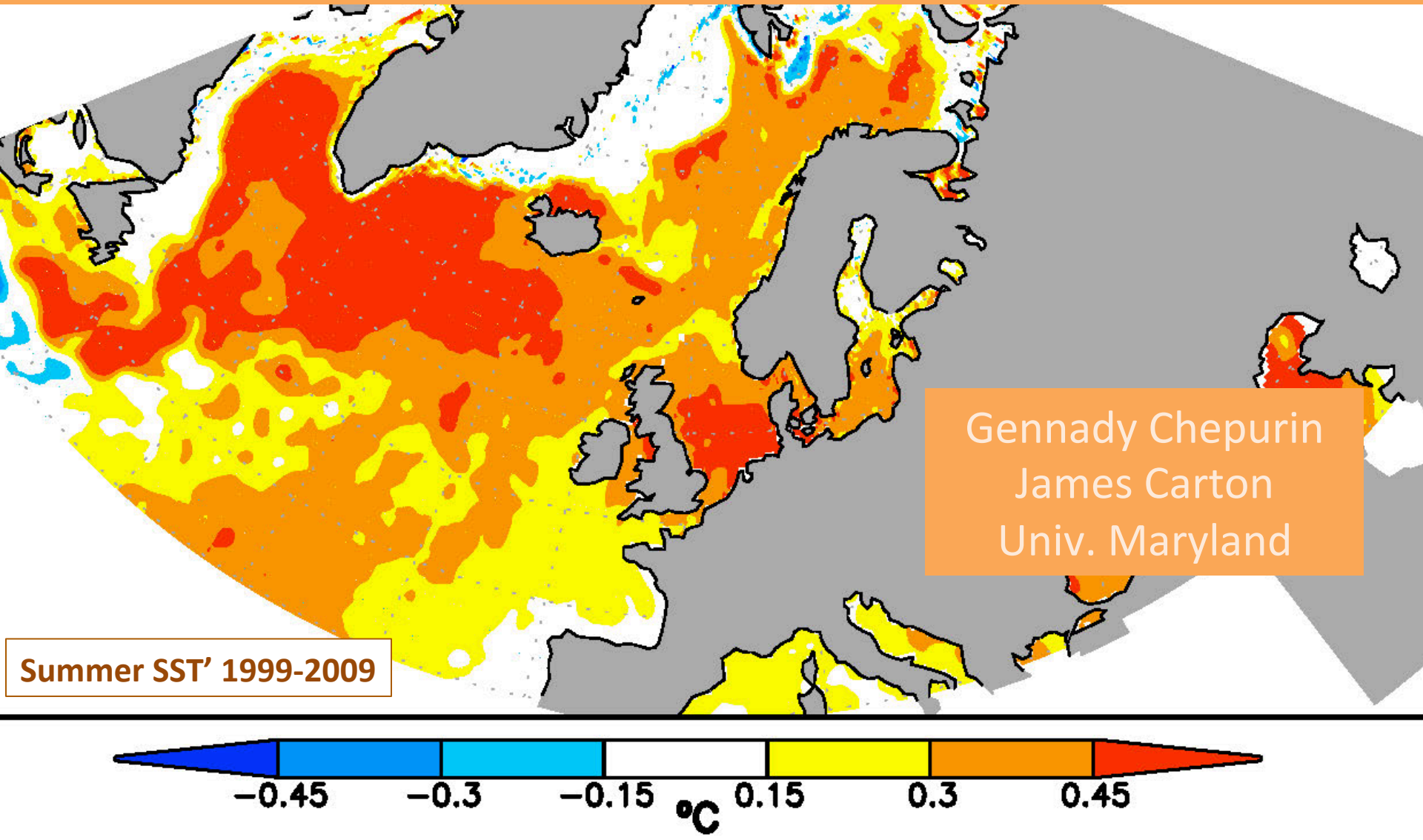
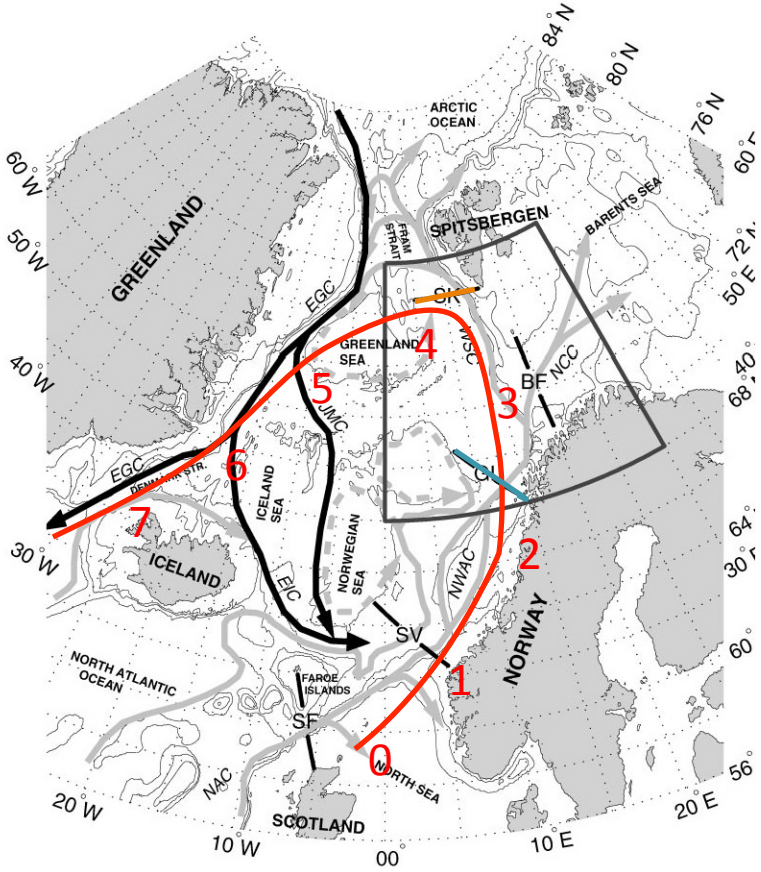
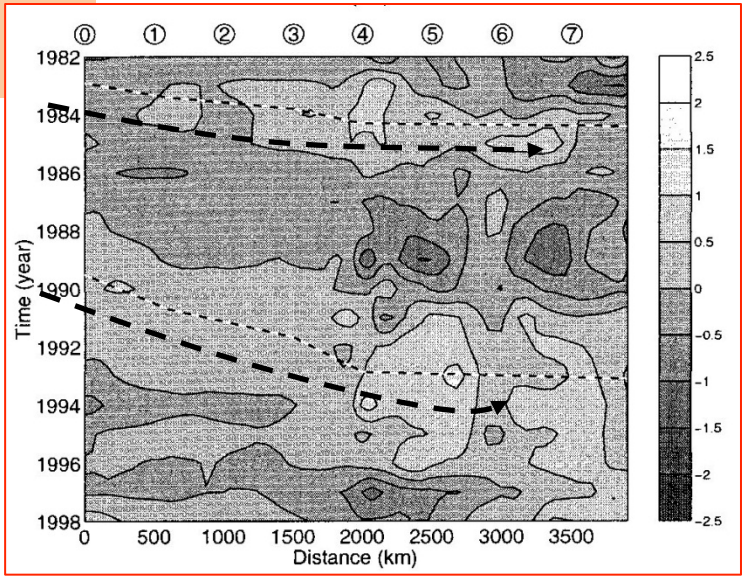
# Does the mid--latitude ocean drive polar variability?



# SST' & HC' in the Nordic Seas from *T. Furevik (2000, 2001)*




SST' along red path

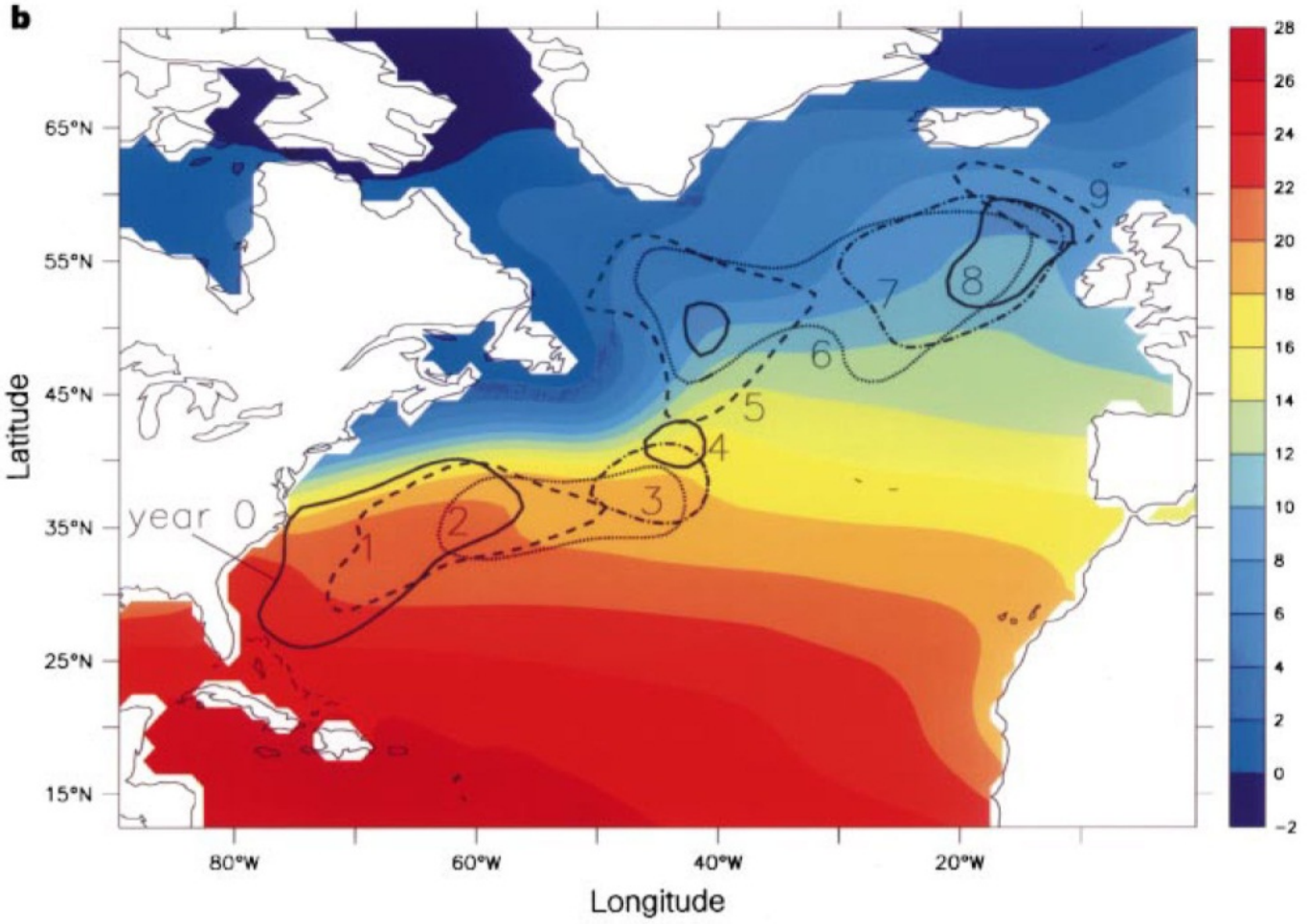



Time ->

# →

{Also: *Venegas and Mysak (2000), Dmentrinko et al (2009)* and some others }

# *Sutton and Allen's* lag correlation of winter SST' against Cape Hatteras SST' (yrs)




Speed: 2 cm/s

CI = 0.8

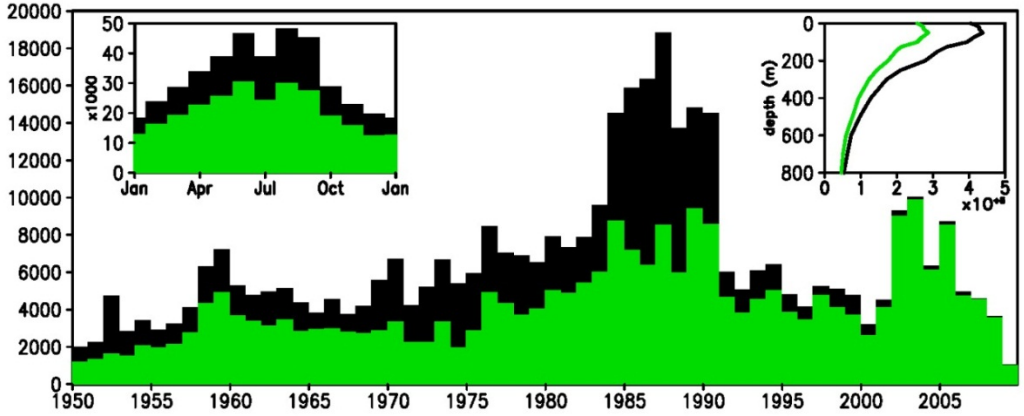
SST' ~ 0.2-0.5C

Sutton and Allen (1997)

{Also: Hansen and Bezdek (1996) and Krahmann et al. (2001) }

# We reexamine two data sets

# Profile Obs (50W-80E, 60-90N) at 100m




**Temperature**

**Salinity**

Sources: WOD09, ICES, …

Blue: difference in reg

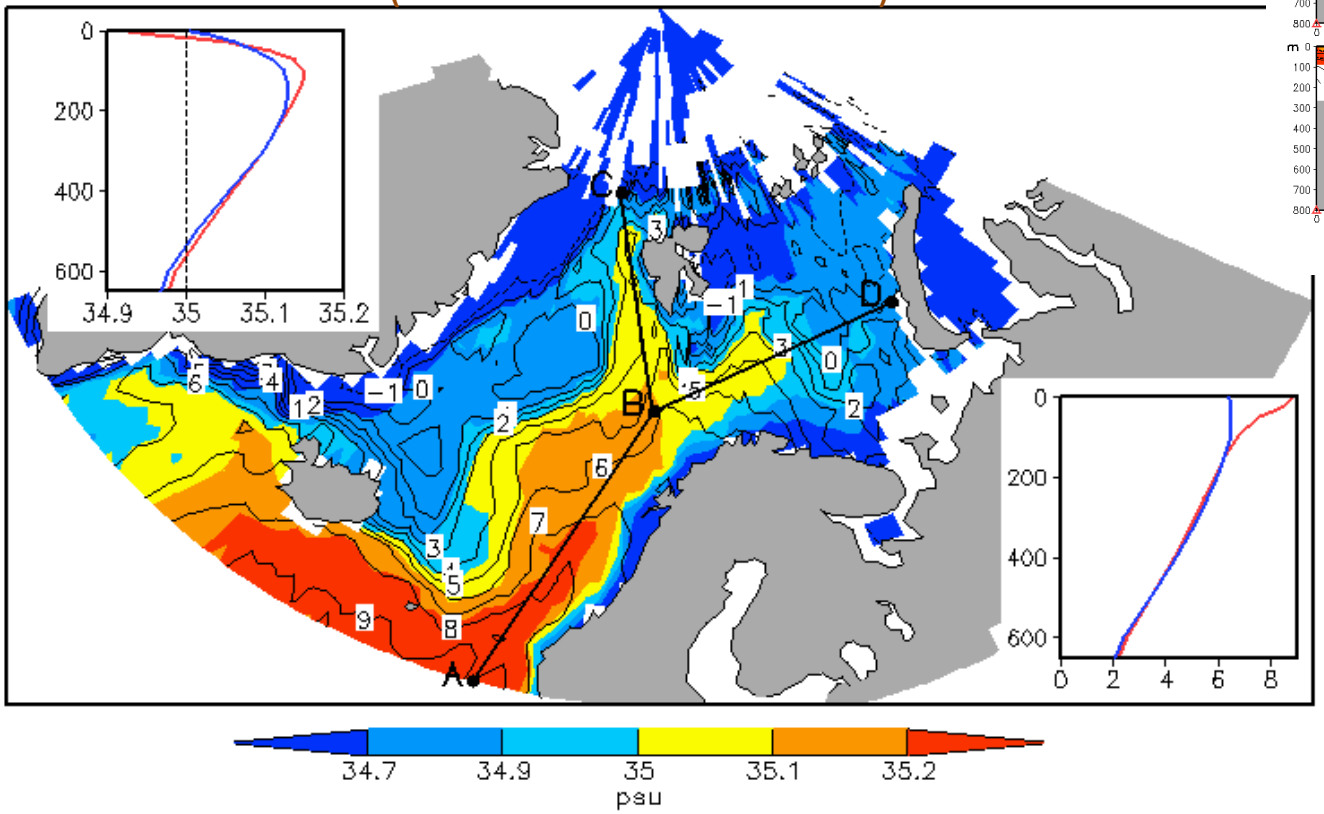
Red: difference in reg

# Nordic Seas Hydrography

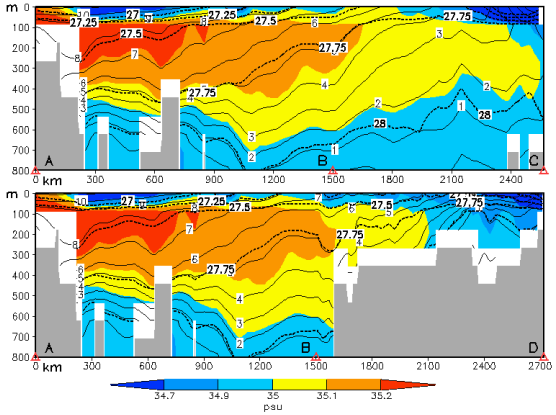
Salinity (color) and Temp (contours) at 100m depth

## Mean hydrography at 100m

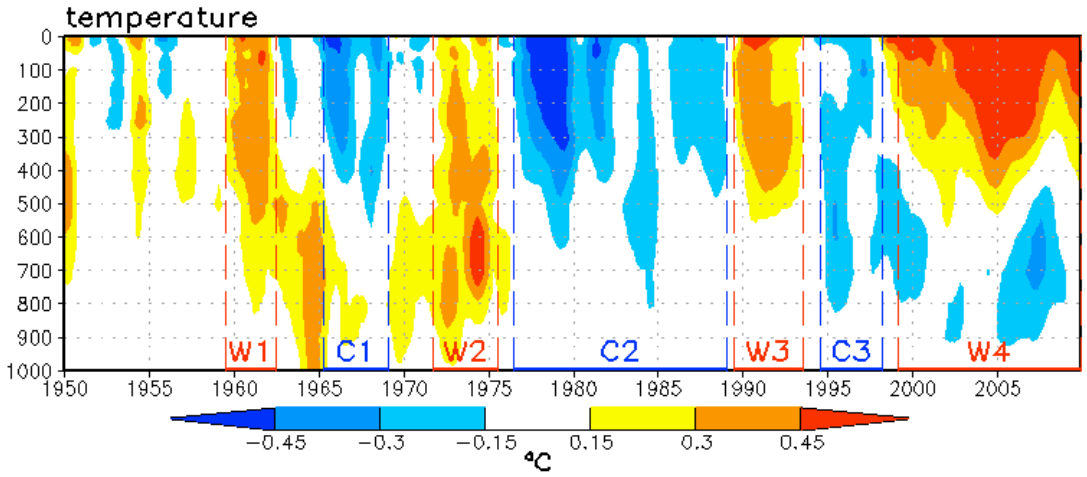
(summer-winter in insets)

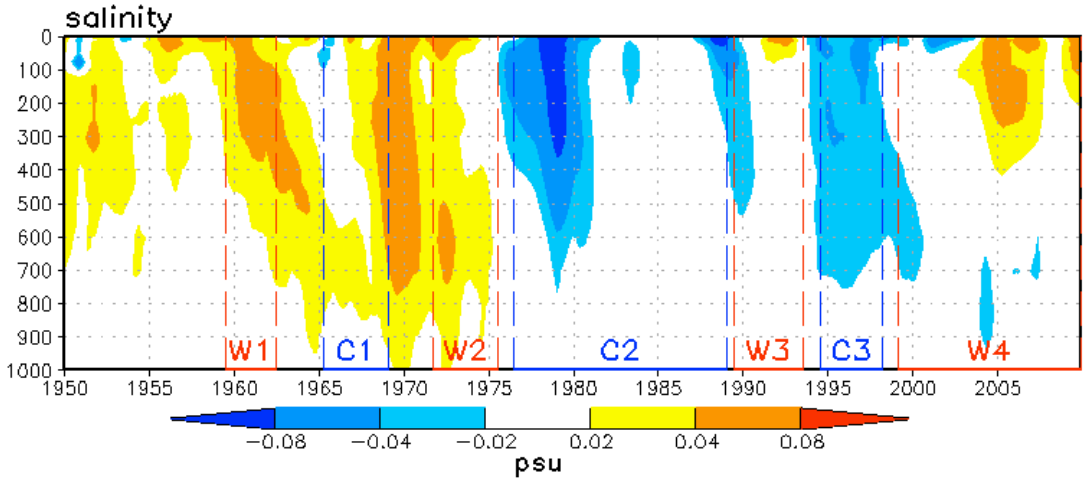


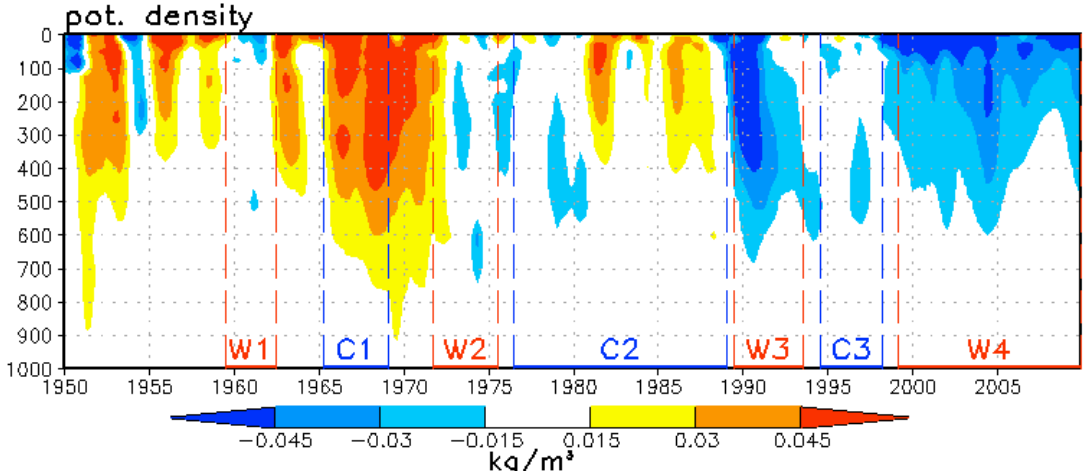

## Vertical sections ABC, ABD



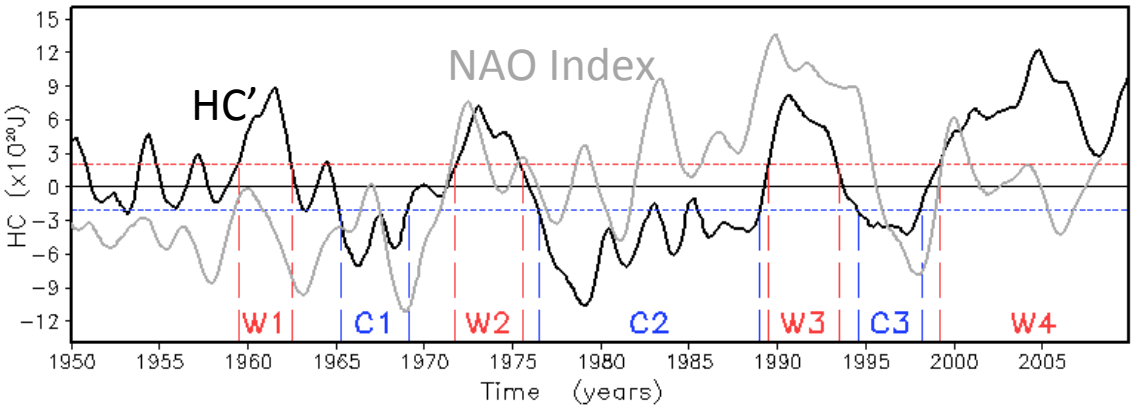
# T & S variability in the Atlantic Water zone of the Nordic Seas



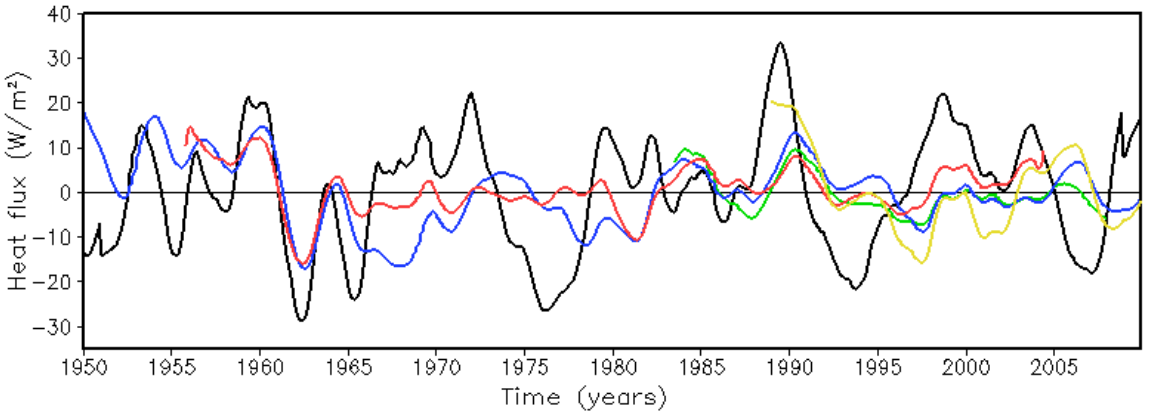



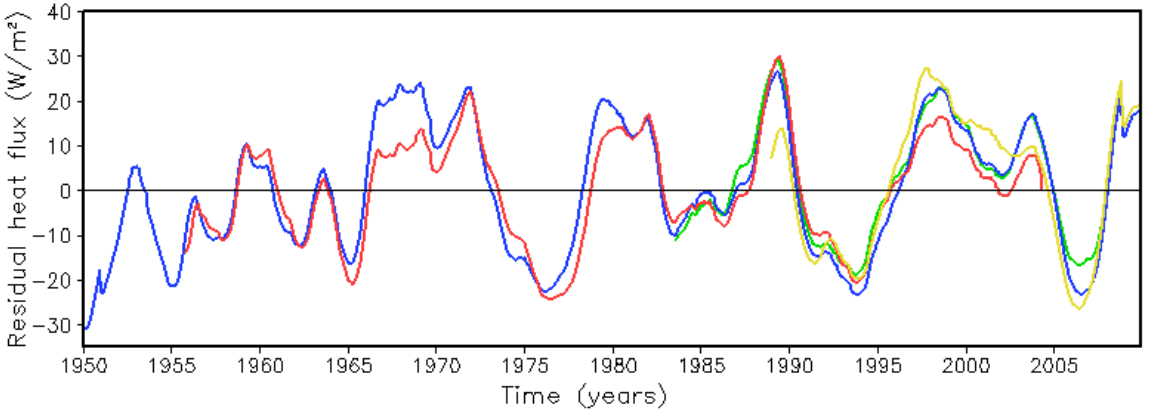
# Heat budget of the Nordic Seas



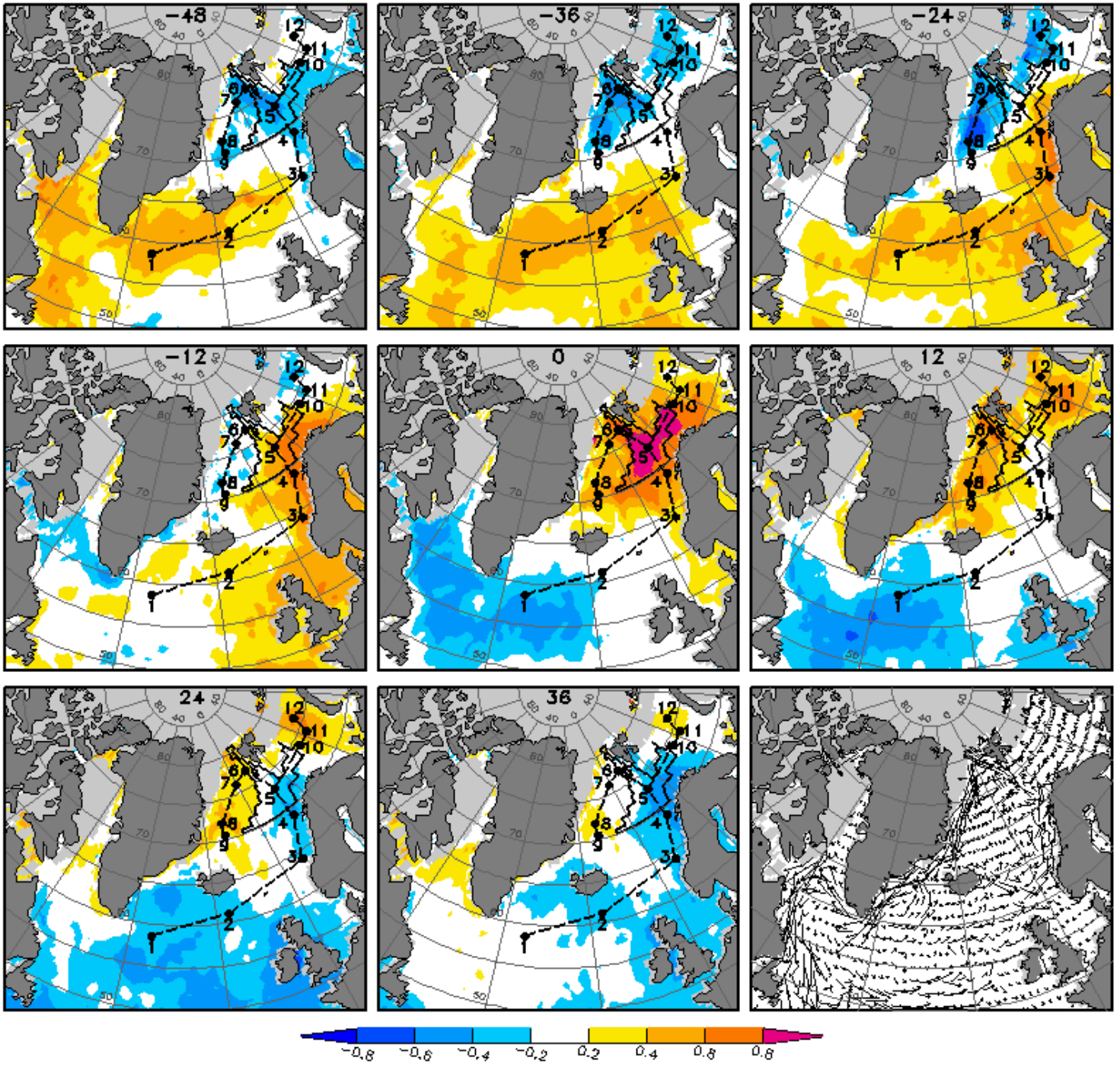

d HC/dt
NCAR/NCEP HFLX'
ERA-40 HFLX'
ERA-Int HFLX'
WHOI OAFLUX



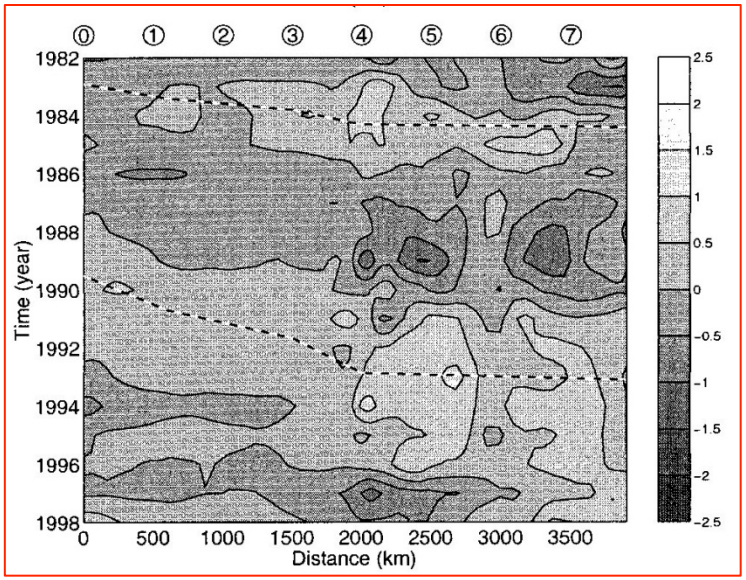

Implied advection of heat

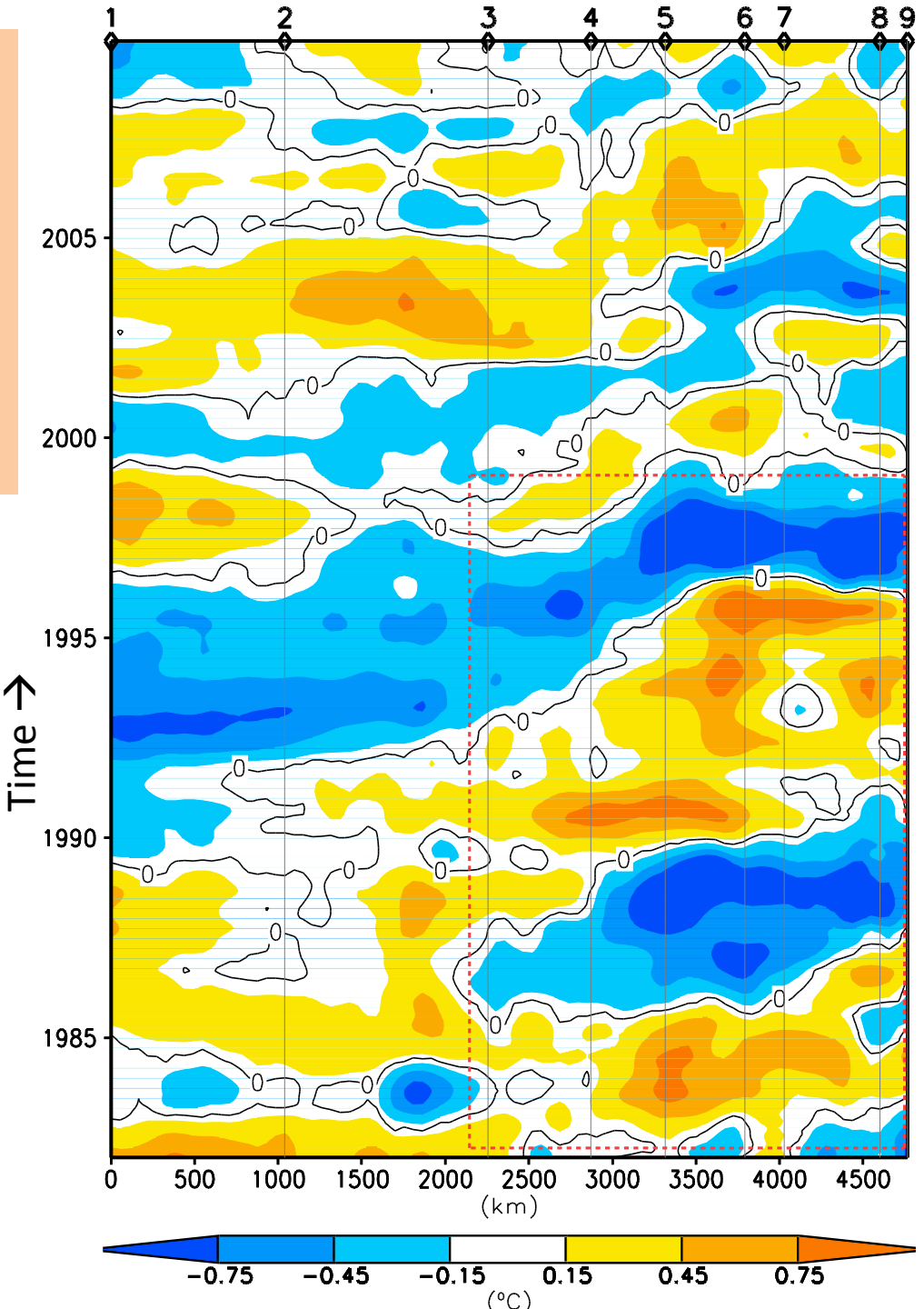


# SST' lag cor
(-48mo to +36mo)

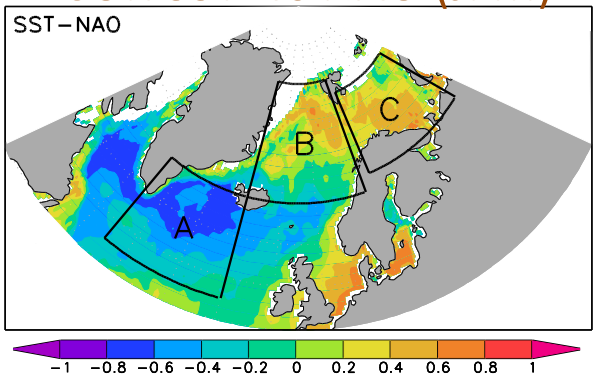


# An expanded view of Furevik's propagating SST' figure



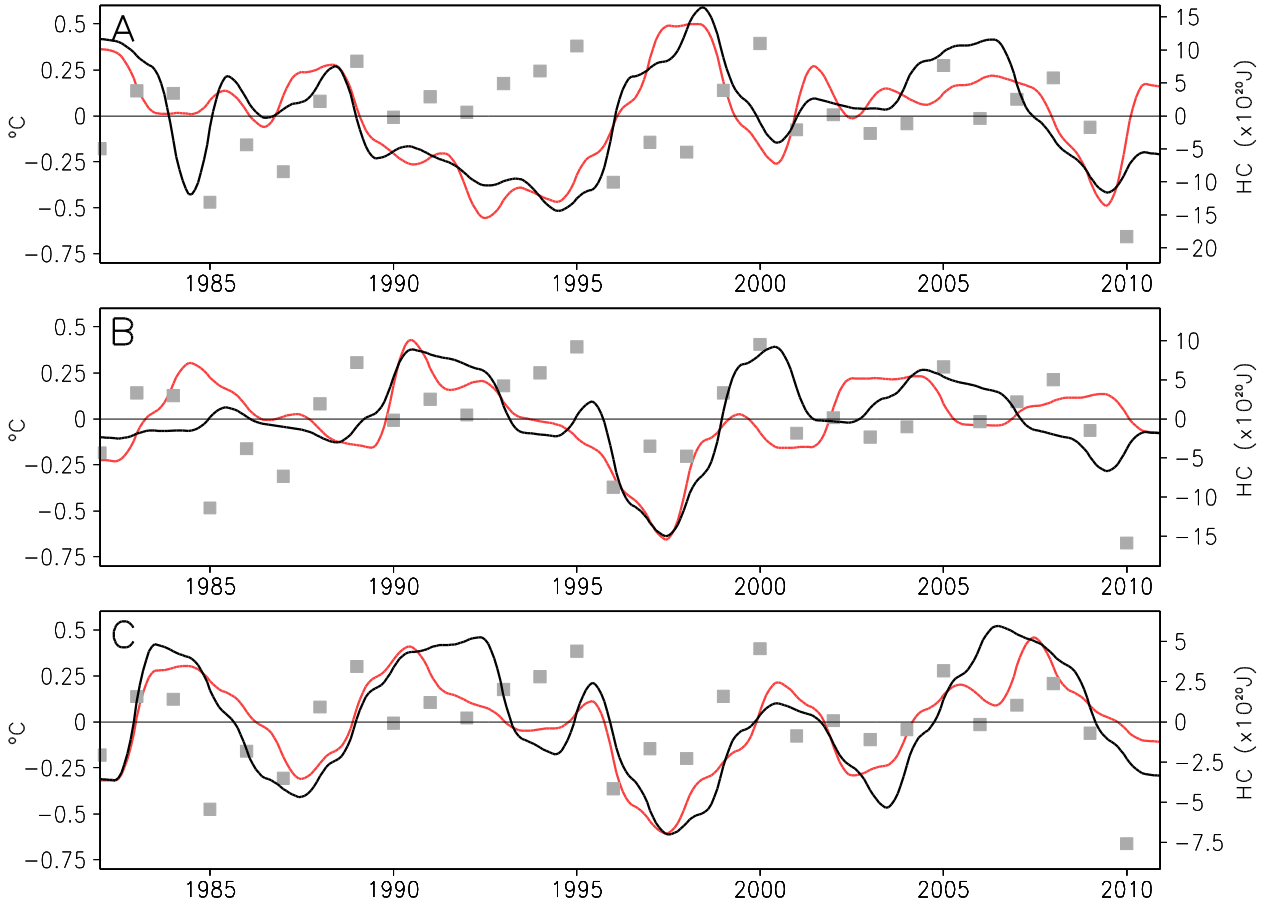



COR SST vs NAO (JFM)




# SST', HC', and NAO

(after detrending)




**SST'**

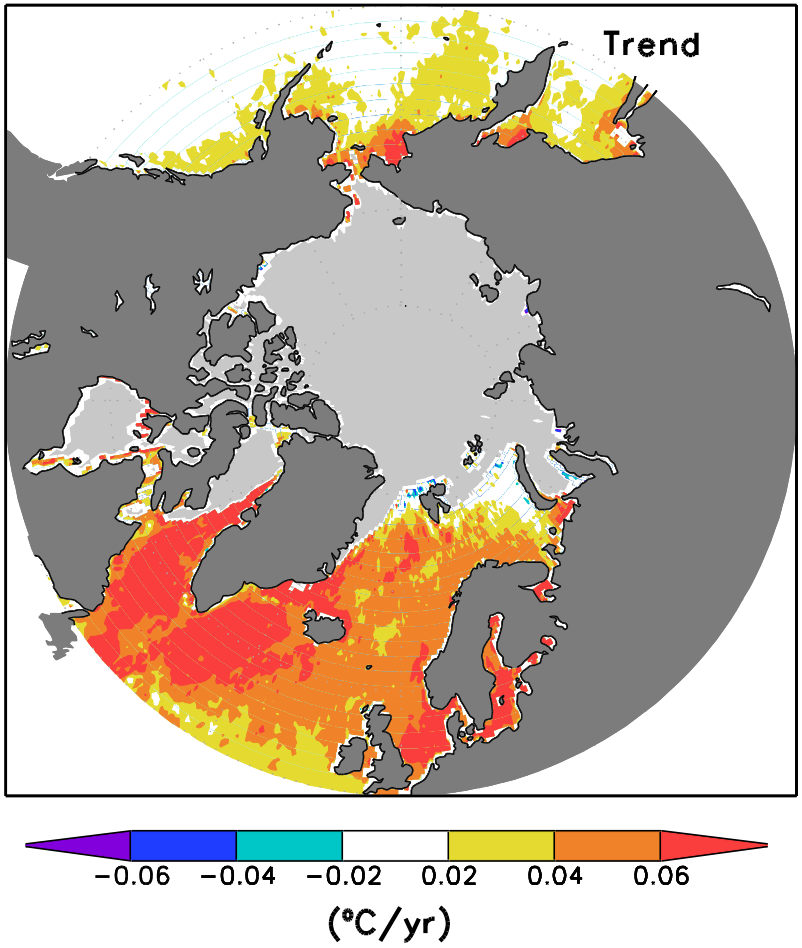
**HC (0/300m)**

**NAO**

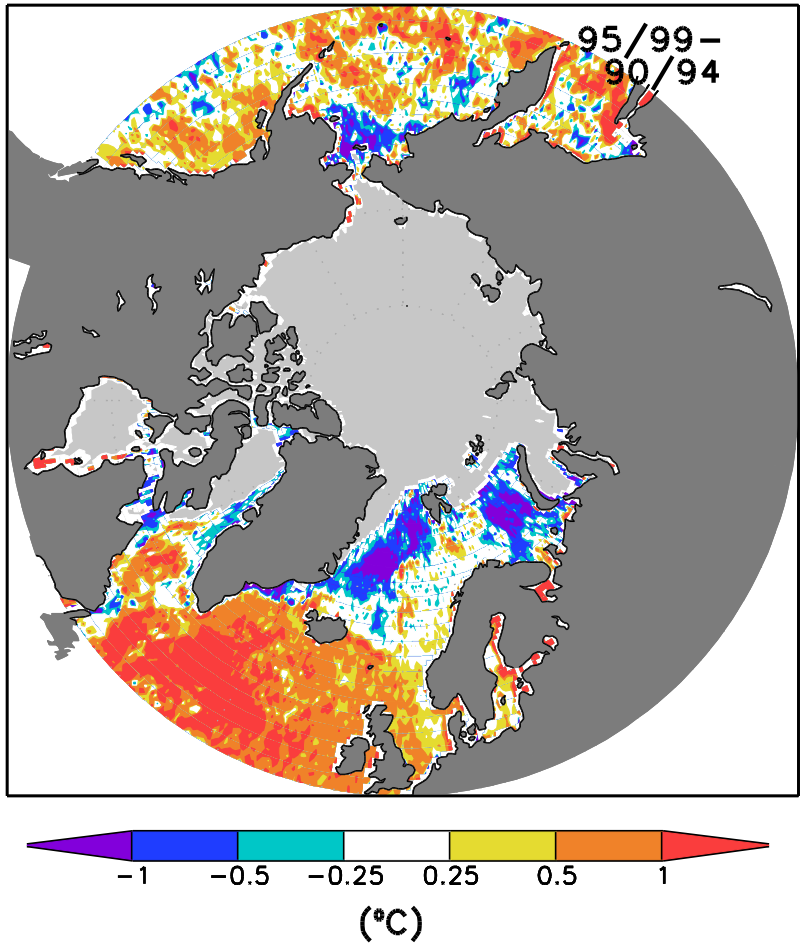
Time series in three regions

# Trend in SST

Trend (1982-2010) of annual SST



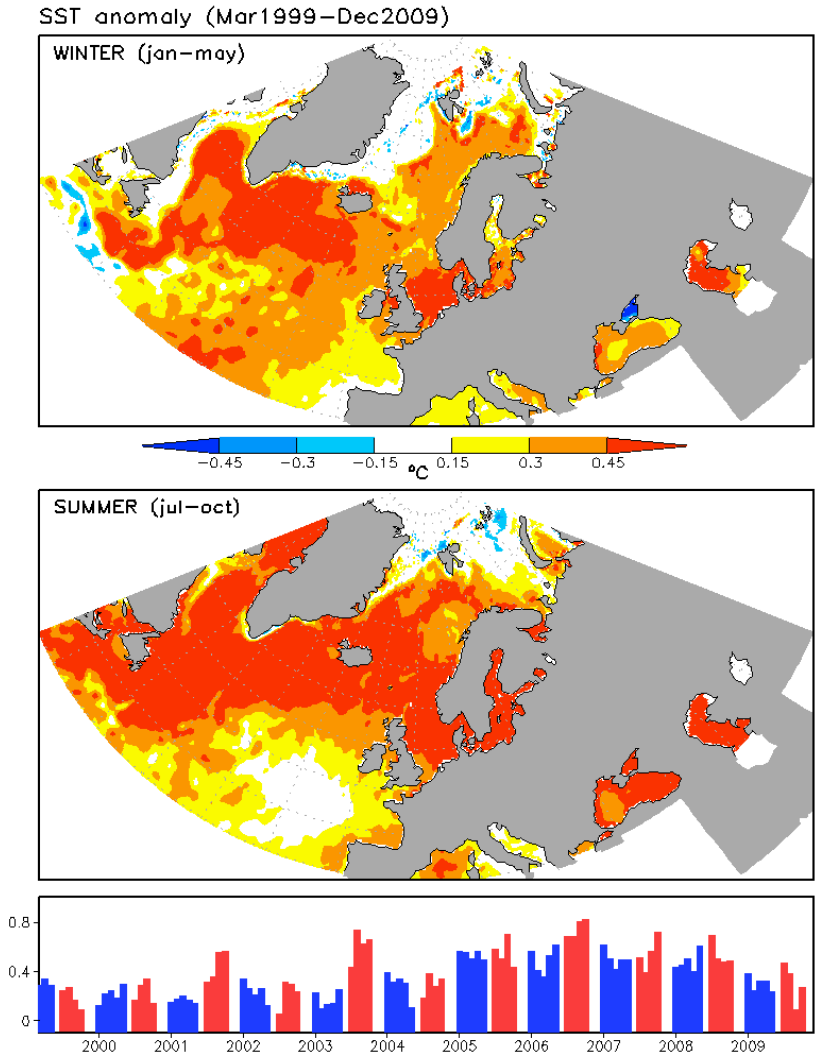

SST 1995-1999 minus 1990-1994

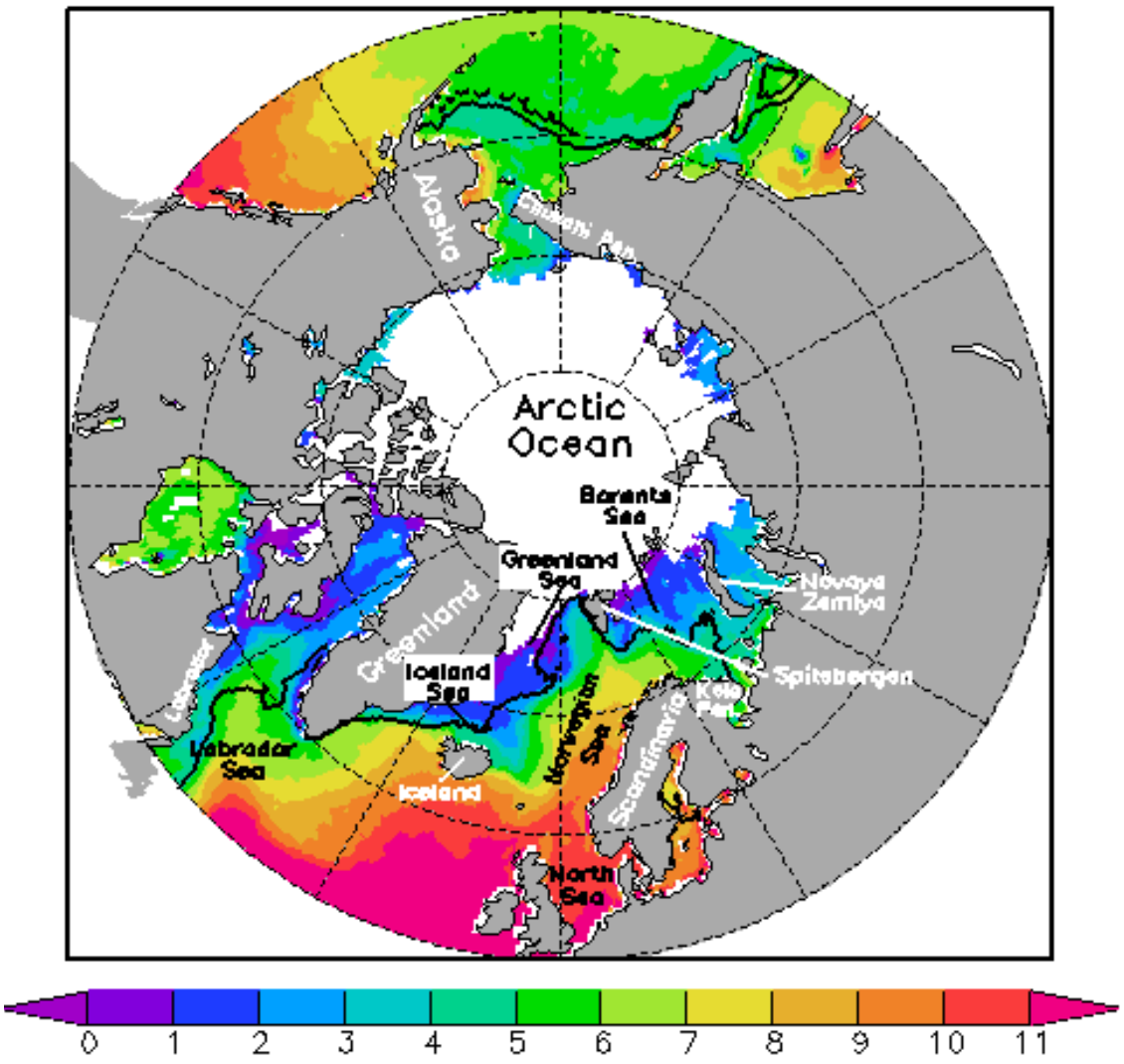


# Discussion

- **Nordic Seas/Arctic variability**
  - Nordic Seas show 0.2C, 0.04psu decadal anomalies.
  - For many, but not all, anomalies T and S are positively correlated
  - Complicated relation to NAO
  - Correlated with SST anomalies (surprising!)
- **Evidence for polar forcing from the south**
  - Link to the subtropical SST anomalies of *Sutton and Allen*
  - Heat budget calculations seem to require an advective source of heat
- **Open questions**
  - What is the impact on the overlying atmosphere
  - What is the impact on sea ice? (what is the interaction with the nearsurface fresh layer?)

Sources: Carton et al. (JGR, 2011), Chepurin and Carton (JGR, 2012)


SST anomaly (Mar1999–Dec2009)
WINTER (jan–may)
−0.45
−0.3
−0.15
°C
0.15
0.3
0.45
SUMMER (jul–oct)
0.8
0.4
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009


Alaska
Chukchi Sea
Arctic Ocean
Barents Sea
Greenland Sea
Novaya Zemlya
Greenland
Iceland Sea
Spitsbergen
Labrador
Norwegian Sea
Kola
Peninsula
Labrador Sea
Iceland
Scandinavia
North Sea
0
1
2
3
4
5
6
7
8
9
10
11