

Fate of early-2000's Arctic warm water pulse



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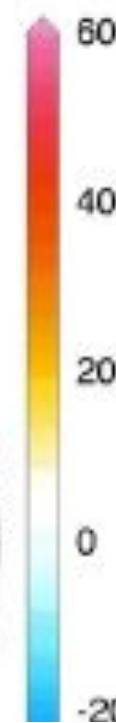
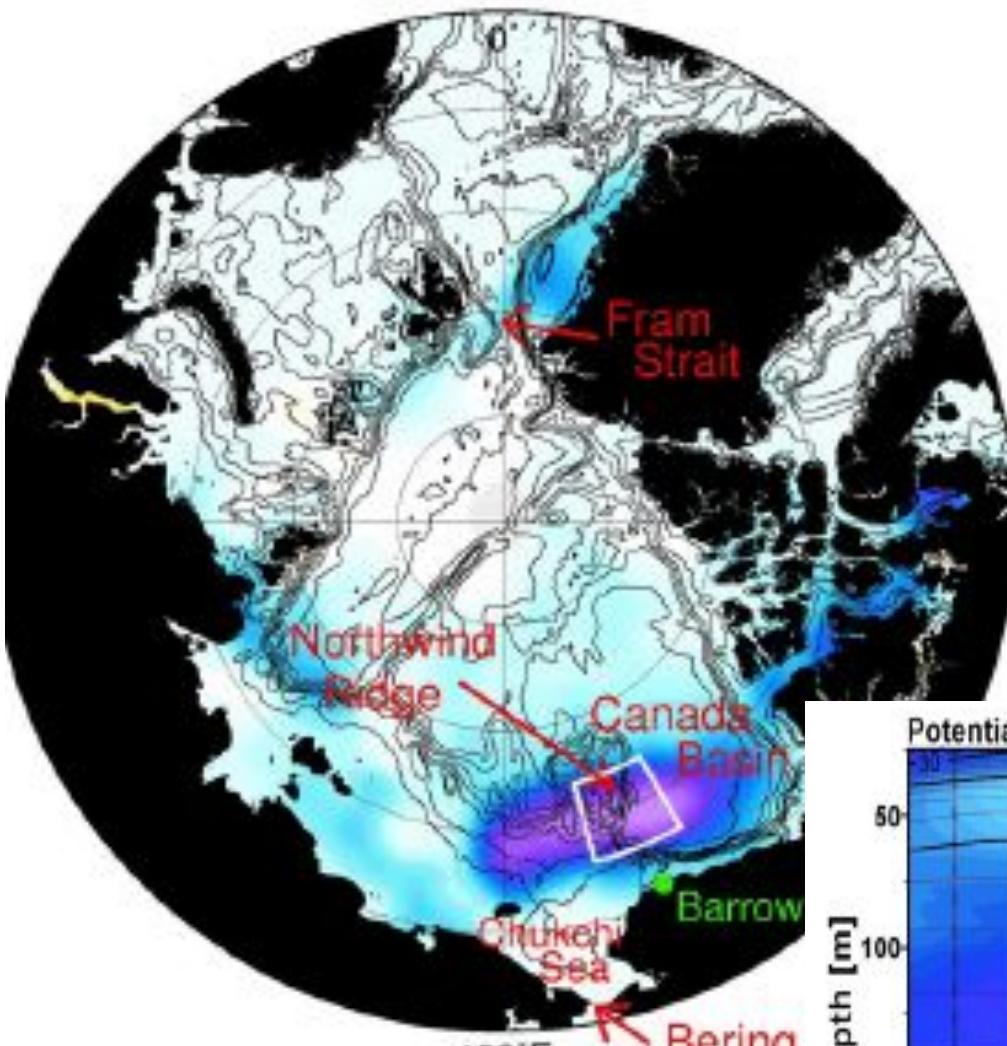
"State of the Arctic" Conference, March 2010, Miami



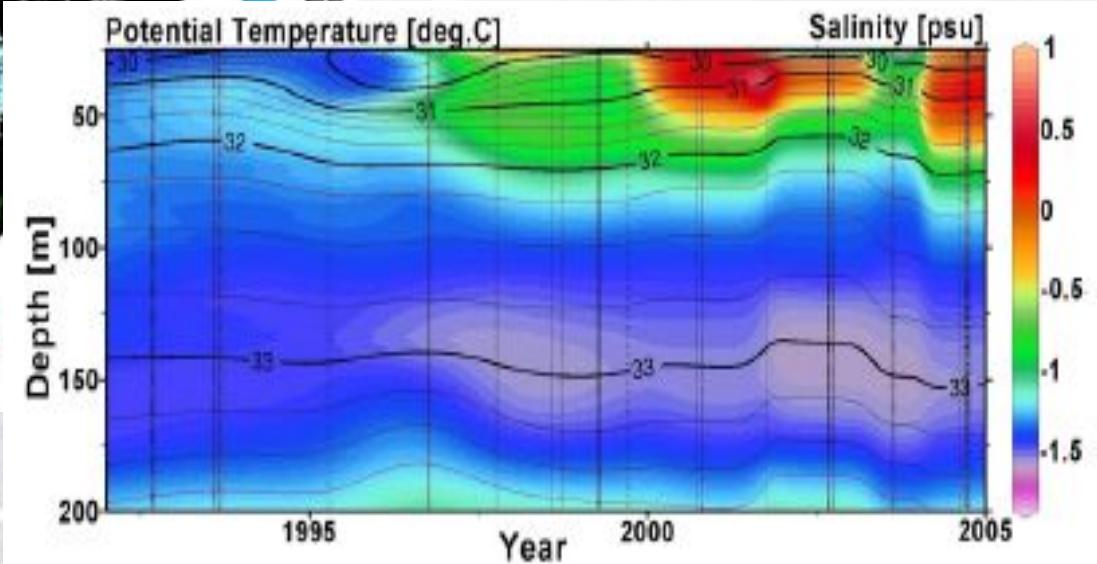
Major Results

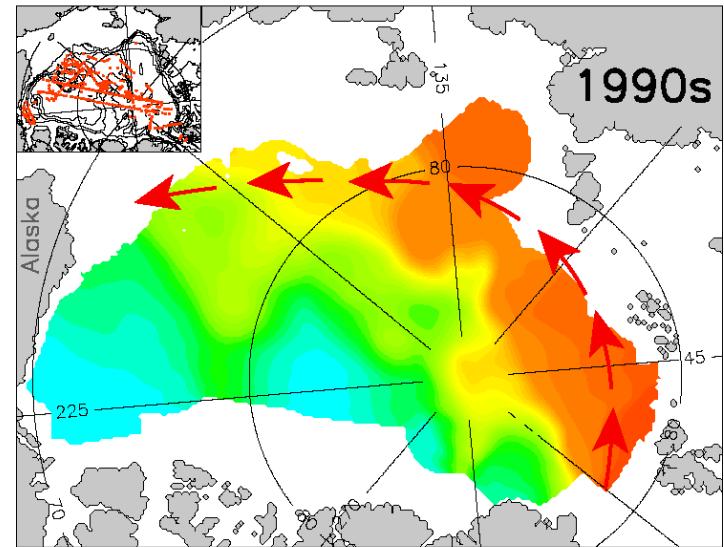
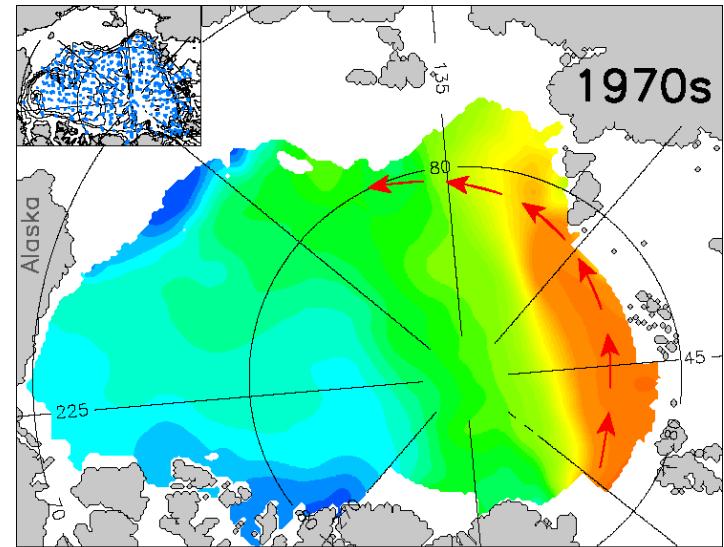
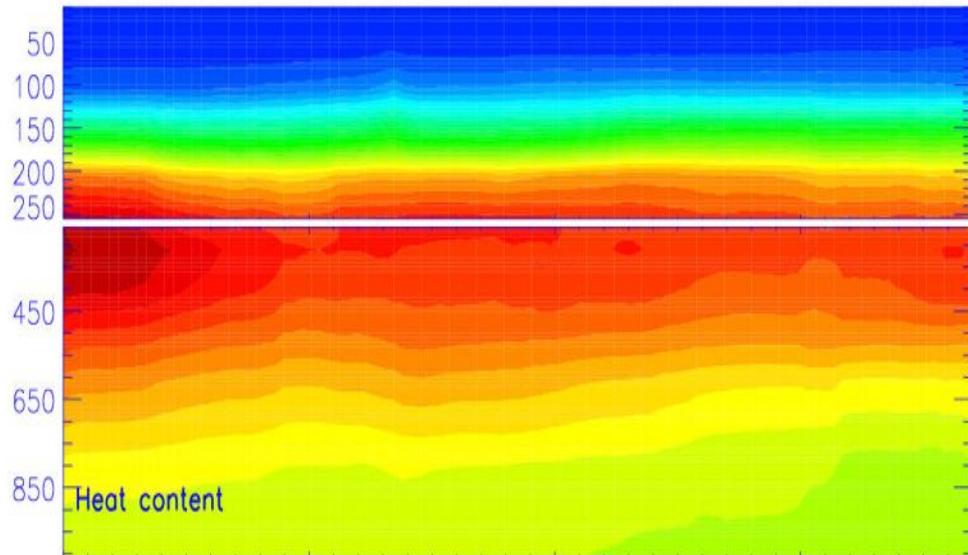
- The temperature of Atlantic Water of the Arctic Ocean was, on average, 0.24°C warmer in 2007 than in the 1990s.
- Recent observations suggest that the eastern Arctic Ocean is in transition towards a cooler state.

Pacific Water of the Arctic Ocean contributes to reduction of sea ice



Shimada et al GRL 2006

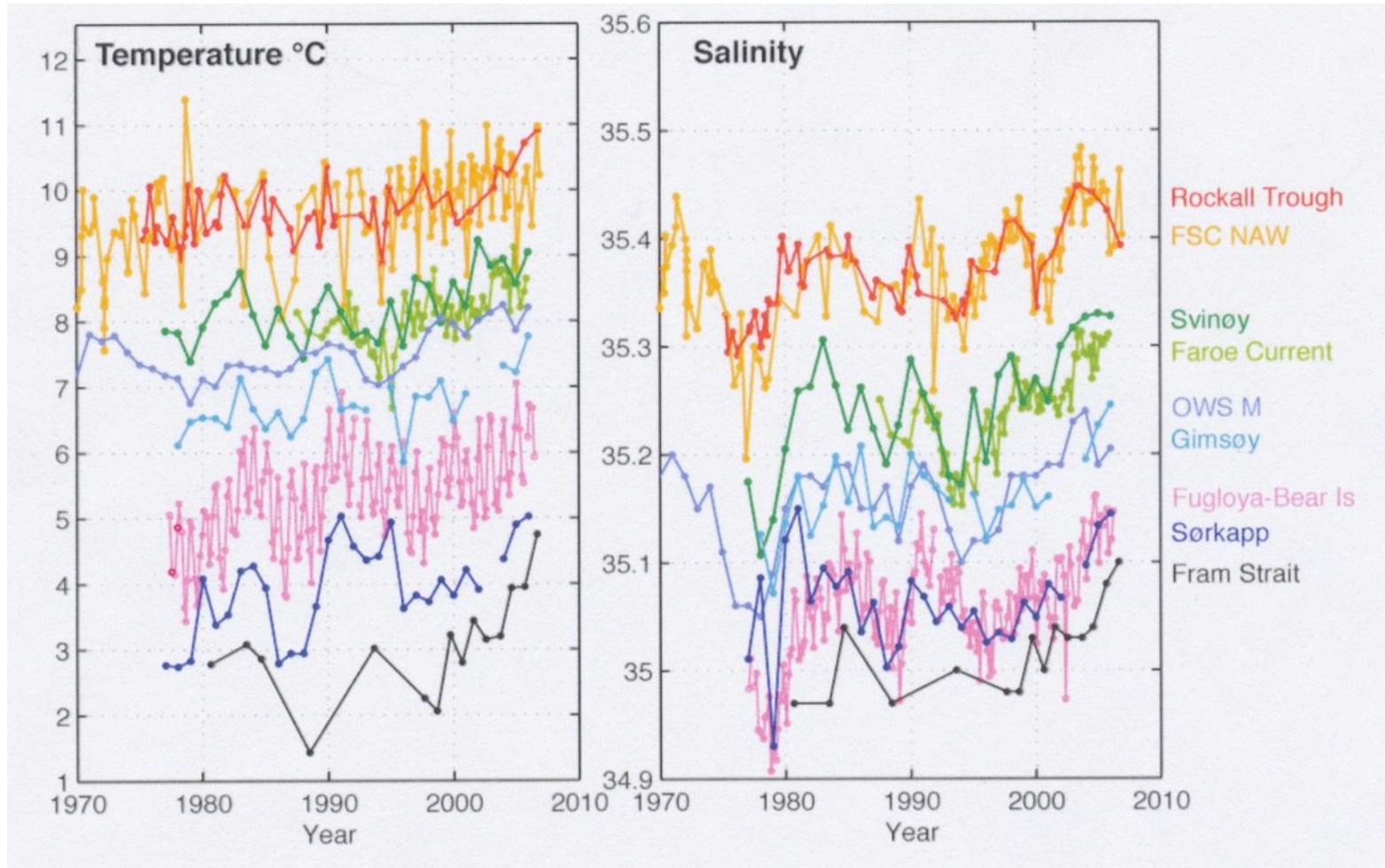




WATER STRUCTURE:

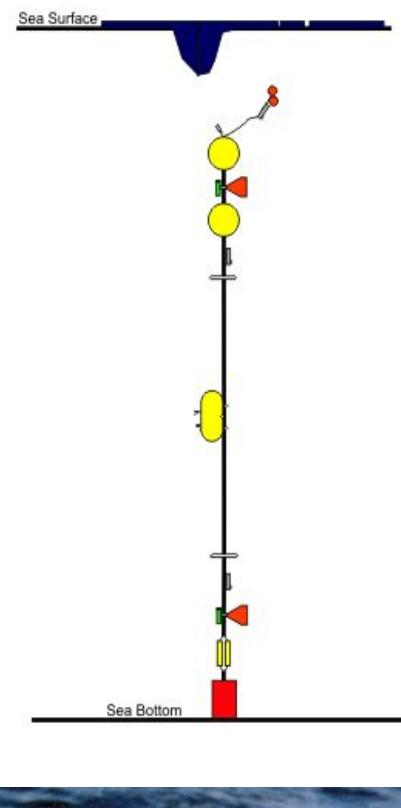
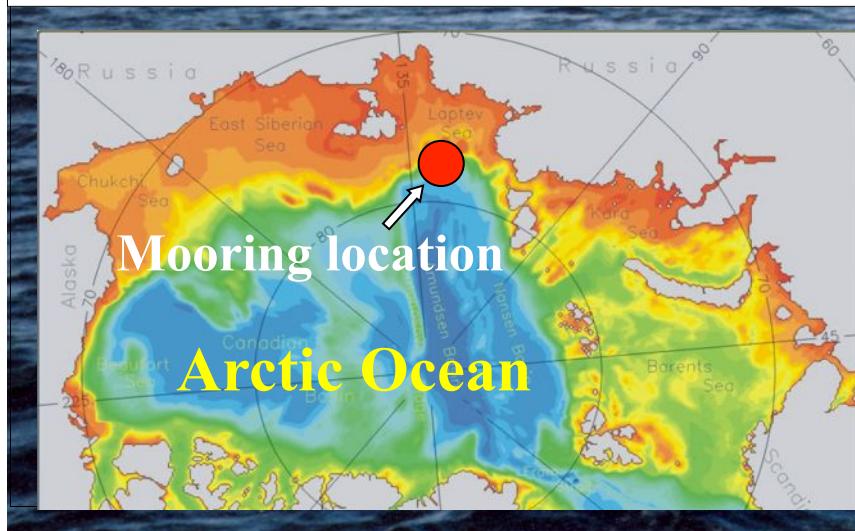
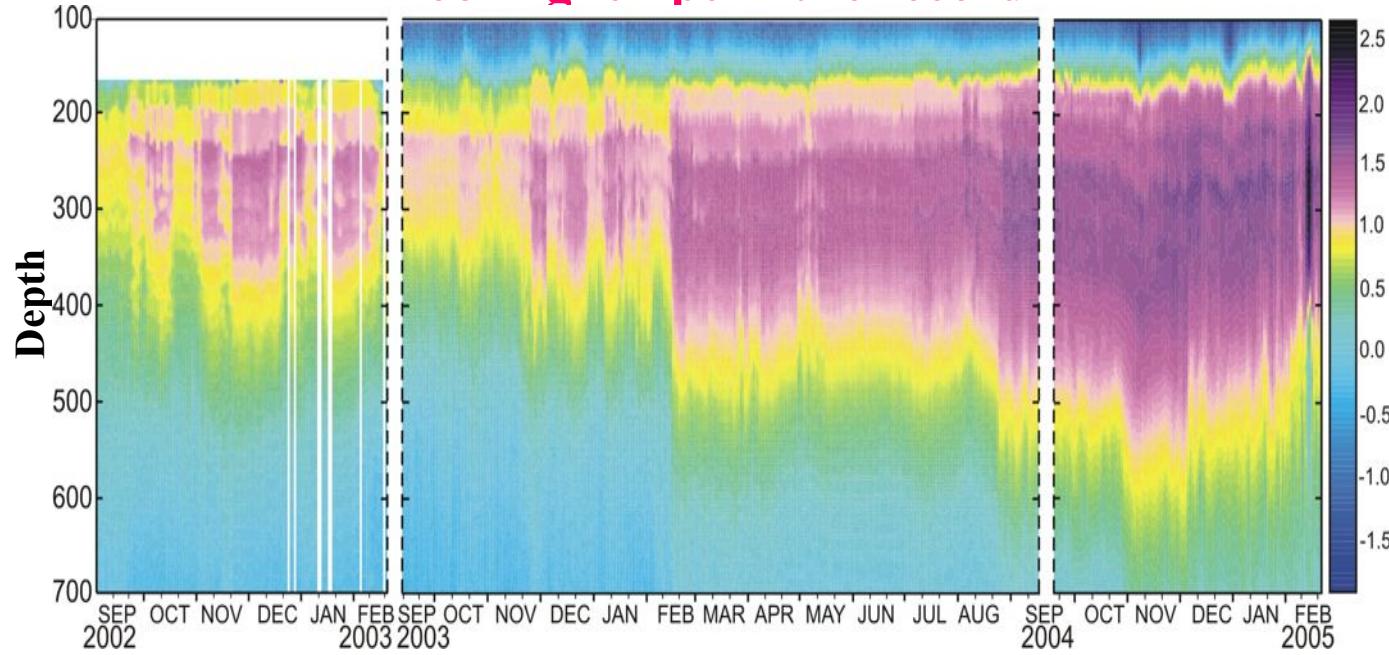
- Fresh and cold upper ocean.
- Colder and fresher deep water.
- Warm and salty Atlantic Water circulating clockwise around major basins.

Time series of temperature (left) and salinity (right) in the Atlantic inflow from the eastern sub-polar gyre to the Fram Strait

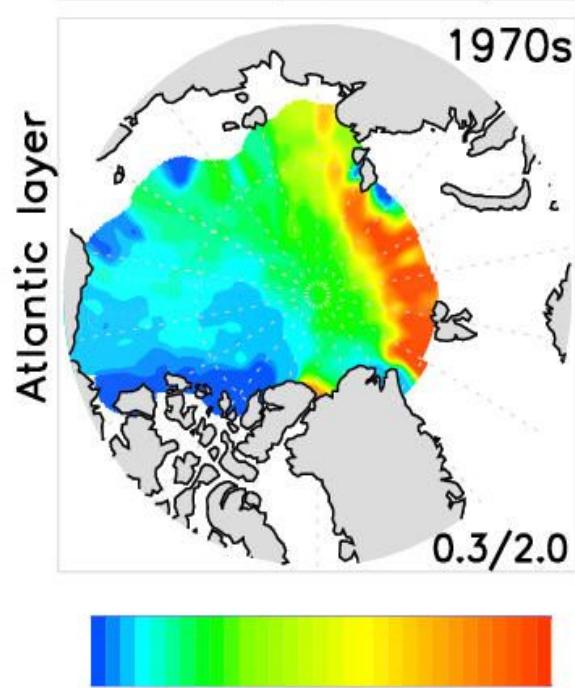


Strong Arctic Ocean warming was captured in 2004

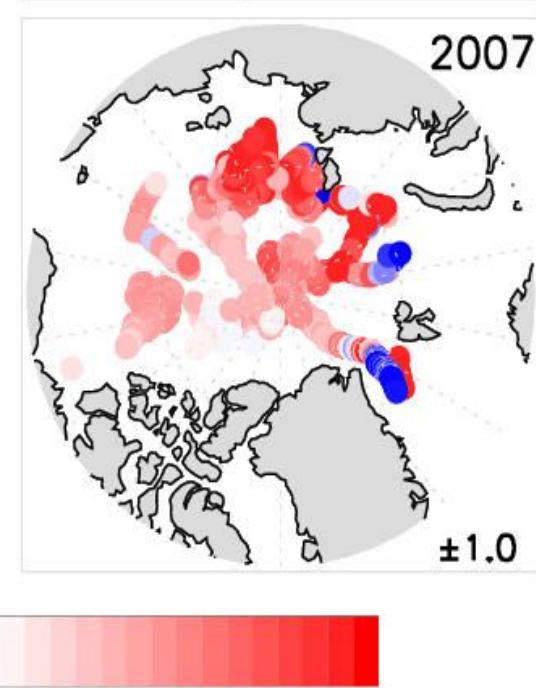
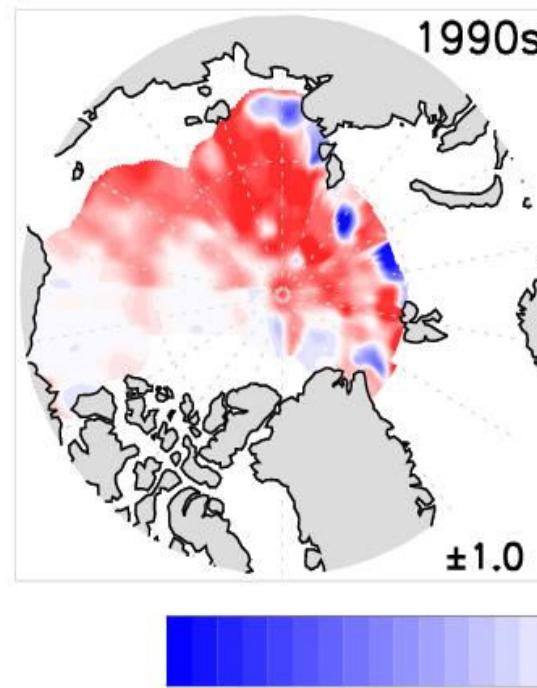
Mooring temperature record



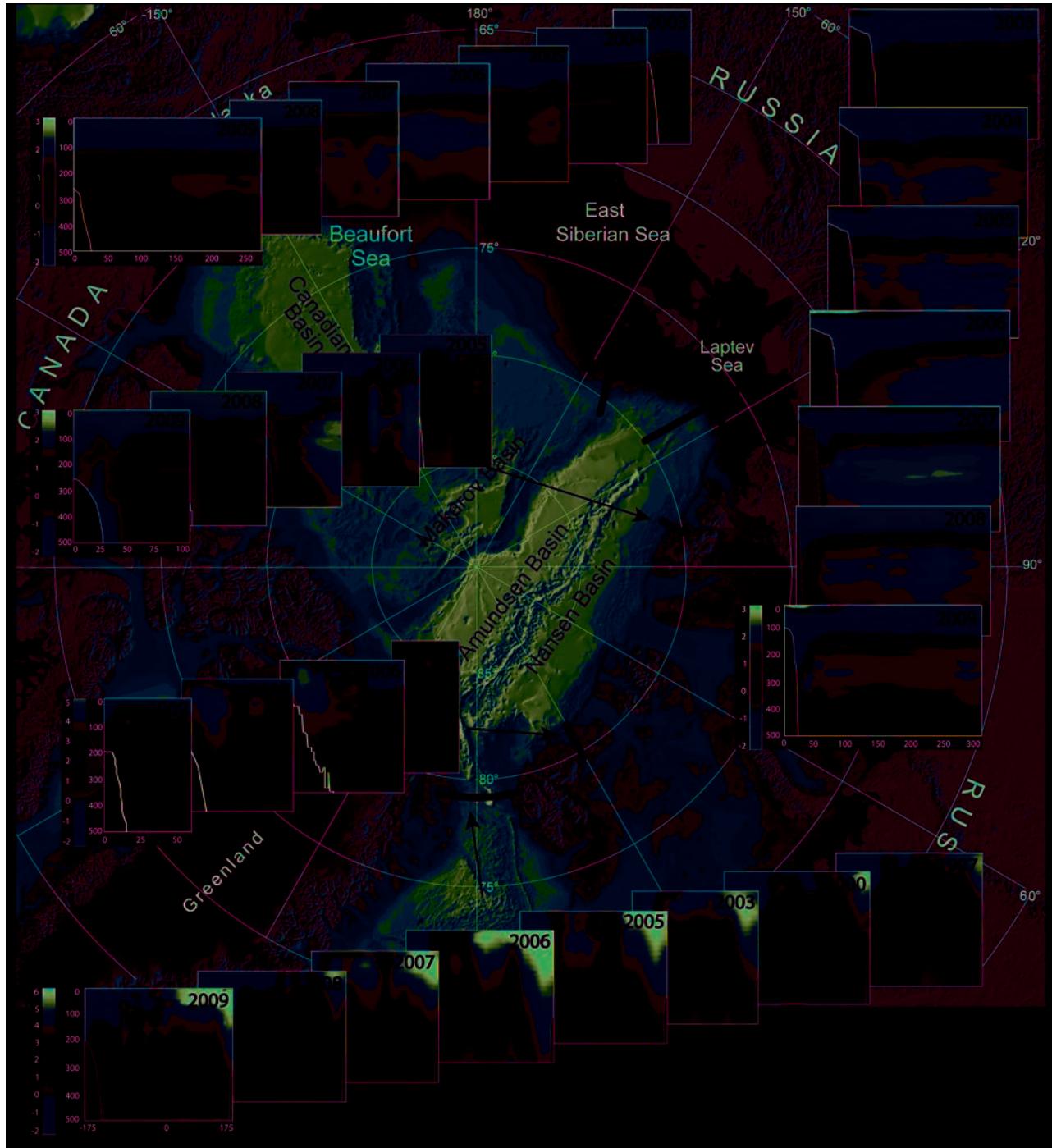
Temperature



Temperature anomalies



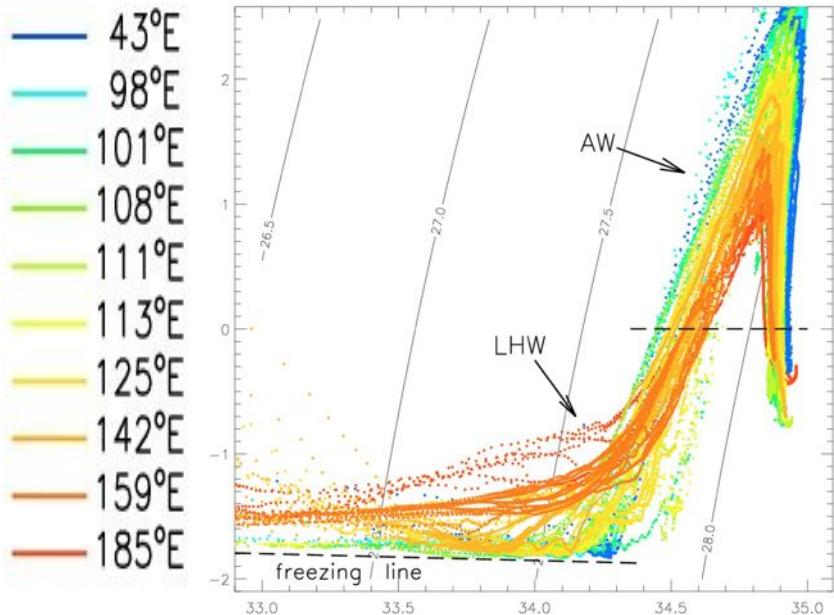
Arctic Ocean was, on average, 0.24°C warmer in 2007 compared with the 1990s



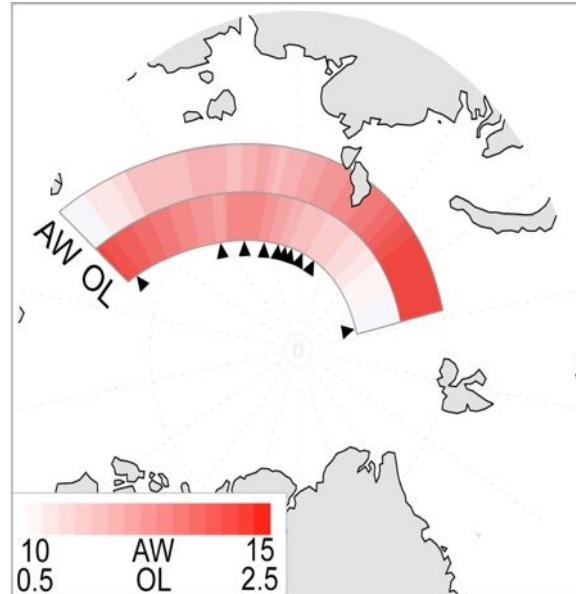
On-going warming
of the Arctic Ocean
passed its peak?

[Polyakov et al. 2010]

Transfer of warmth from the intermediate Atlantic Water (AW) to overlying layers (OL)



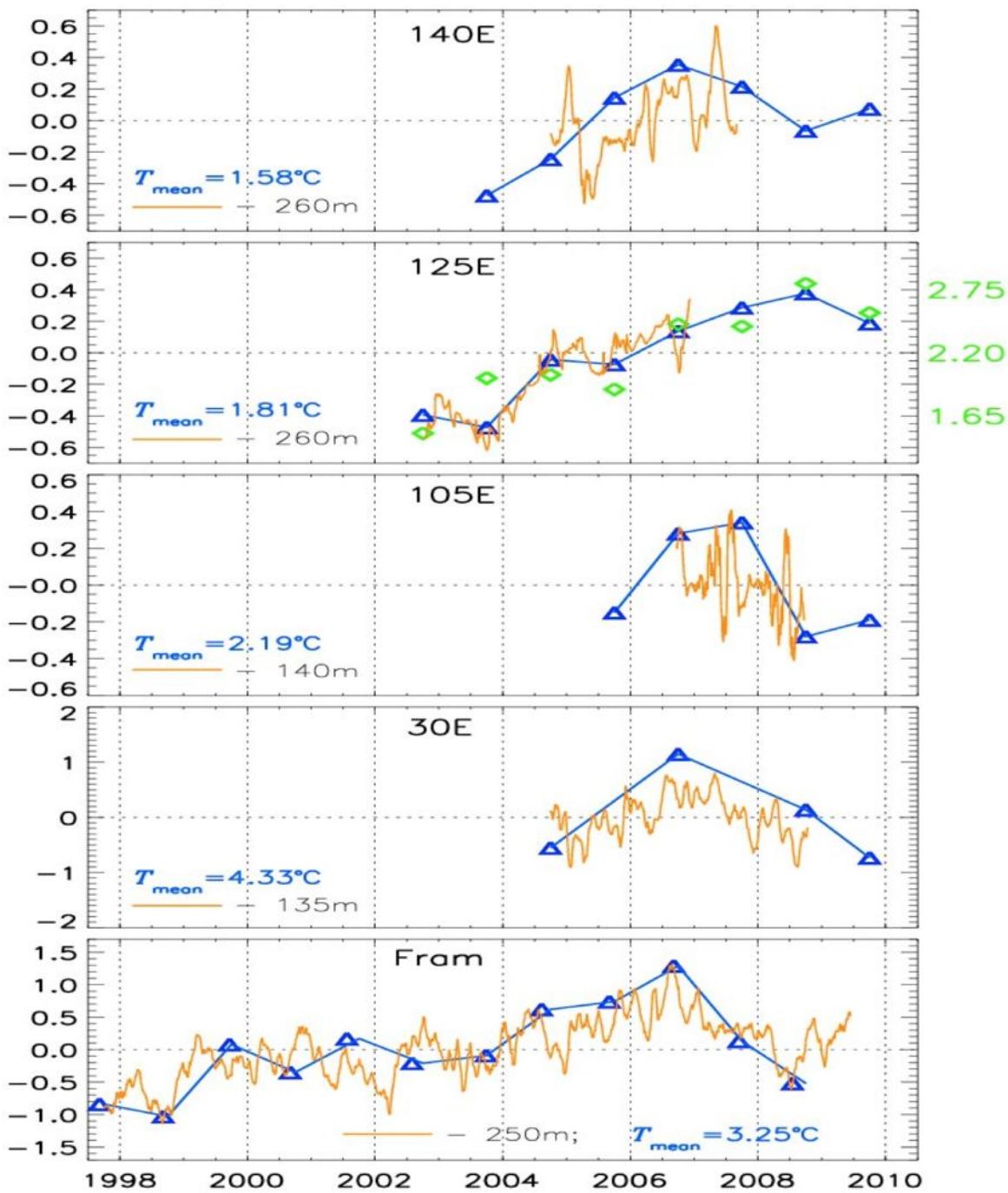
T-S diagram for the ten cross-sections carried out in 2007. At low salinities (<34.3 psu), temperatures are substantially higher at eastern sections (orange) compared with western sections (green).



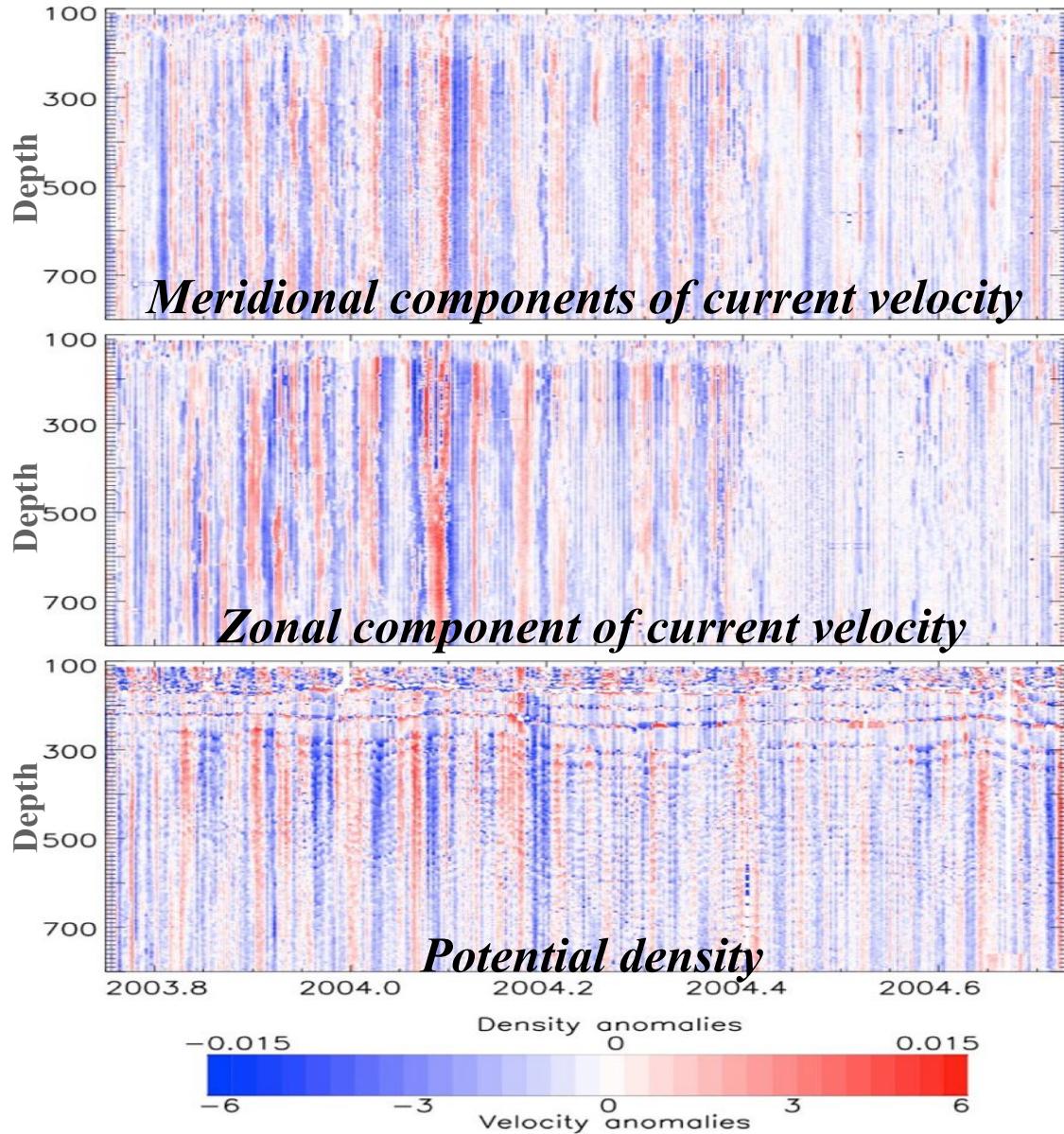
Anomalous heat content density (MJ/m^3) in the AW and OL. Black triangles show positions of cross-sections. OL heat gain constitutes $\sim 7\%$ of total AW heat loss.

These figures provide evidence of the upward spread of AW heat along the AW path.

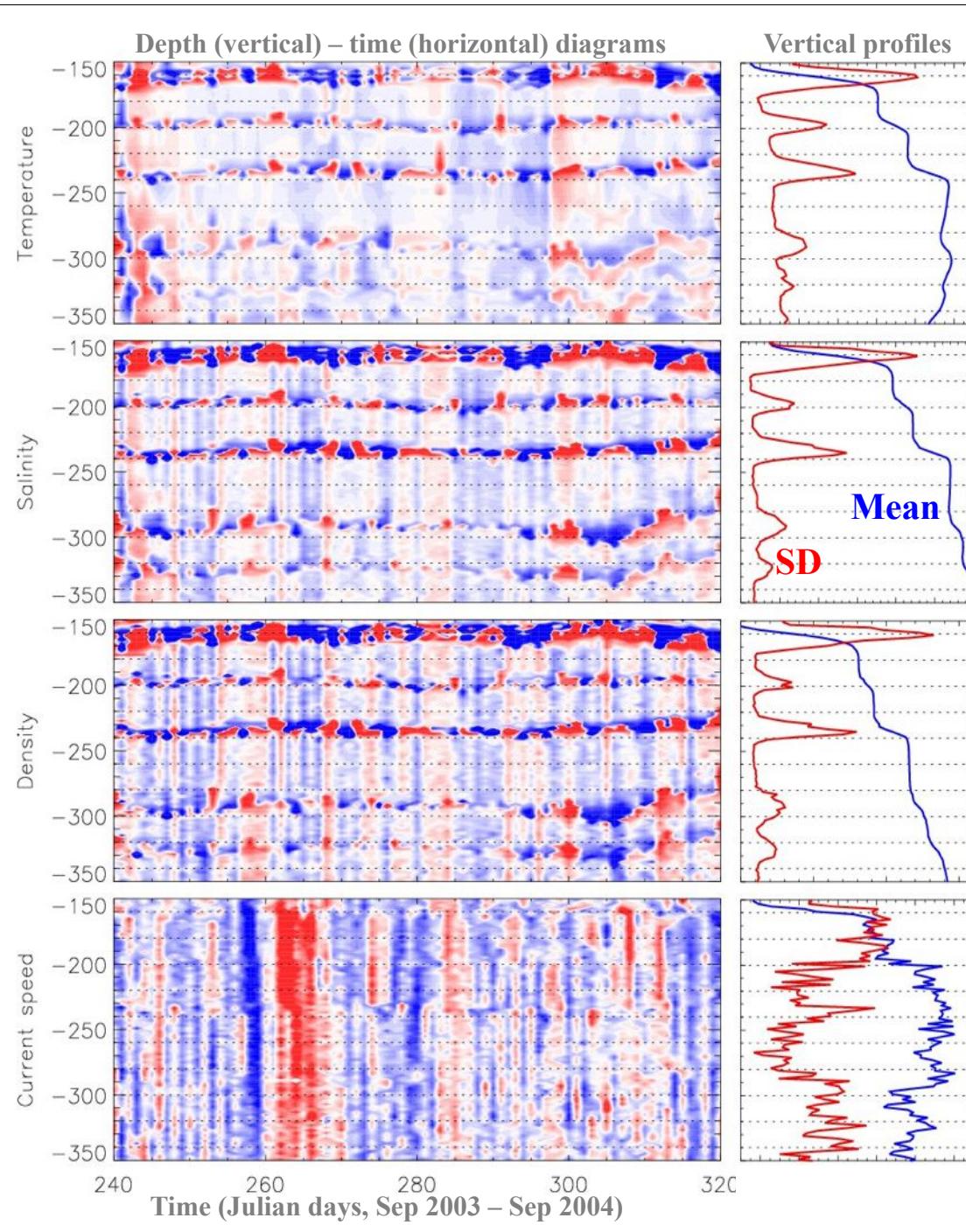
**Atlantic Water (AW)
temperature anomalies
from CTD sections
(blue) and moorings
(yellow) and heat
content density of the
layer overlying AW
(~50–125m depth range,
MJ/m³, green).**



2003-04 anomalies of current velocity and potential density at the eastern Eurasian slope



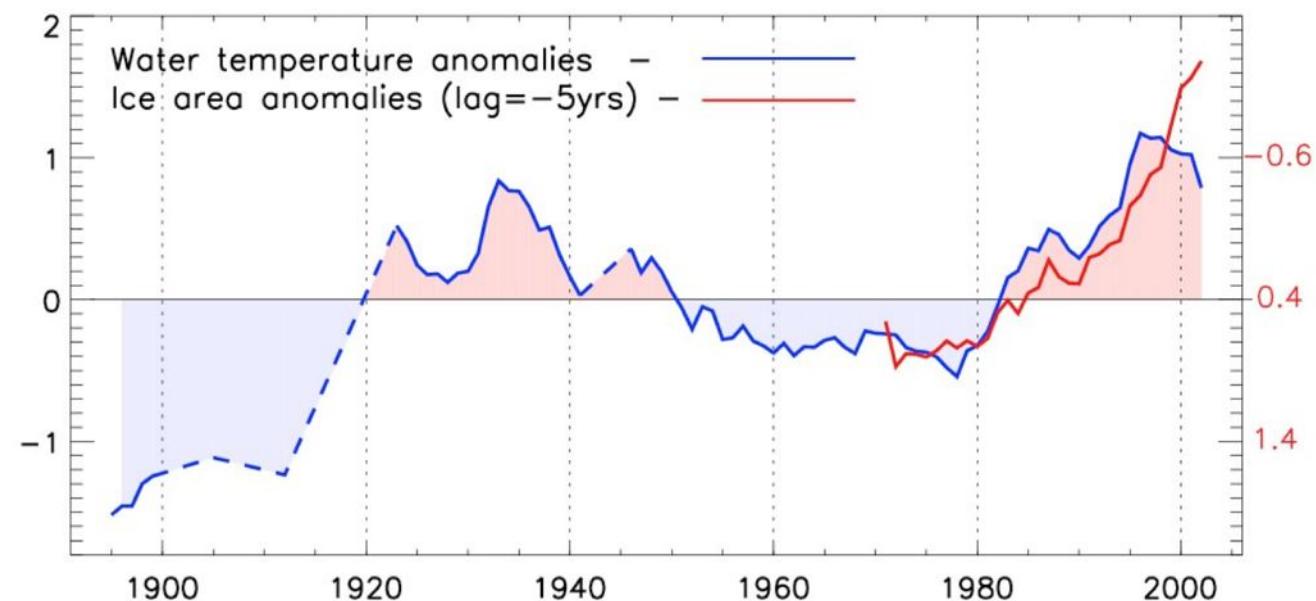
Intensive eddy activity expressed as vertical strips of positive and negative anomalies is striking



Temperature, salinity, density and current speed anomalies from NABOS mooring (Laptev Sea slope, 2600m).

Layers of enhanced variations correspond to strong vertical gradients of temperature, salinity and density. No obvious relation is found between currents and step-like density structure.

Normalized AW temperature anomalies and September Arctic ice area anomalies (10^6 km^2 , reverse vertical axis is used)



Summary

- The temperature of Atlantic Water of the Arctic Ocean was, on average, 0.24°C warmer in 2007 than in the 1990s.
- Recent observations suggest that the eastern Arctic Ocean is in transition towards a cooler state.
- There is an urgent need to continue observations in the Eurasian Basin of the Arctic Ocean that have been maintained since 2002 as a part of NABOS program.

