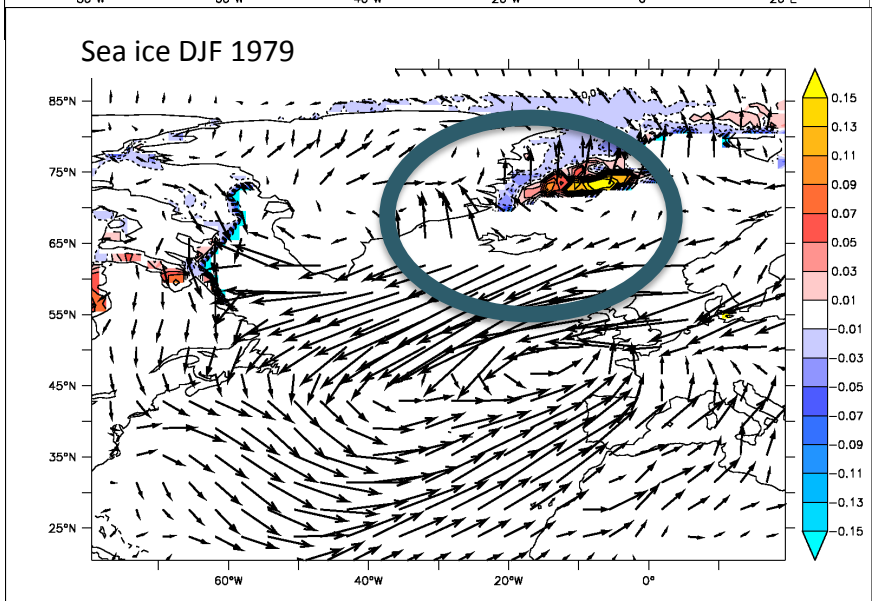
Nudged simulations





NCEP





Hindcasts

- Only one member of the nudged ensemble (planned to apply to each)
- 3-members ensemble of free run
- Good predictive skill for the AMOC in perfect model analysis (Persechino et al., in prep.)
- 90's max. missed