

# Comparison of Northern Hemisphere ecosystems: Physical oceanographic responses to recent climate variability

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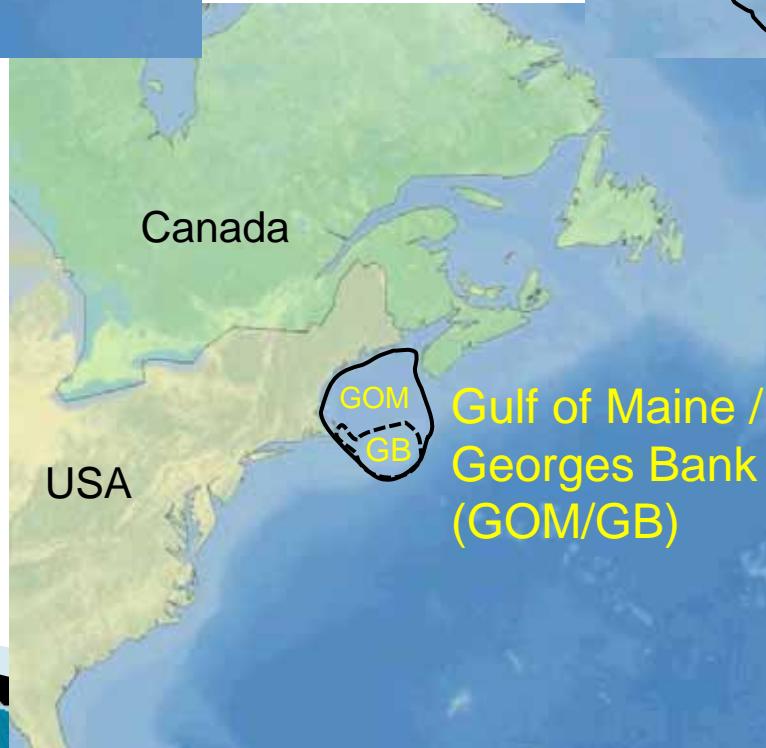
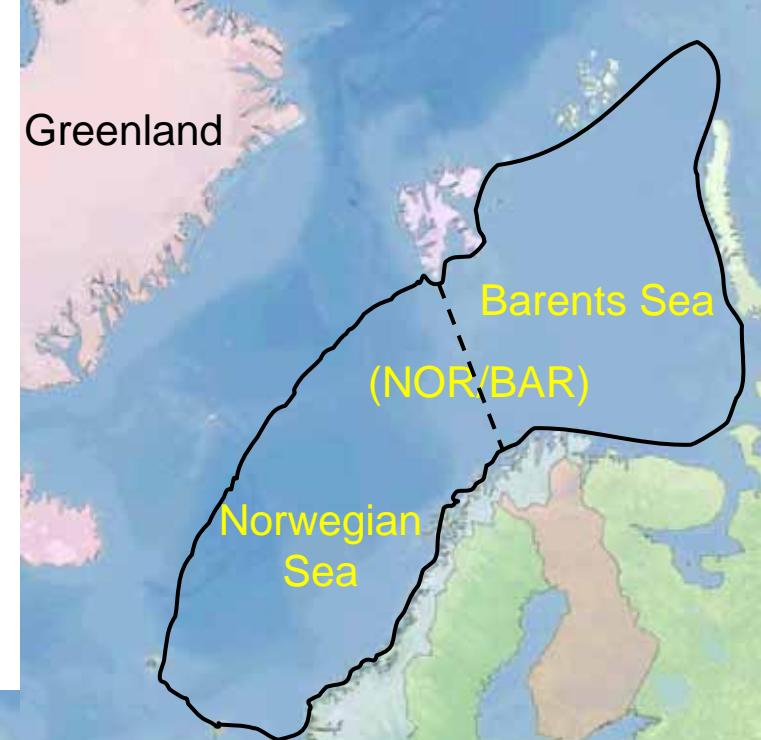


MENU

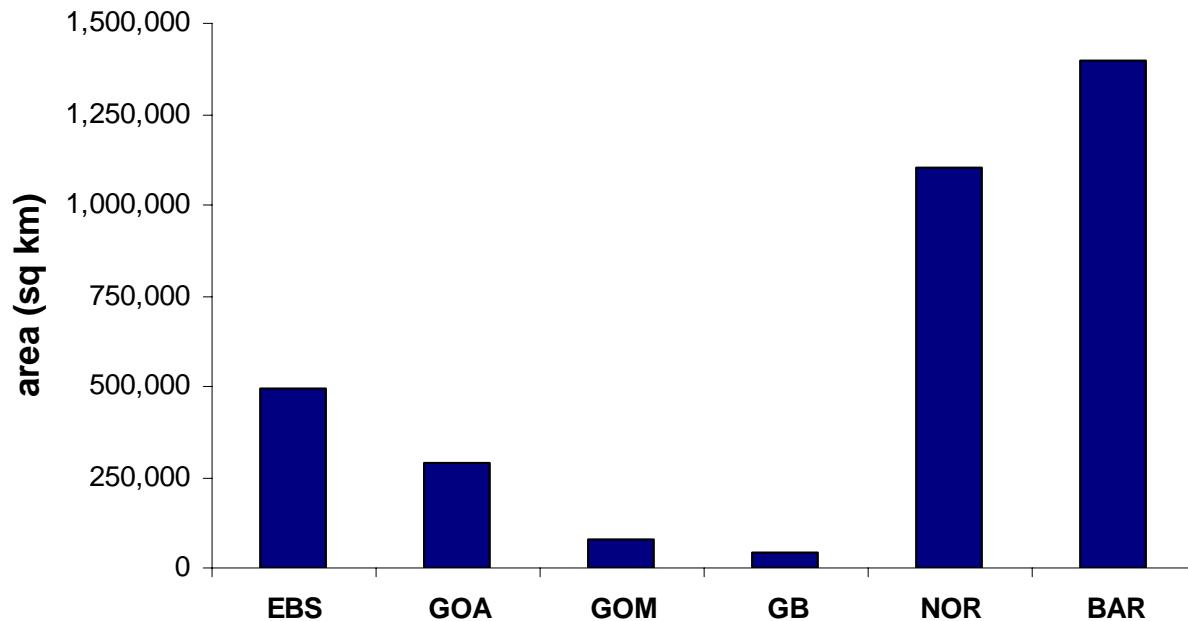
PICES XVI Annual Meeting,  
Victoria, B.C. Canada  
29 October-2 November 2007

# Objectives

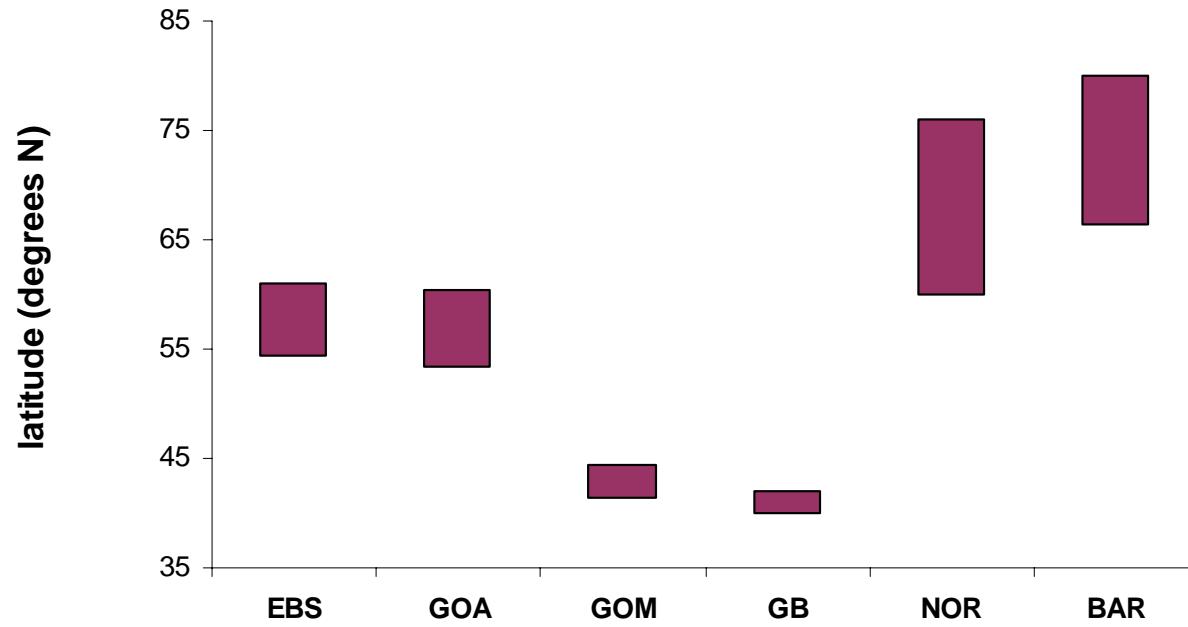
- ▶ MENU (Marine Ecosystem Comparisons of Norway and the US) is undertaking comparisons of 4 regions: Bering Sea, Gulf of Alaska, Georges Bank/Gulf of Maine, and Barents/Norwegian Seas
  - Environment (this presentation)
  - FIS Paper Session Friday
    - Biota (Mueter et al.)
    - Fisheries (Gaichas et al., Megrey et al. - Poster)
- ▶ This talk largely examines similarities and differences in temperature and salinity responses in the various regions to recent climate variability in order to compare physical forcing on the 4 regions.
  - ▶ Work in progress



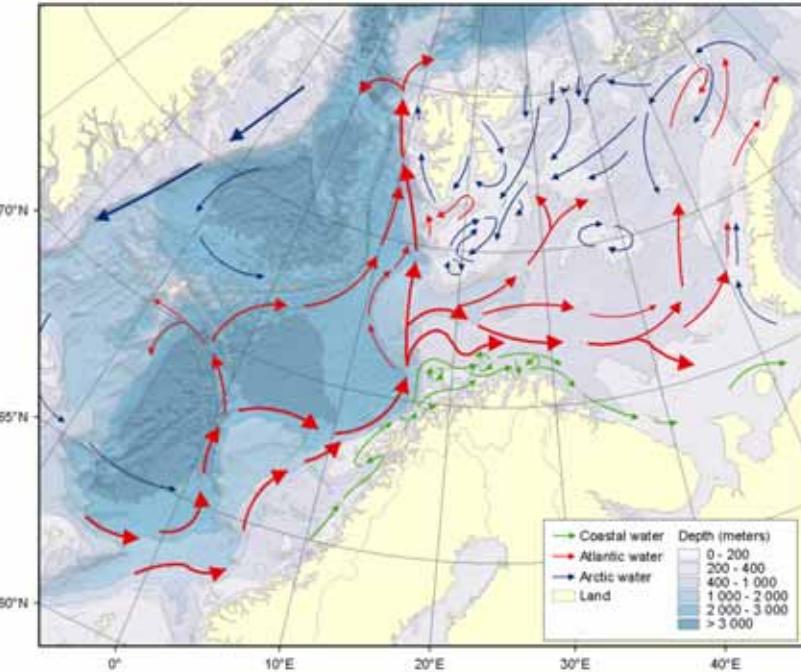
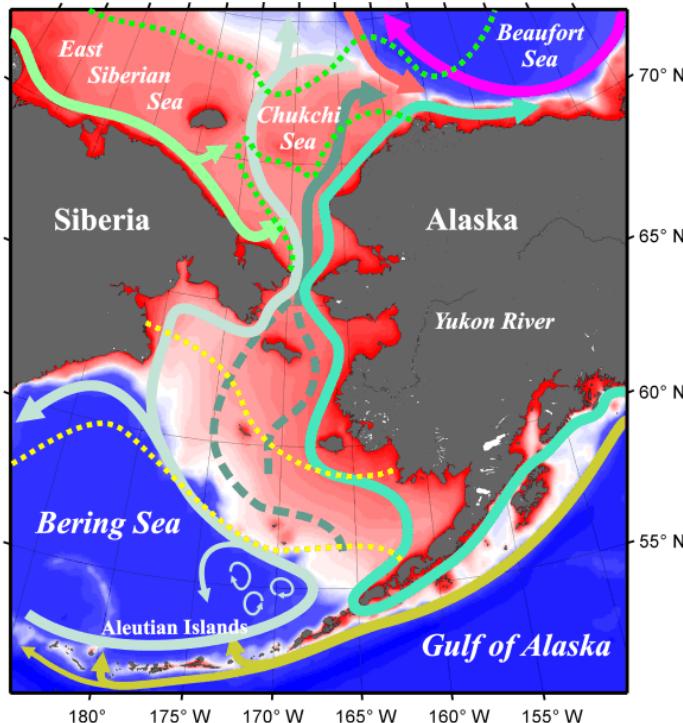
# Area



# Latitude



# Mean Circulation



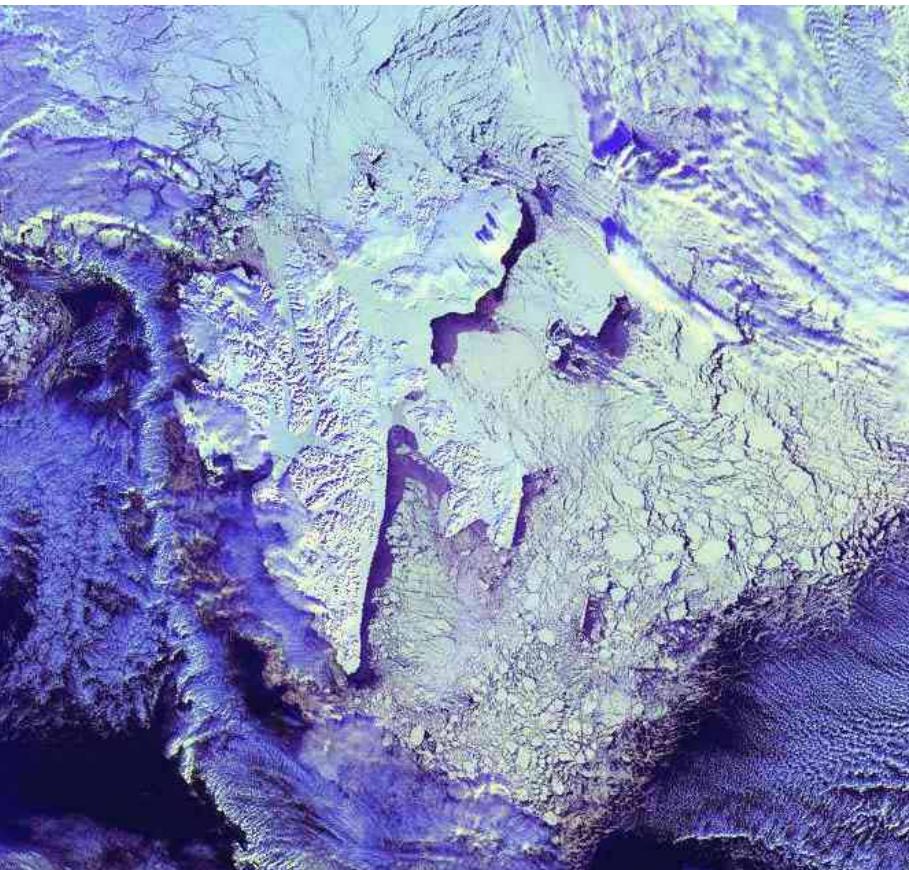
Strong Tidal Currents and Mixing in subregions



Highly Advective Systems

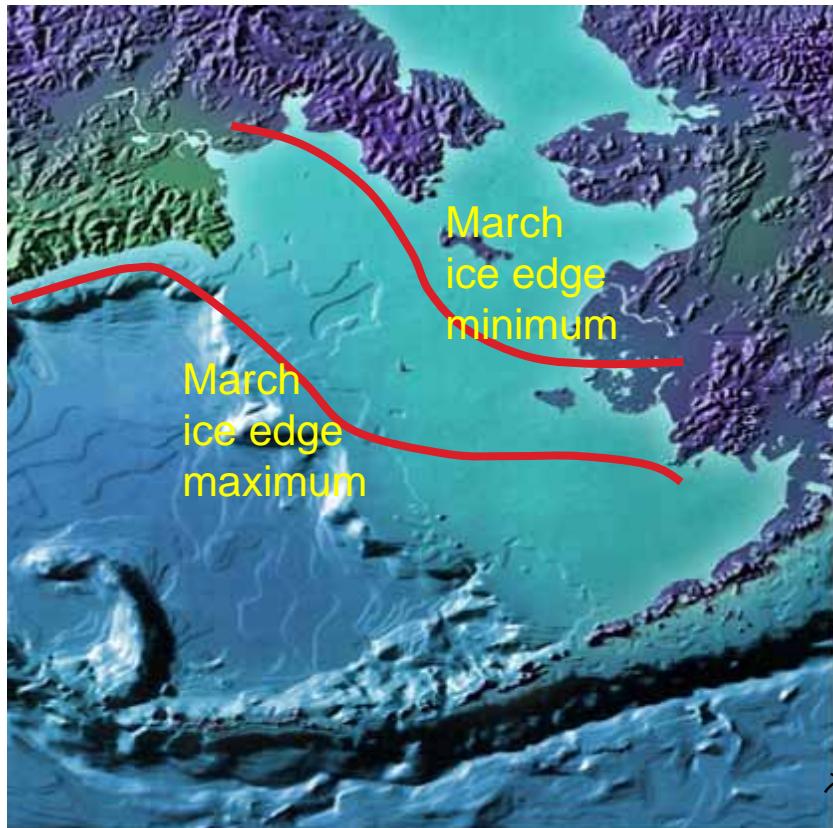
# Seasonal Sea Ice

Around Spitzbergen in the  
Barents Sea



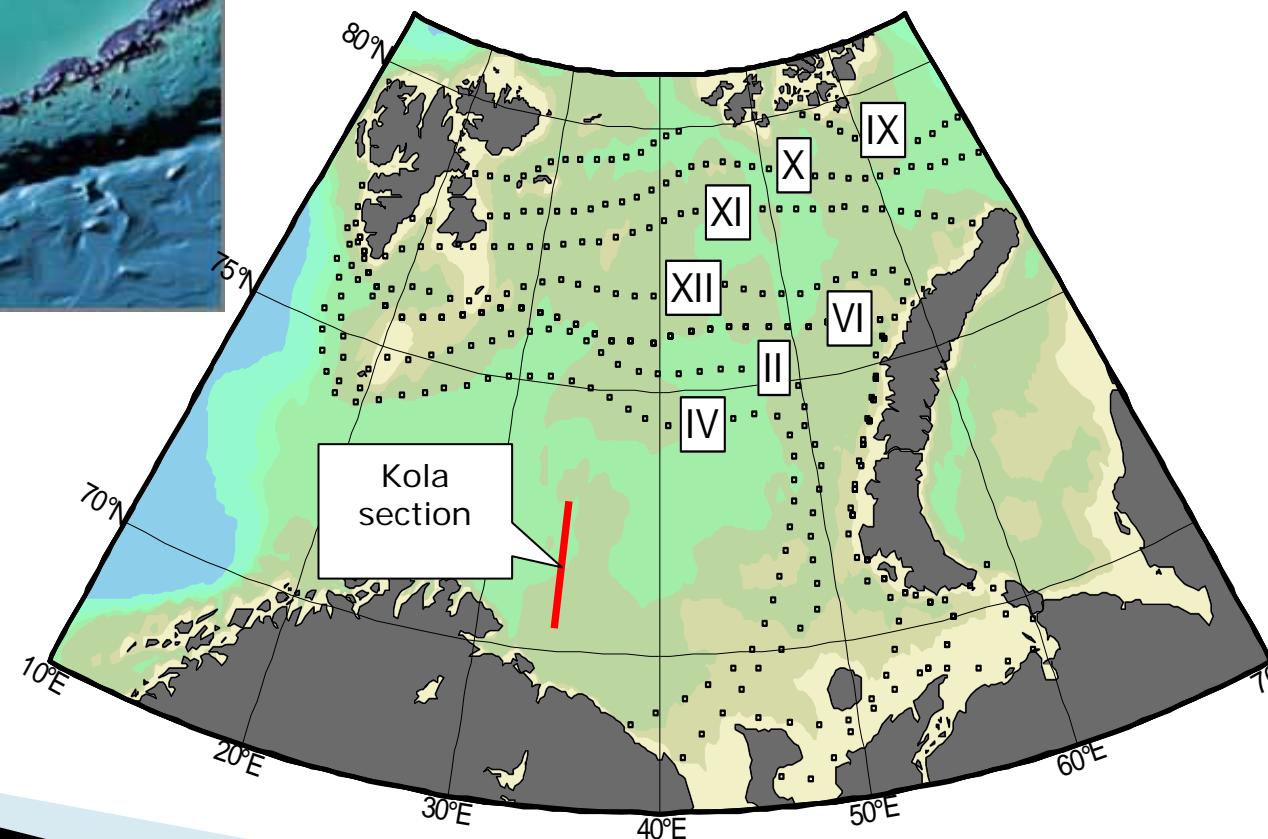
Flowing through the Bering Strait  
in the Bering Sea

# Sea Ice



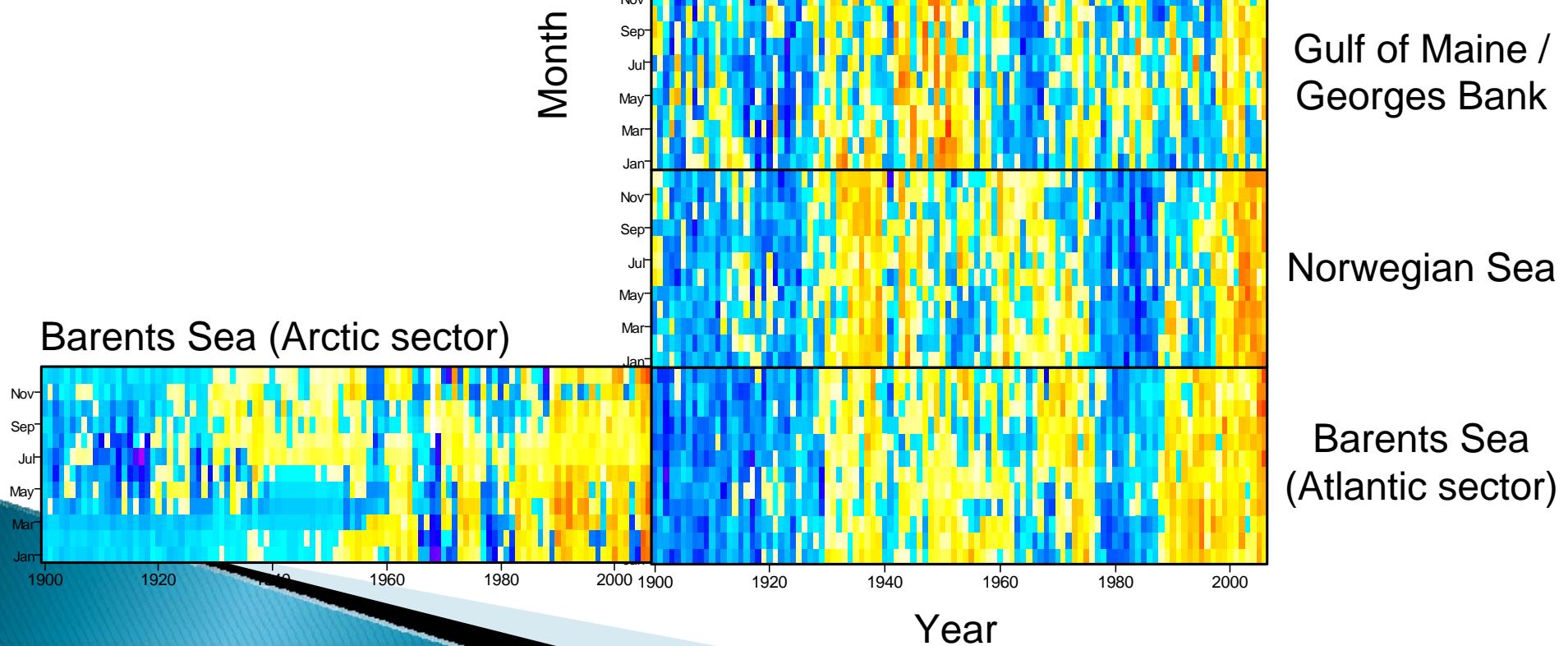
Bering Sea

Barents Sea

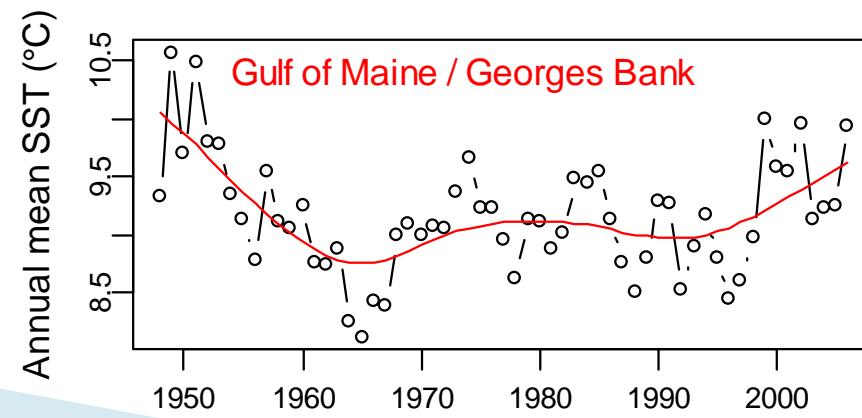
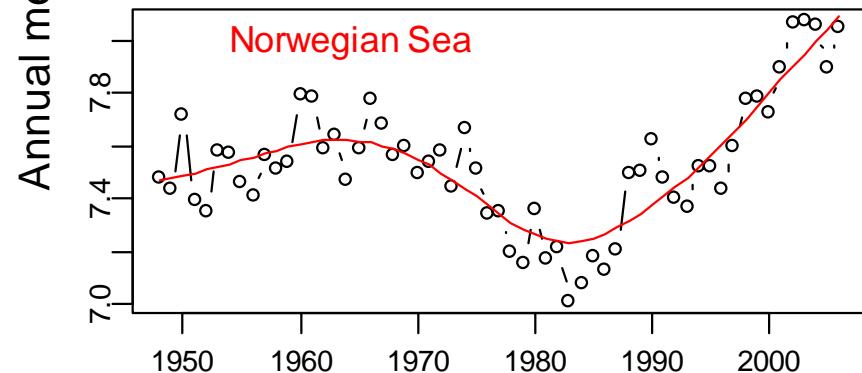
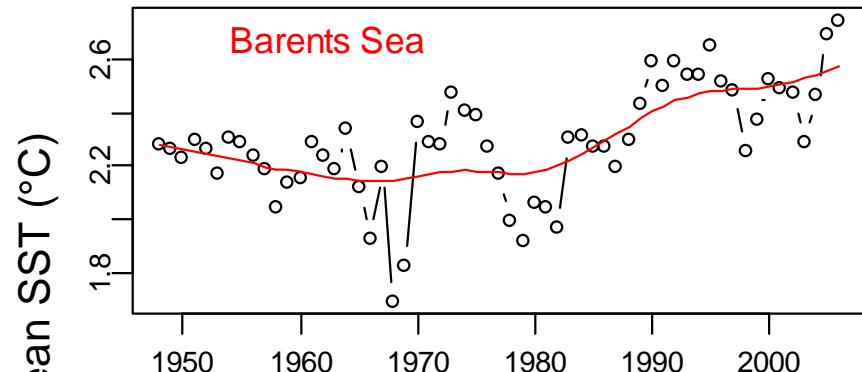
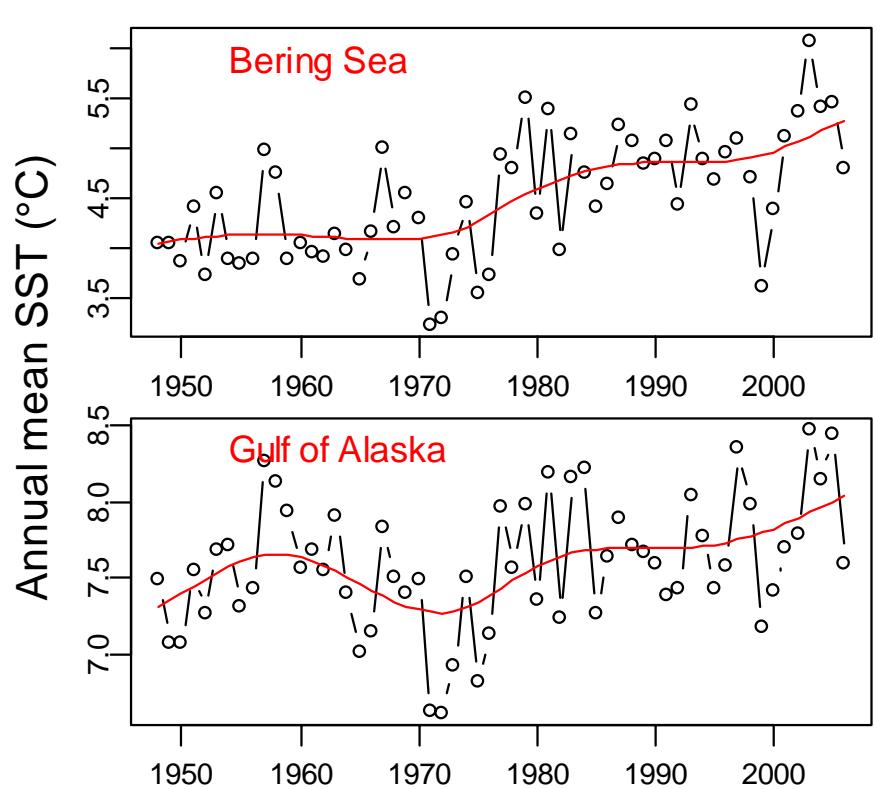


# Interannual Variability

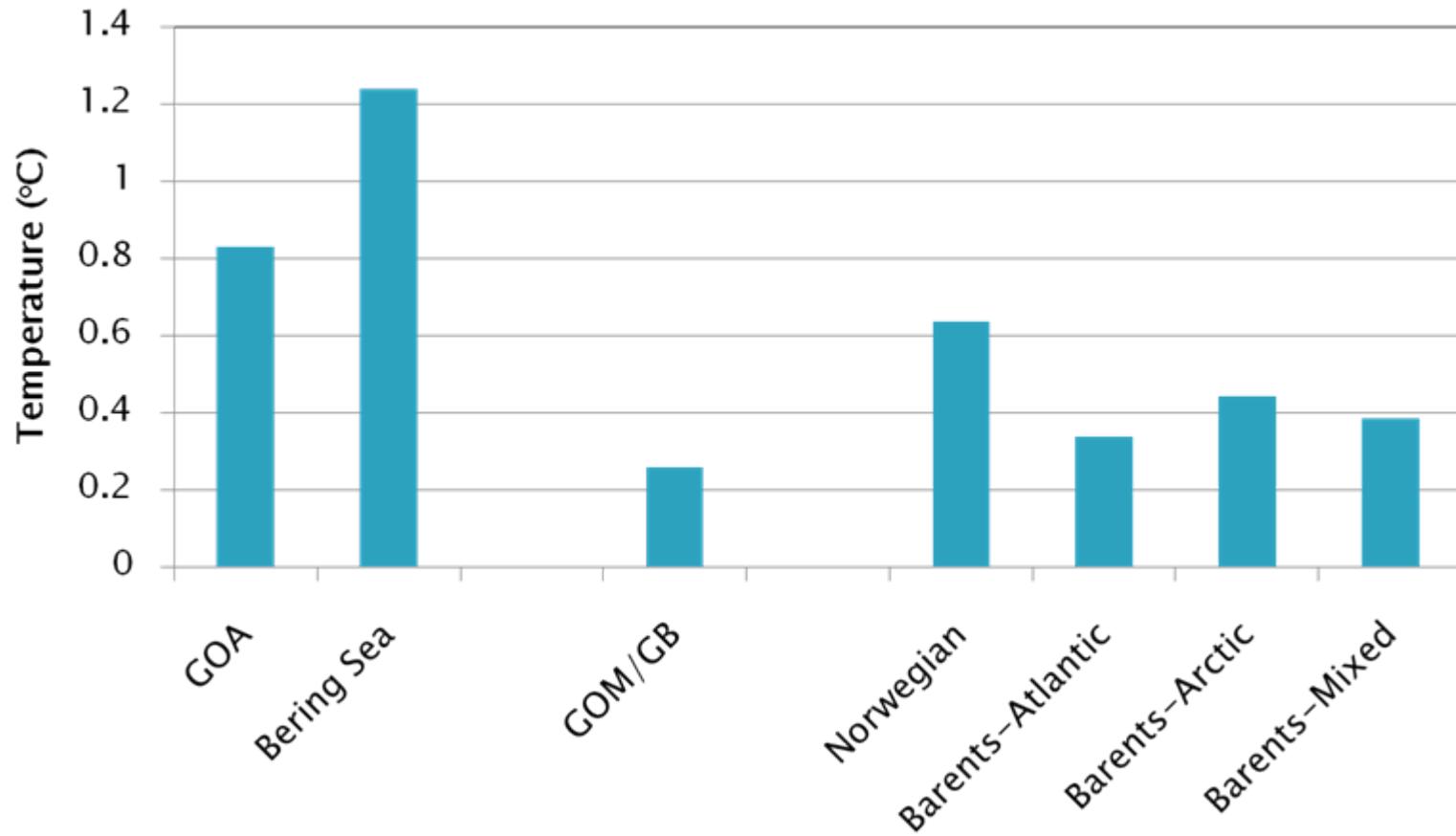
# Monthly mean sea-surface temperature anomalies 1900–2006



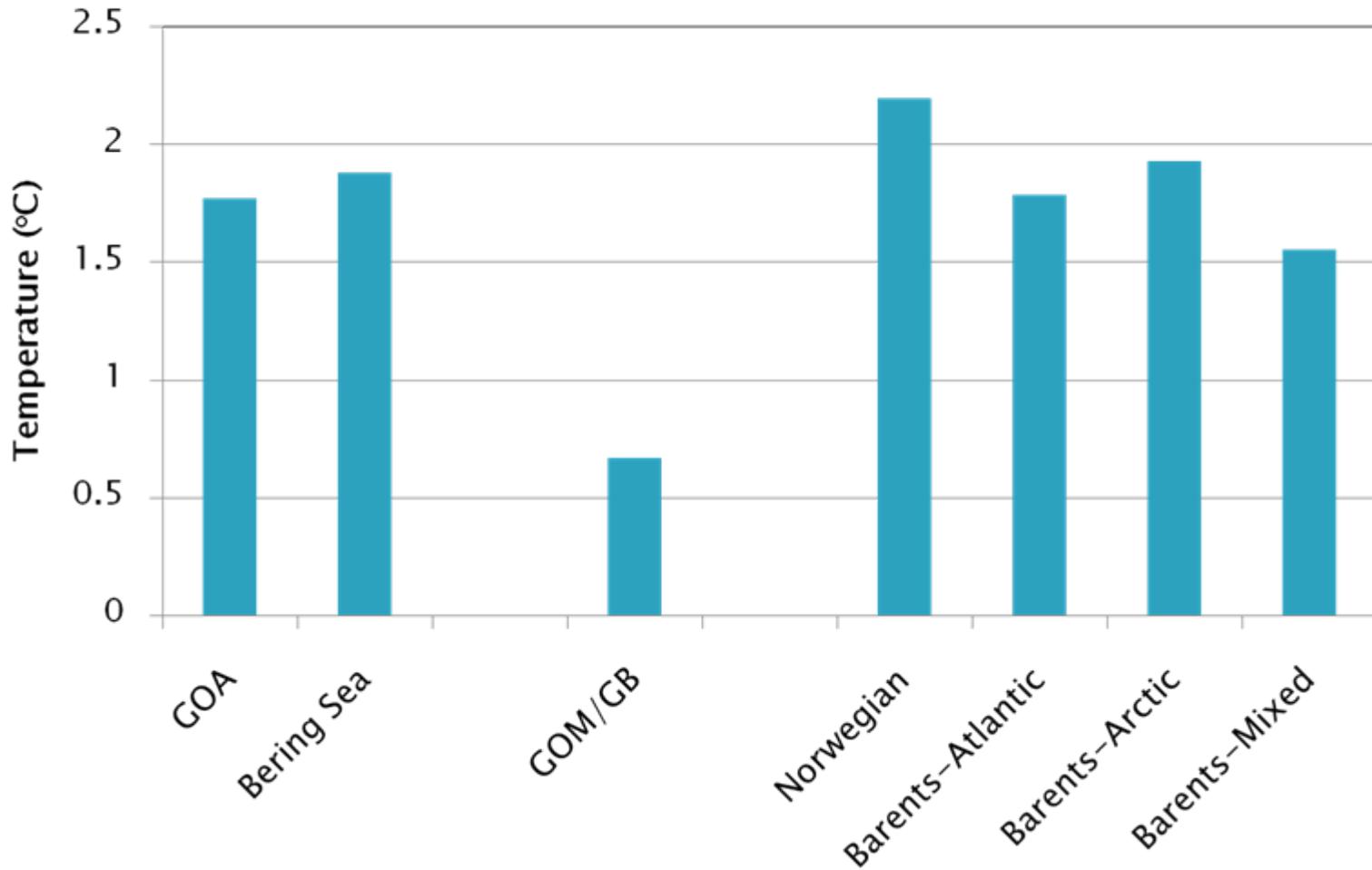
# Annual SST trends



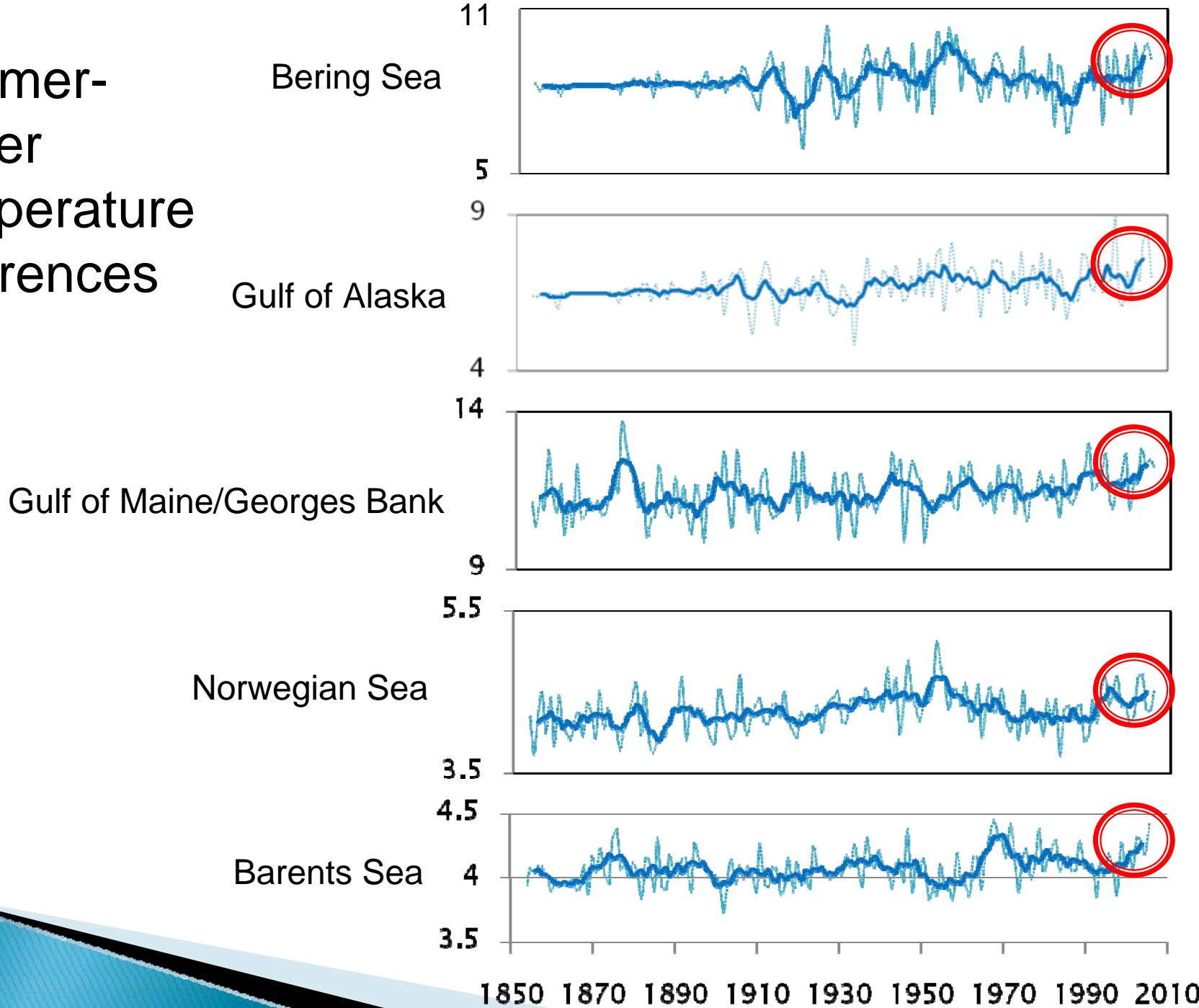
## Temperature Increase 1970–2006



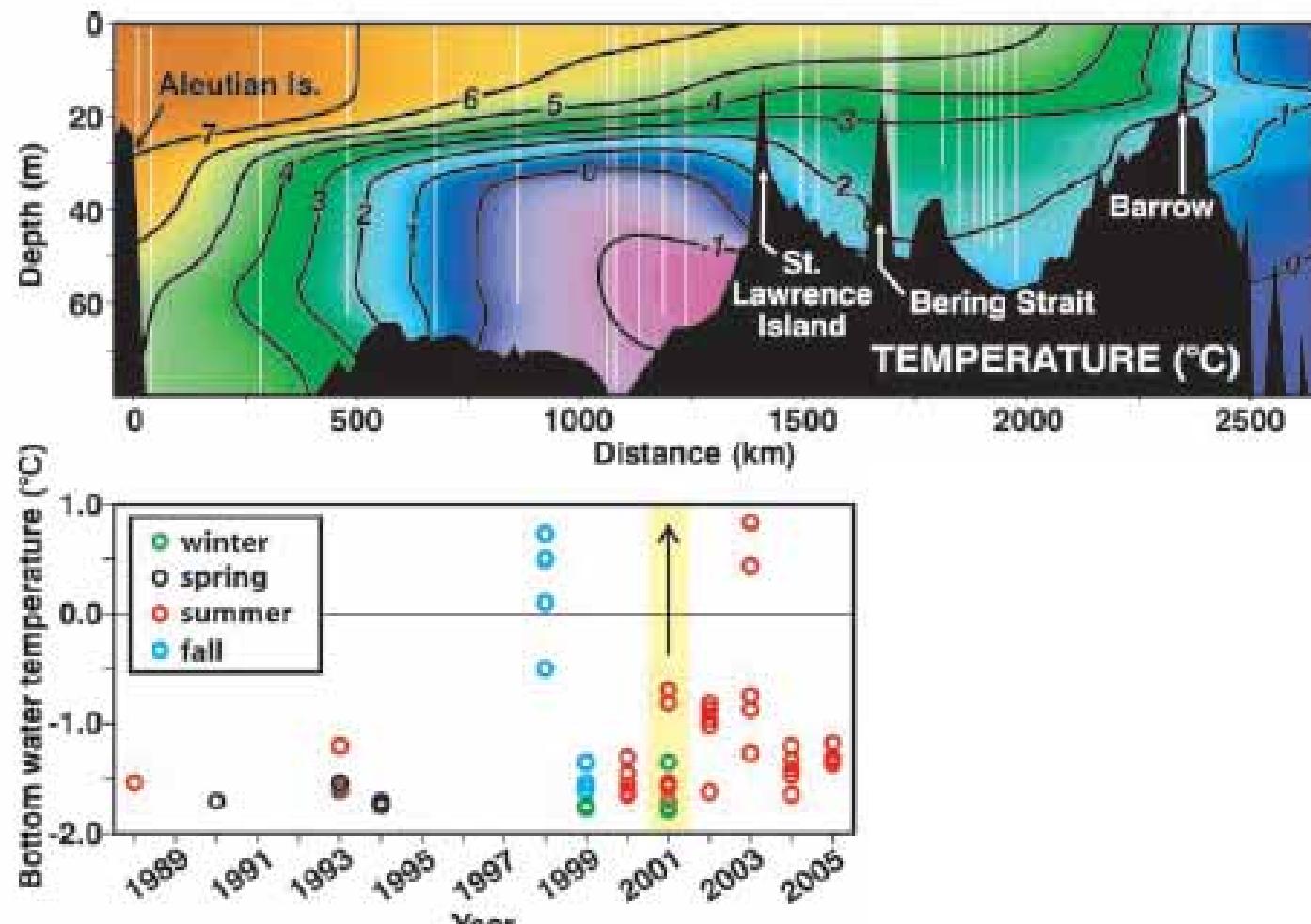
## Normalized Temperature Increase 1970–2006



# Summer-Winter Temperature Differences

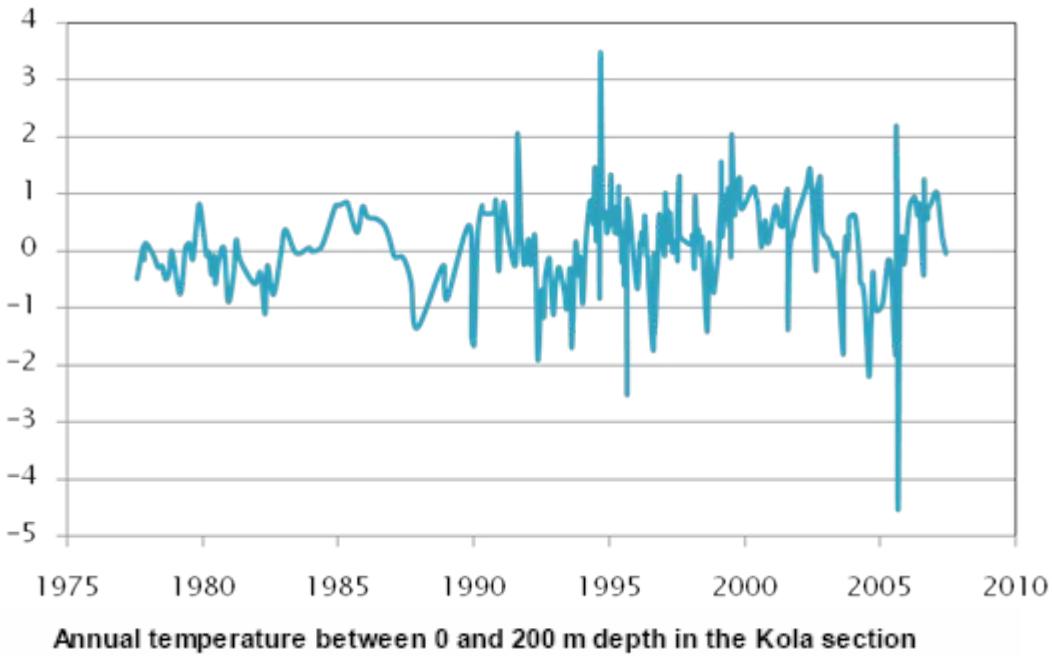


# Bering Sea Bottom Temperatures

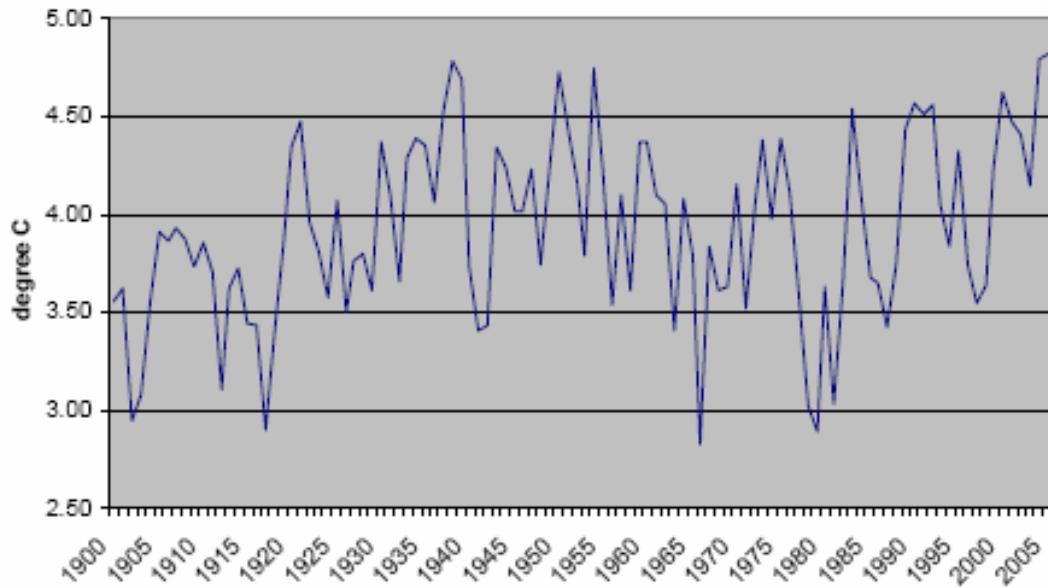


2001

# Subsurface Temperatures

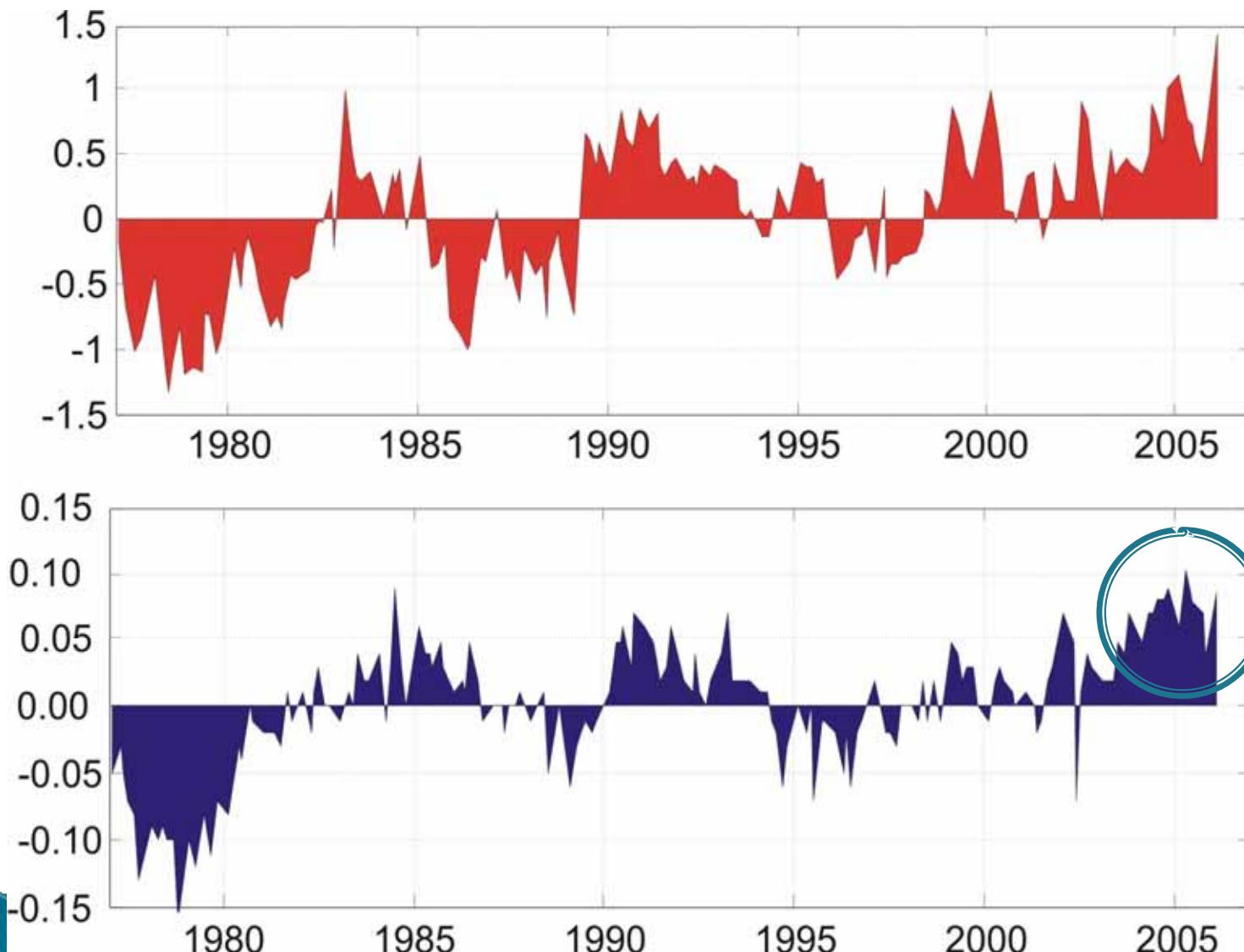


Bottom Temperature anomalies over the Gulf of Maine/Georges Bank from NFMS/NOAA Surveys

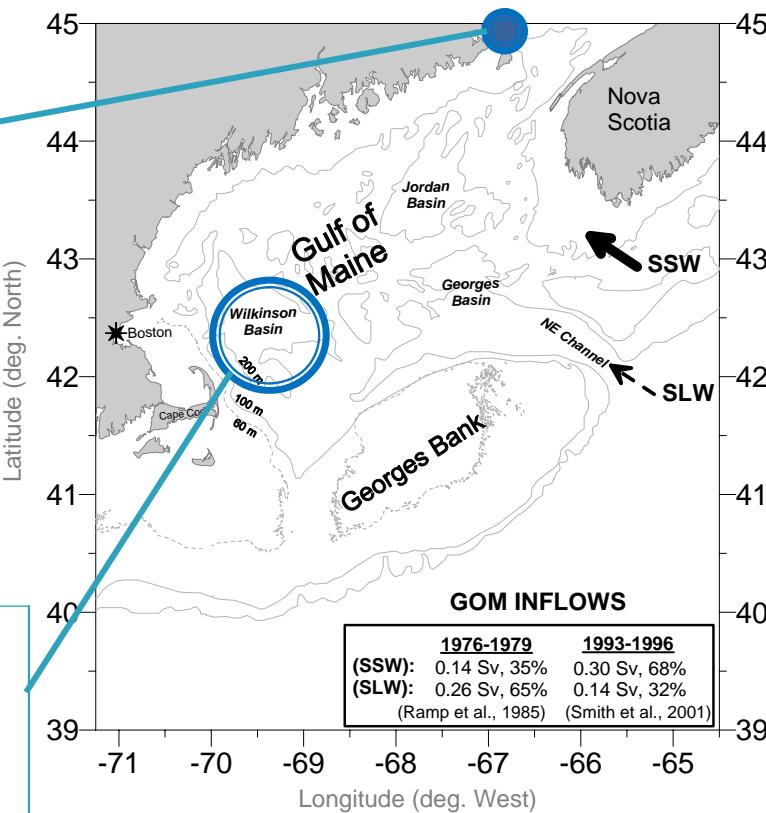
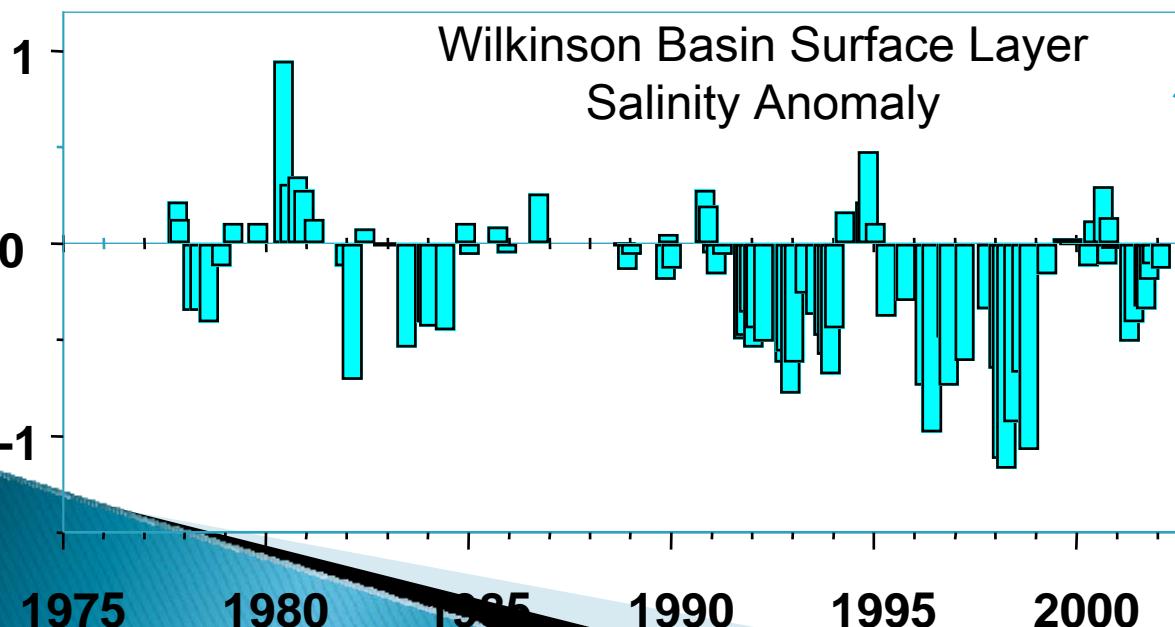
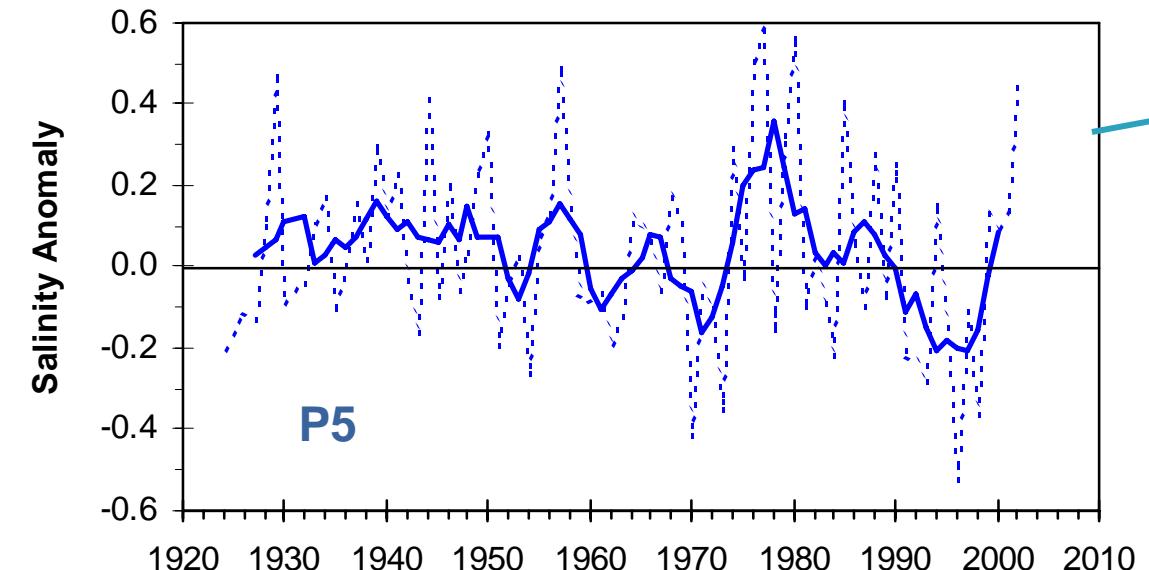


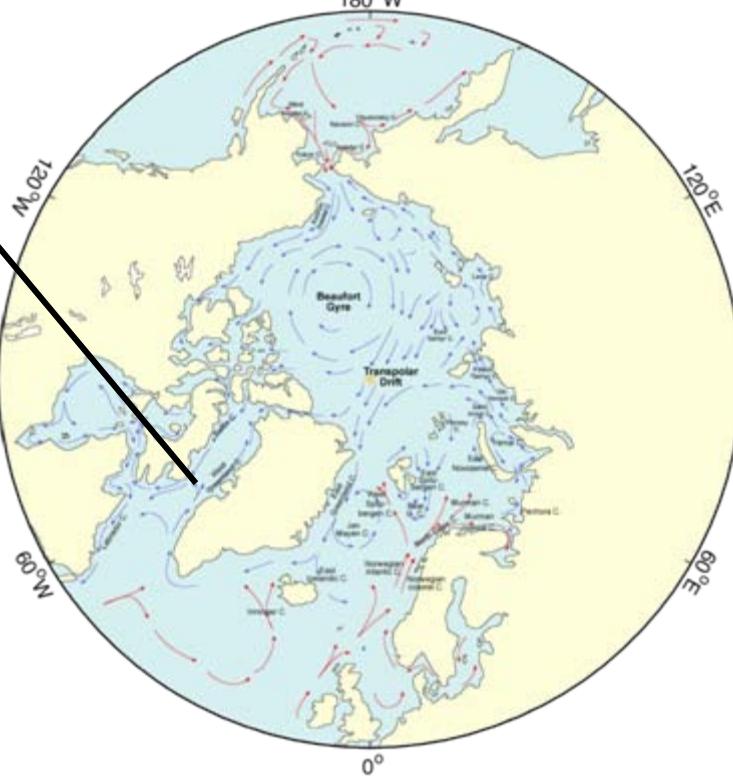
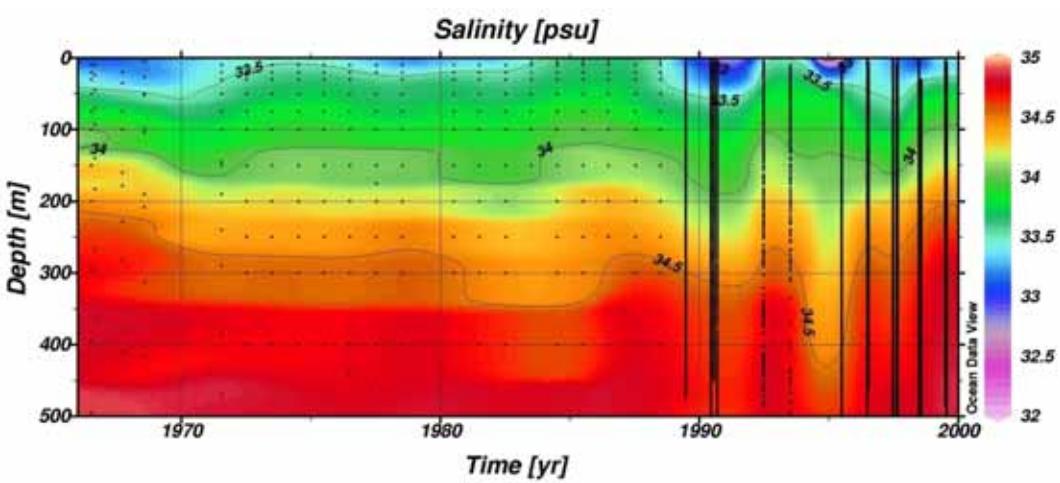
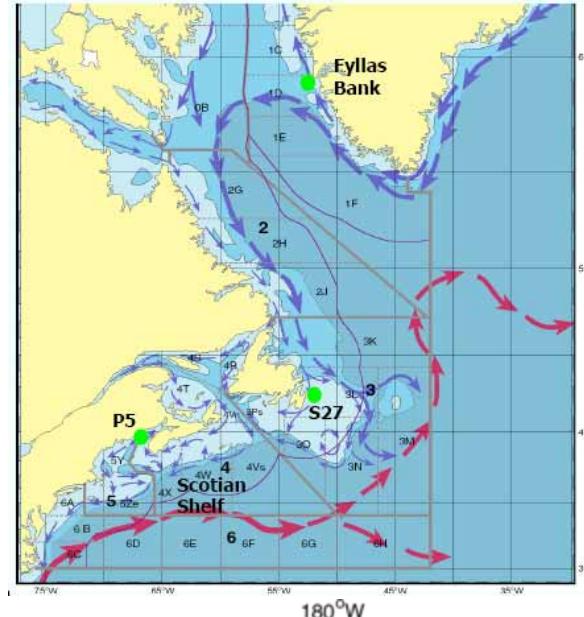
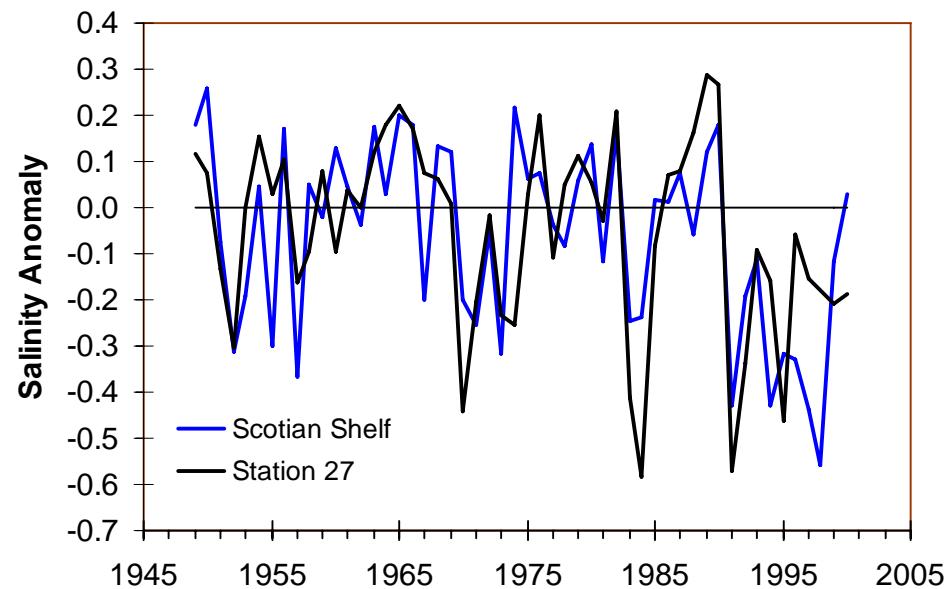
Kola Section temperatures (0-200 m) in the Barents Sea.

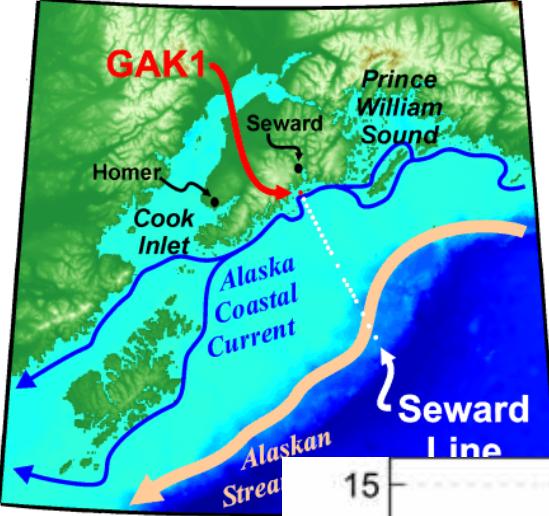
# Temperature and salinity anomalies BSO



# Gulf of Maine

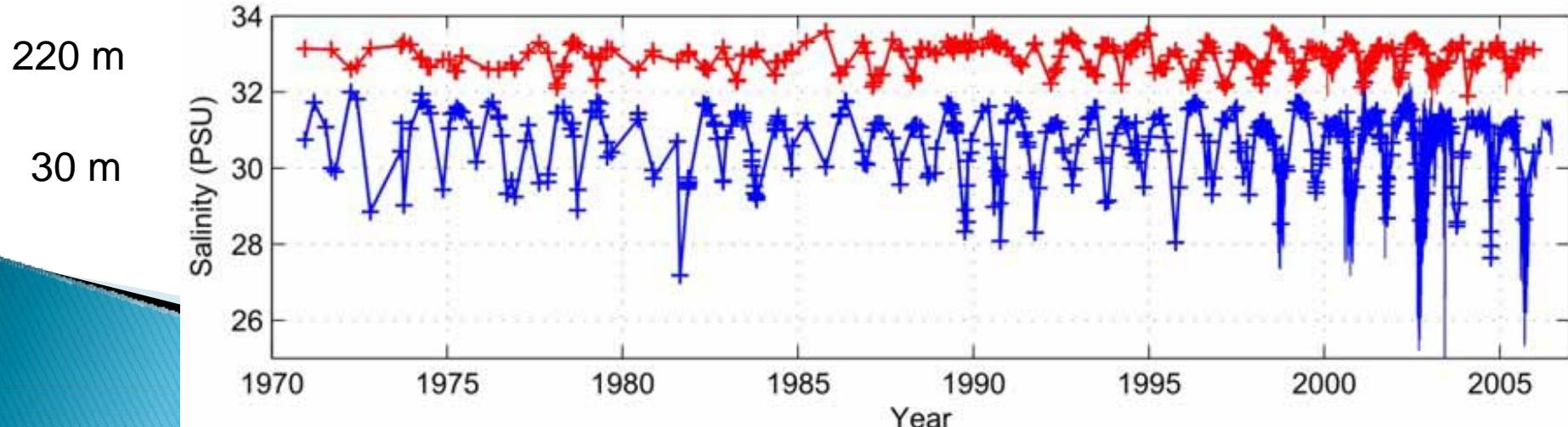
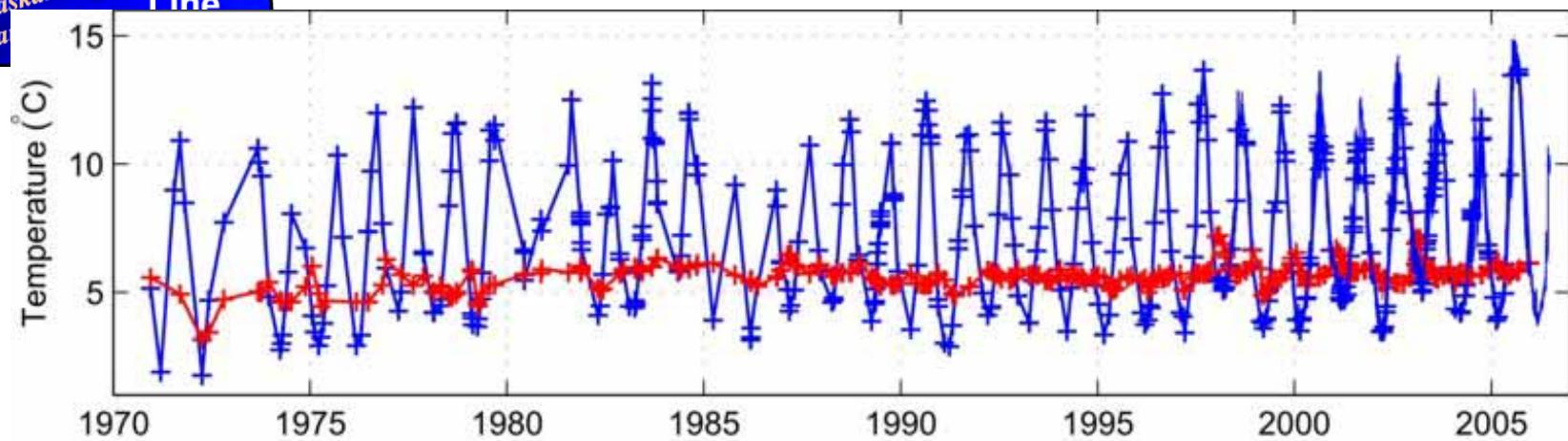






# Gulf of Alaska

Monitoring Site (GAK1) Near  
Seward in Alaska Coastal Current



# Southern extent of sea ice

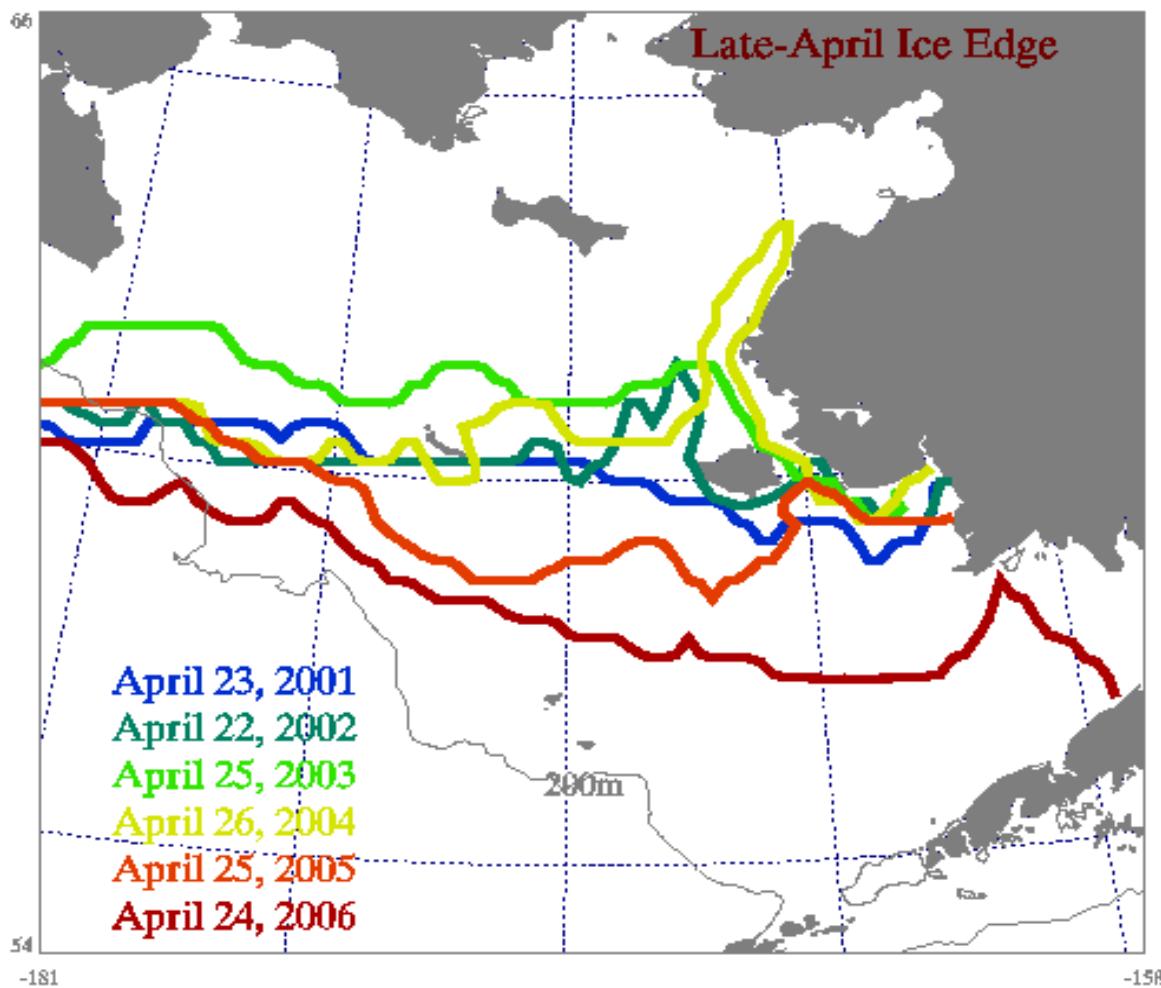
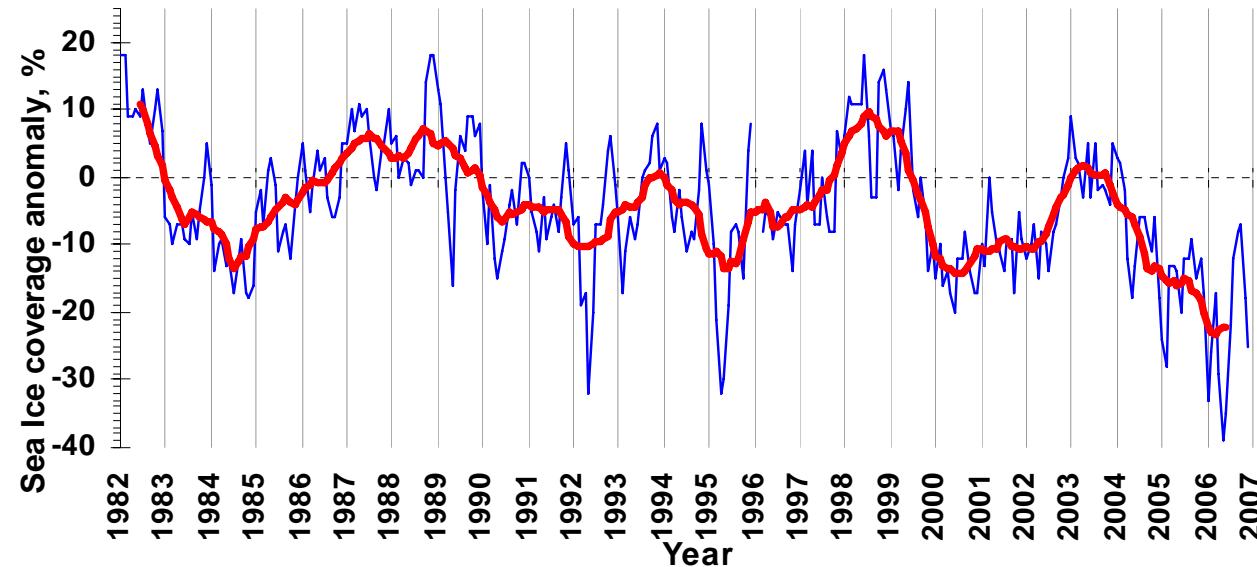


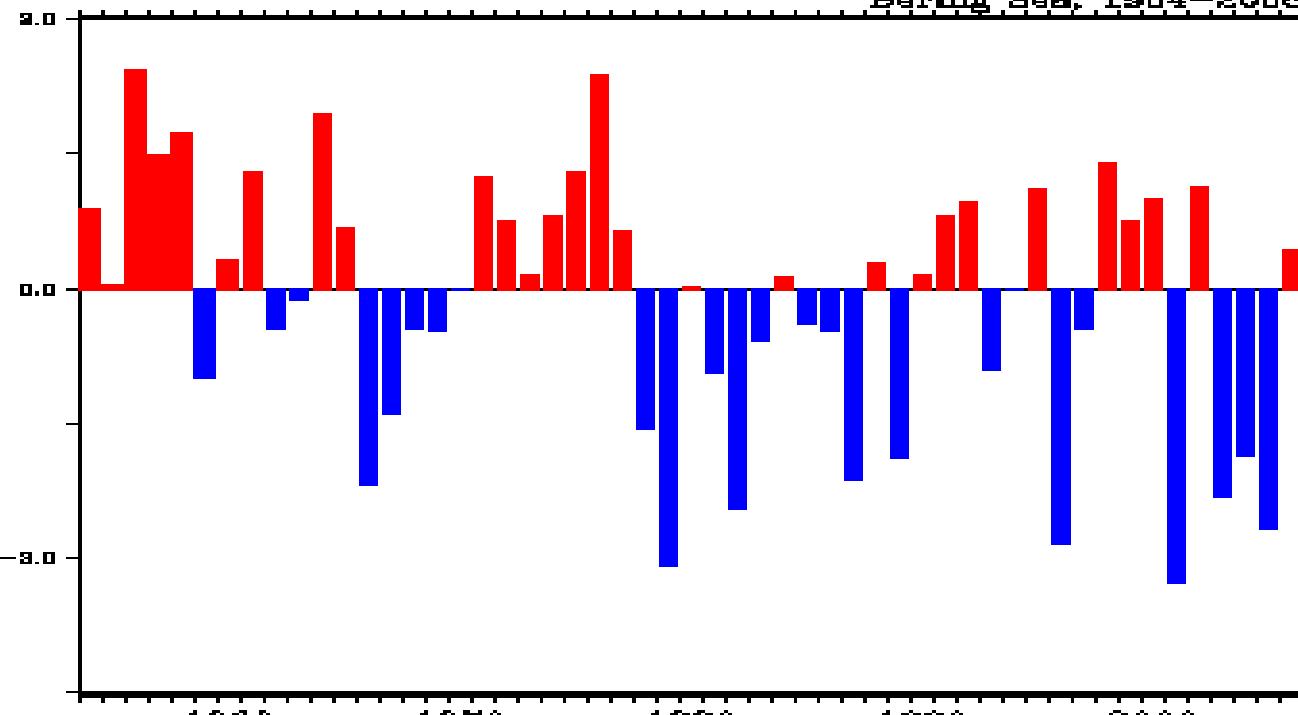
Figure courtesy of:  
Phyllis Stabeno  
NOAA-PMEL  
Seattle, WA

# Sea Ice Cover Anomalies



Barents Sea  
1982-2006

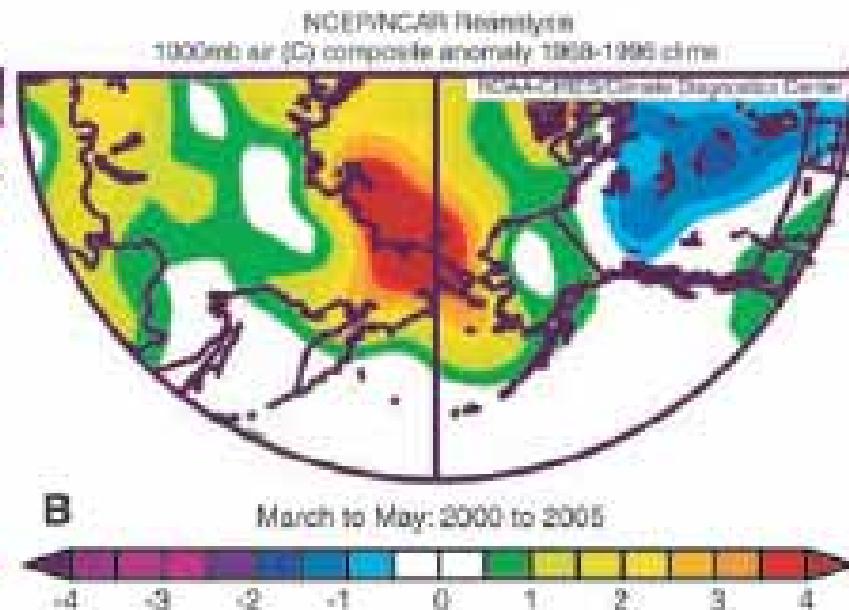
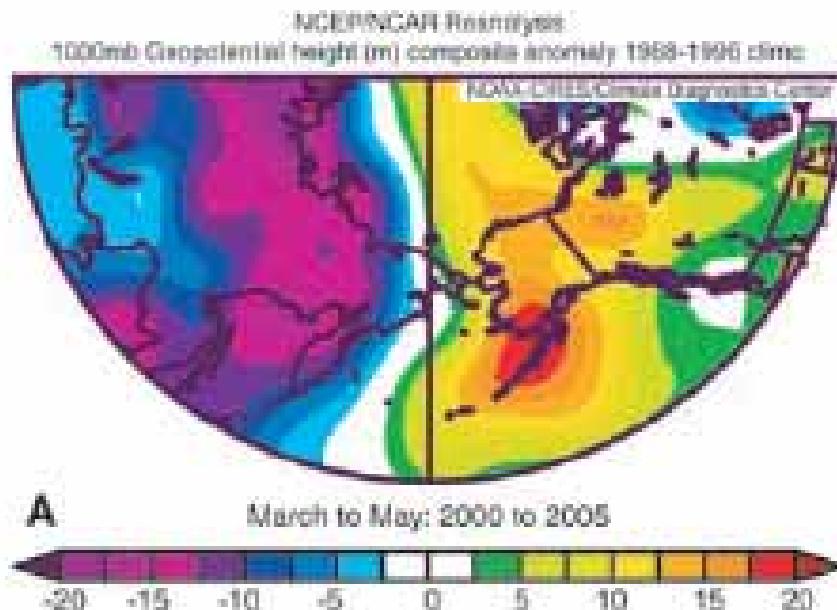
07-15:49 Sep 17 2007 (PAGE: 1)  
Ice cover index (winter)  
Bering Sea, 1954-2006



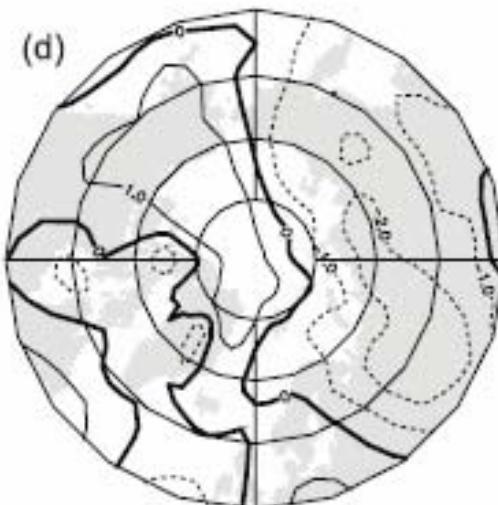
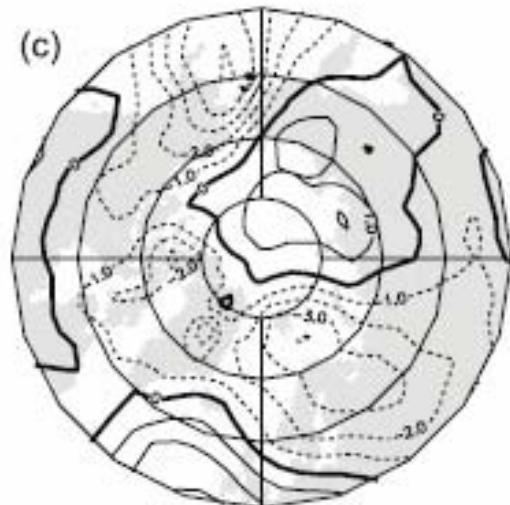
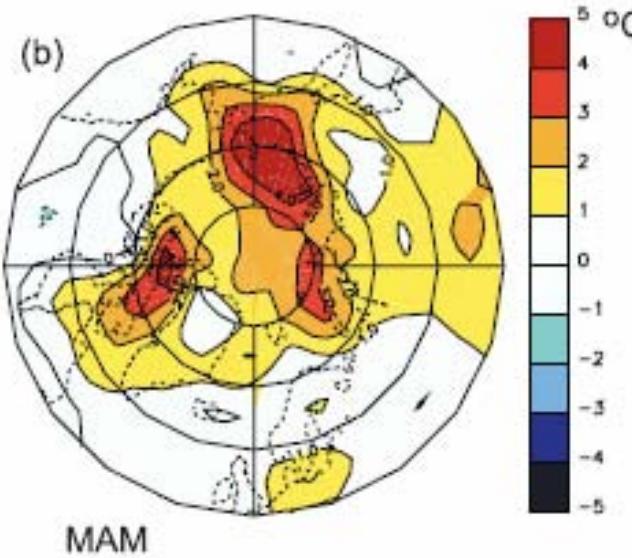
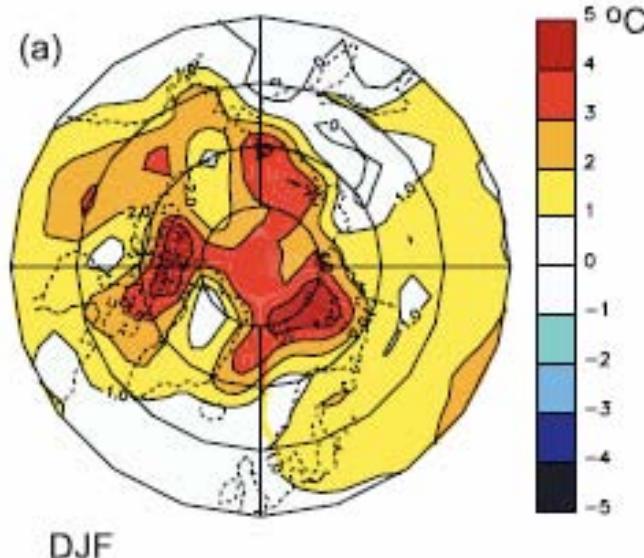
Bering Sea  
1954-2006

# Geopotential Height Anomaly (m)

# Air Temperature Anomaly ( $^{\circ}\text{C}$ )



Air  
Temperature  
Anomaly  
( $^{\circ}$ C)



Sea-Level  
Pressure  
Anomaly

**Figure 1.** Composite 1000 hPa temperature anomaly fields for 2000–2005 in (a) winter (DJF) and (b) spring (MAM). Corresponding sea-level pressure anomaly fields for (c) winter and (d) spring; negative SLP contours are dashed. All data are from the NCAR/NCEP reanalysis.

# Summary

- ▶ Recent warming in all three regions
- ▶ Salinity changes varied, due to advection
- ▶ Decreases in sea ice area where present
- ▶ Future: What is the relative contribution of advection vs. atmospheric heat fluxes in determining the changes in temperature