

Mechanisms behind Decadal Variability of North Atlantic Deep Water in a coupled ice-ocean model of the Arctic-North Atlantic

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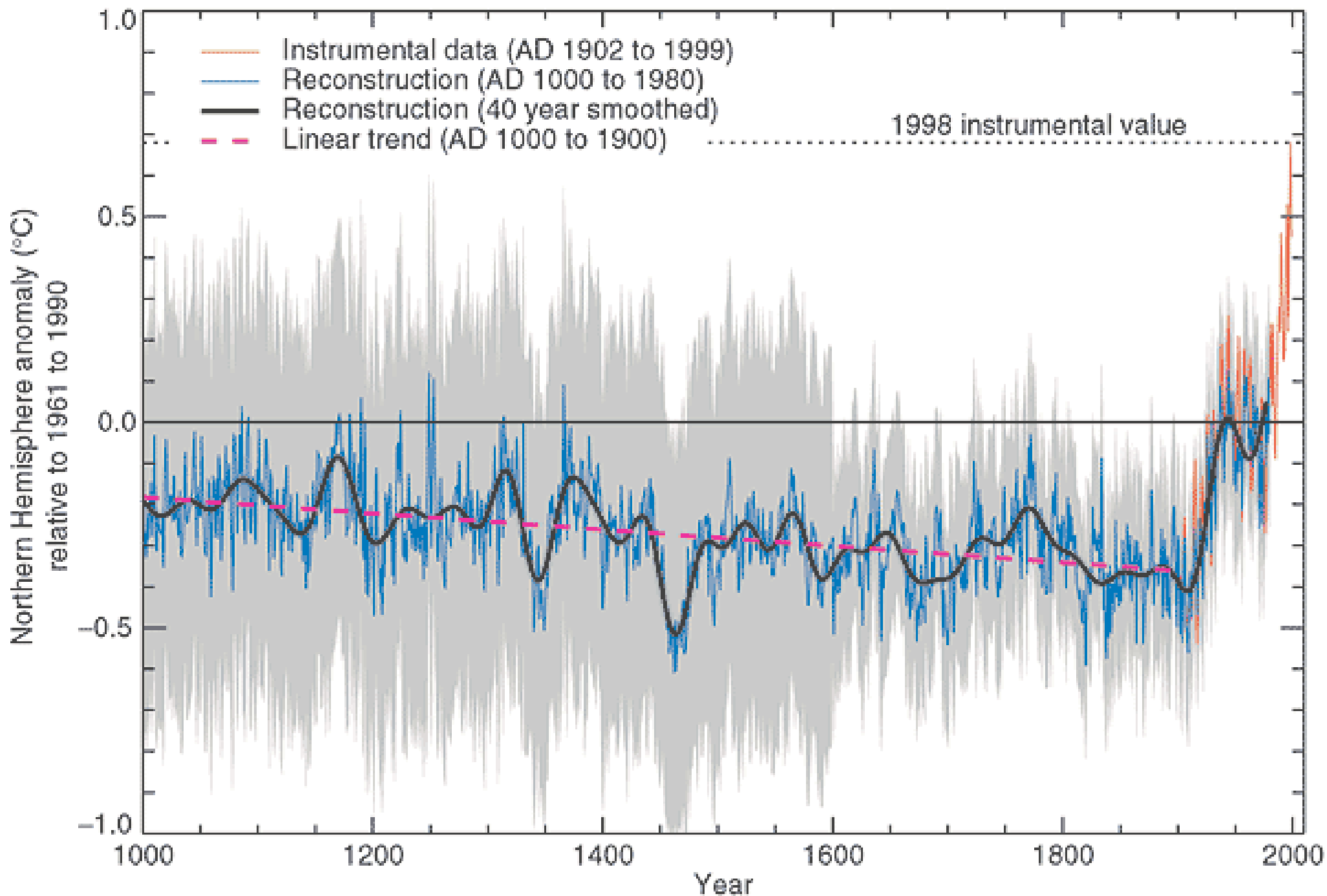
and

Center for Ocean-Land-Atmosphere Studies

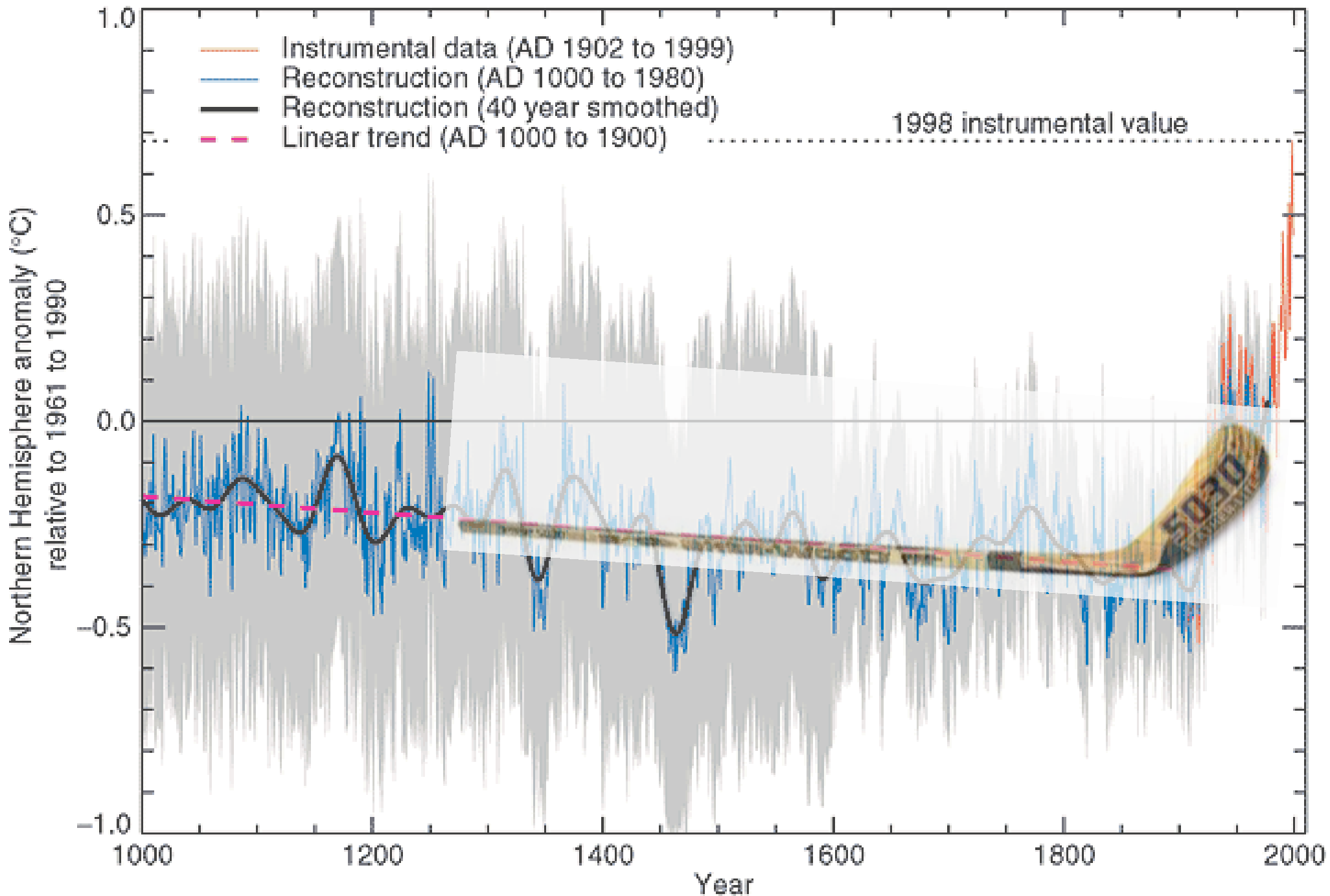
Peter Rhines, Sirpa Häkkinen and Paul Schopf



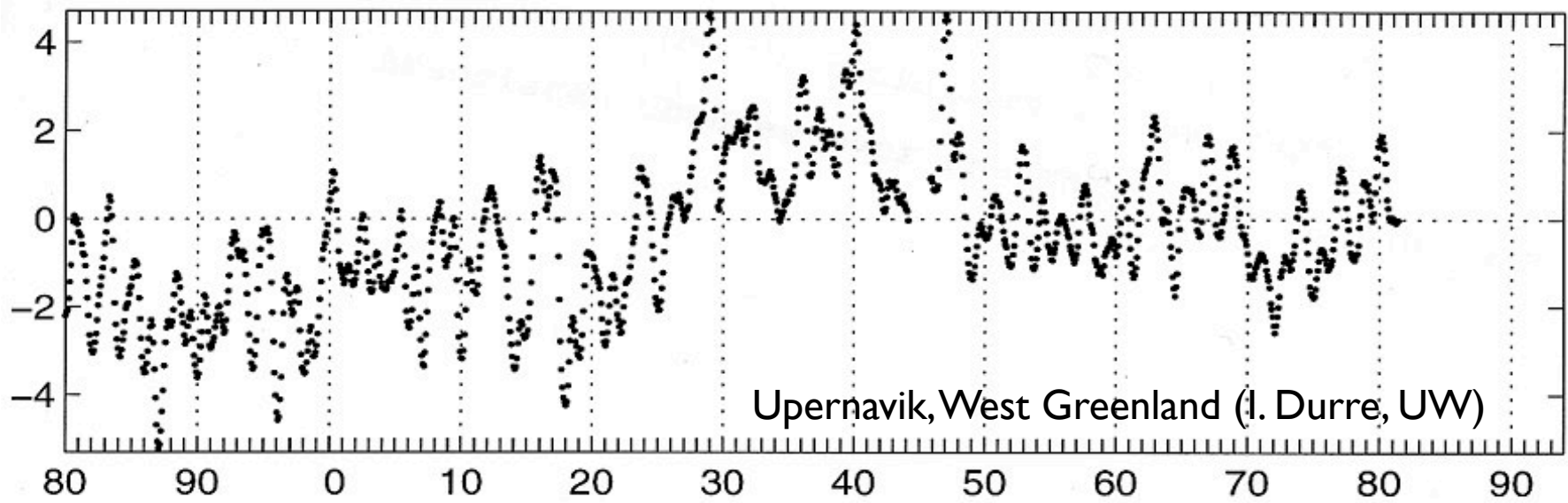
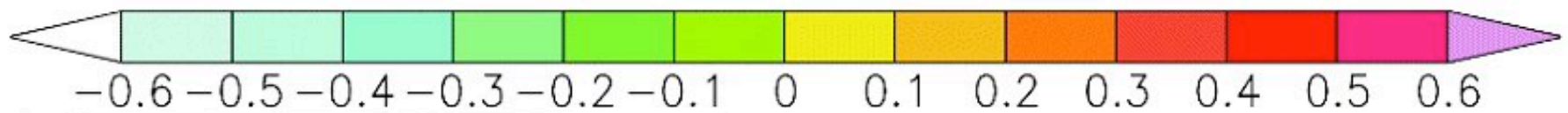
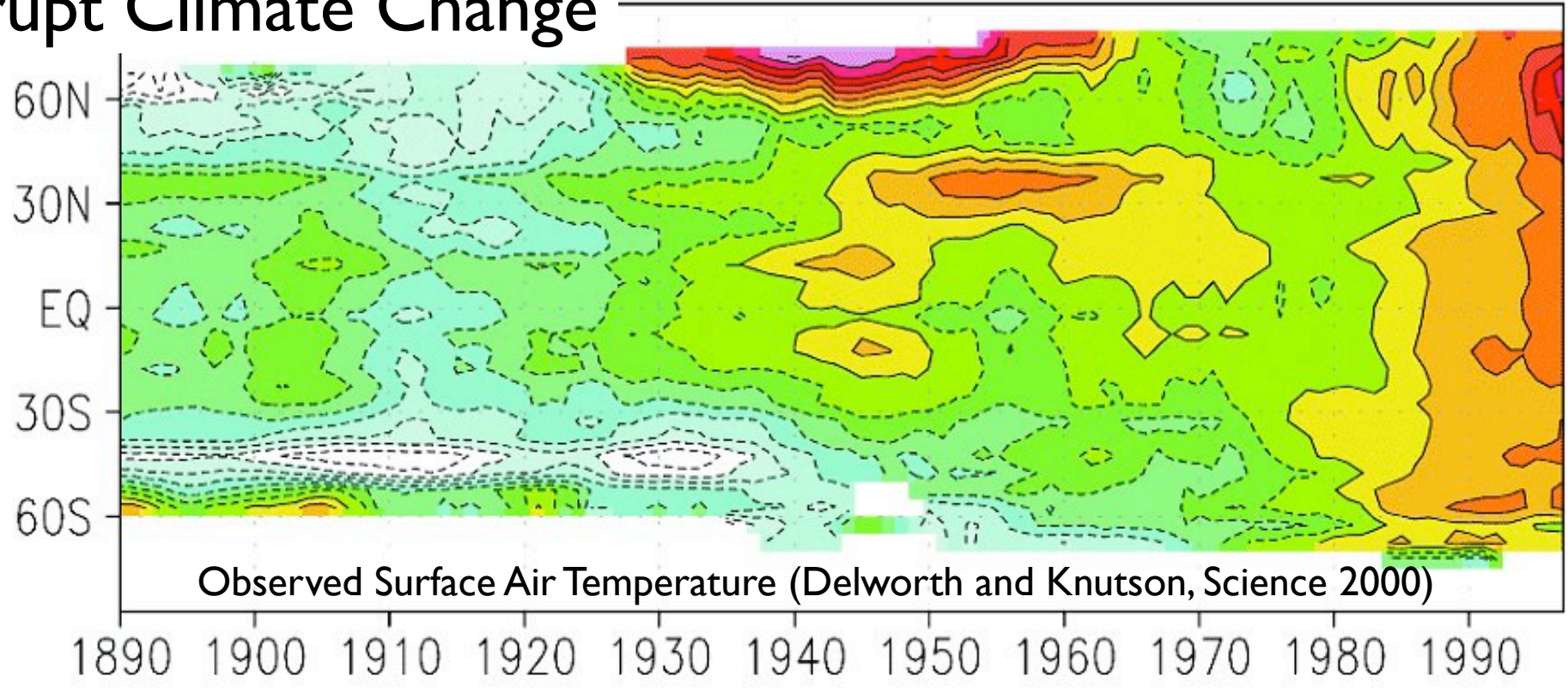
Intergovernmental Panel on Climate Change



Intergovernmental Panel on Climate Change

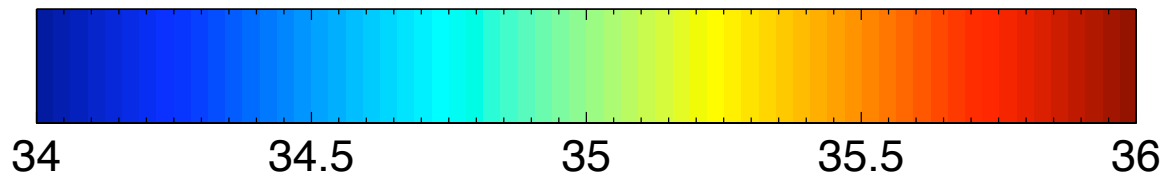
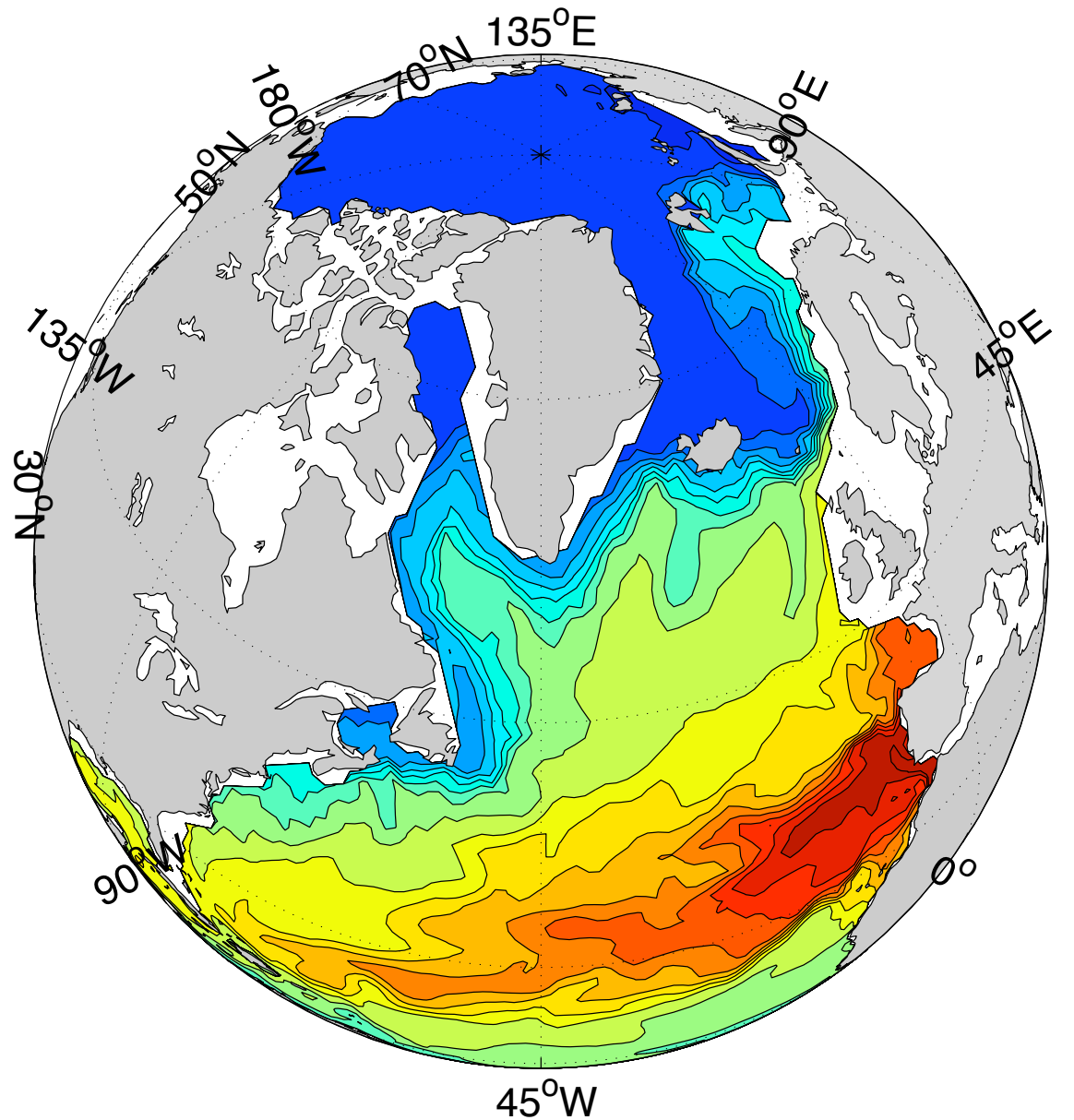


Abrupt Climate Change

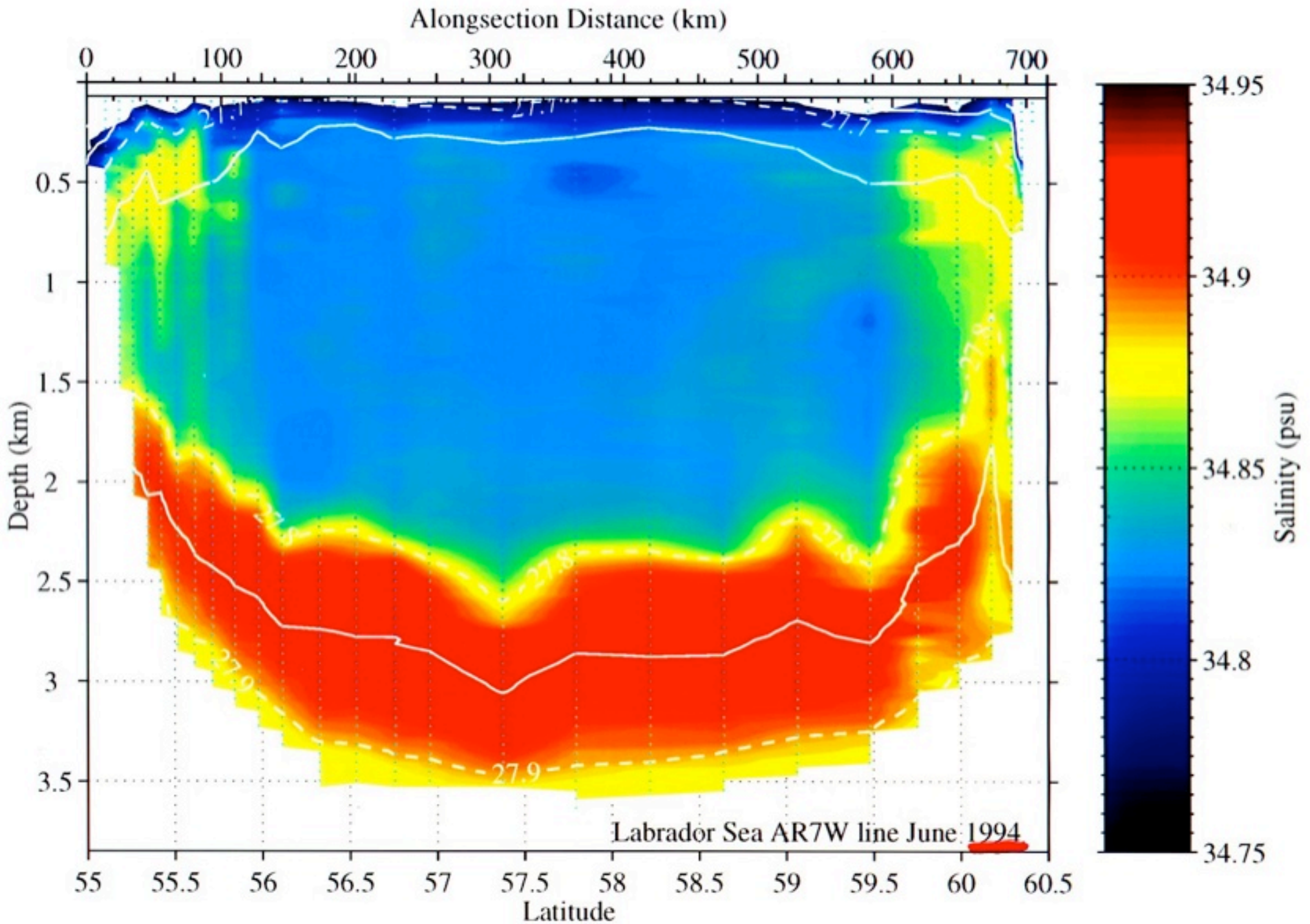


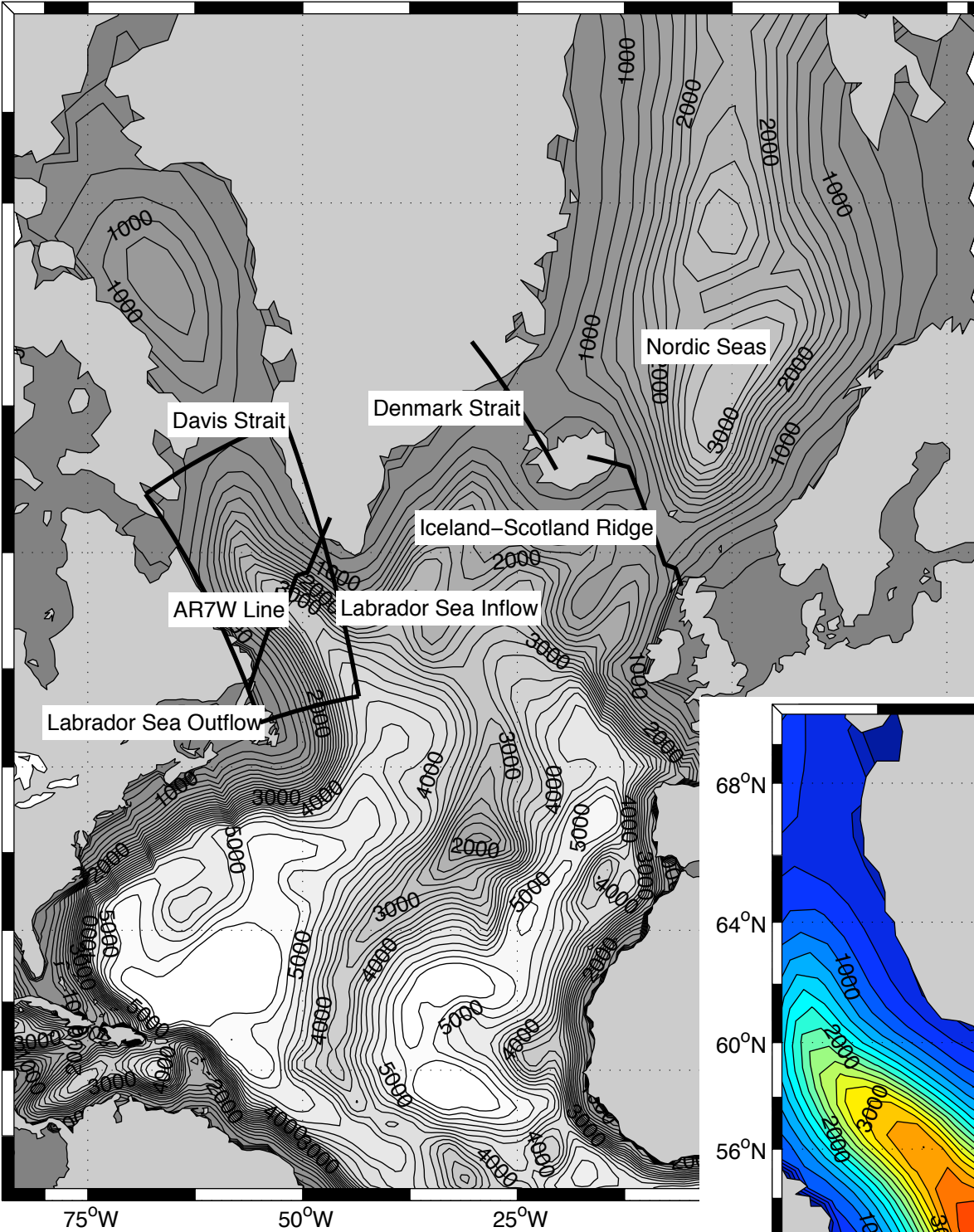
Fresh Water

Salinity on
 $\sigma_0 = 27.6$



WOCE AR7W Section - June 1994

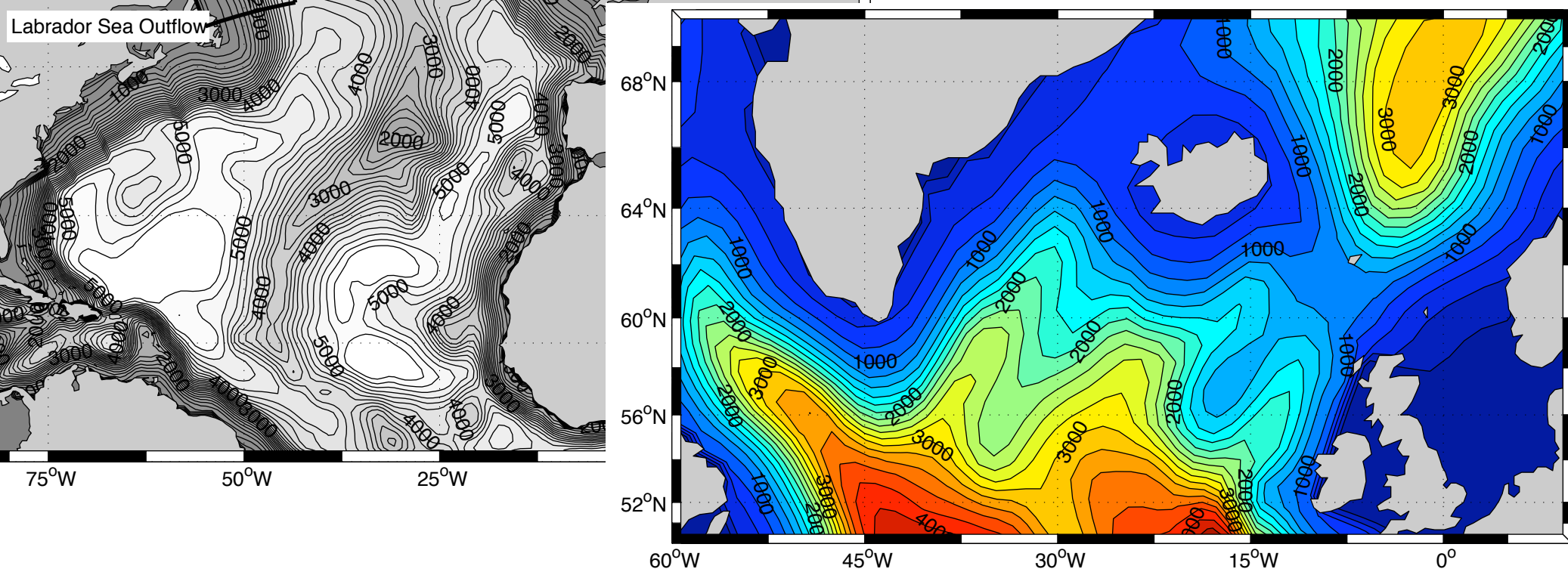




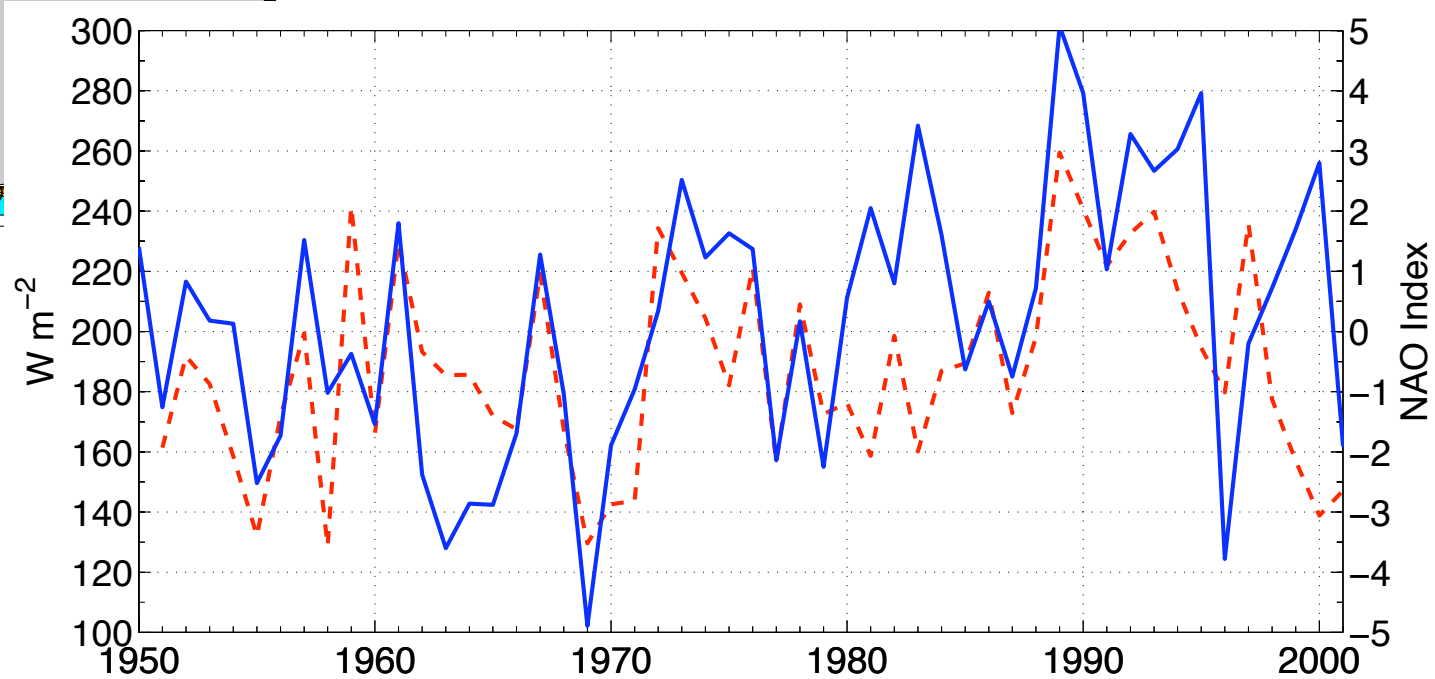
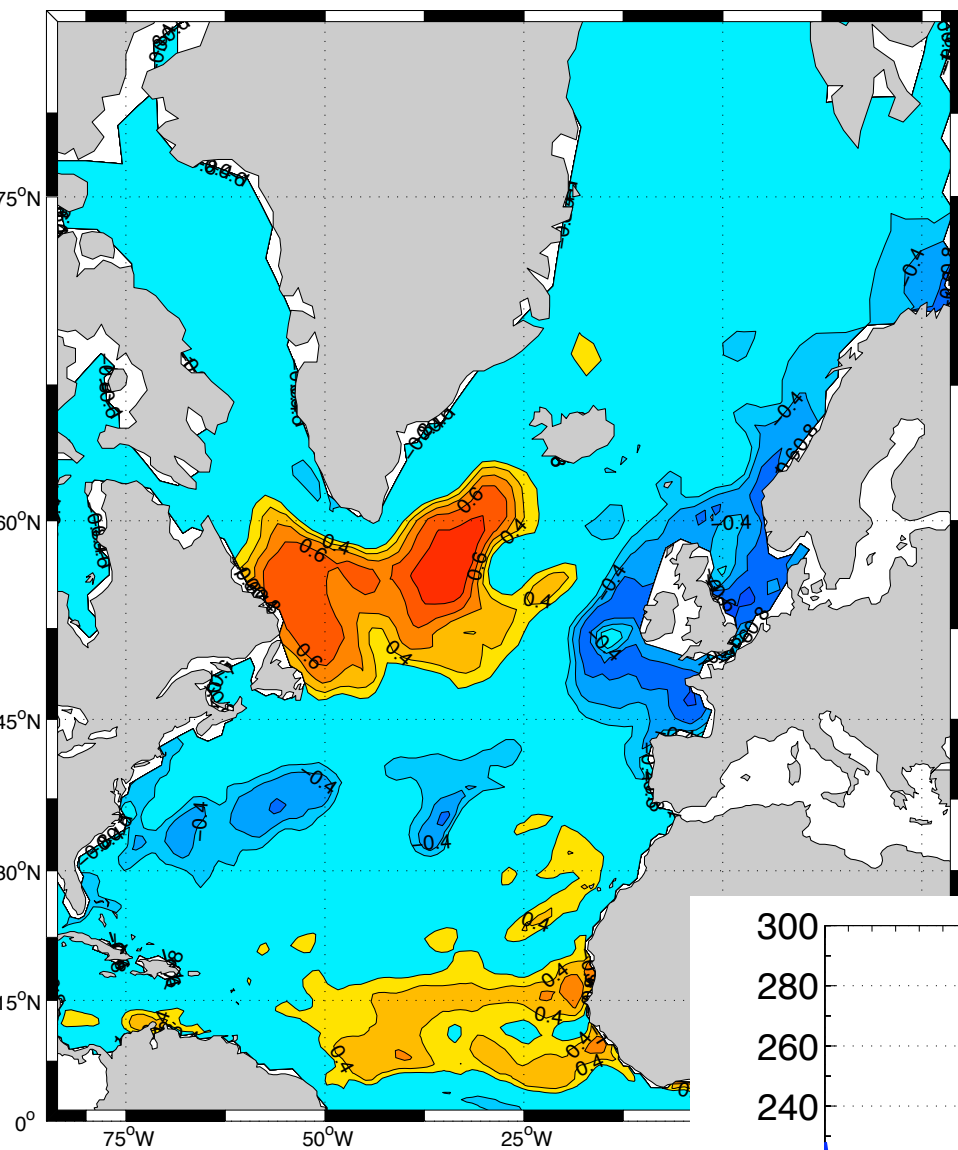
Häkkinen / POM

Topography-following
Sigma-coordinate

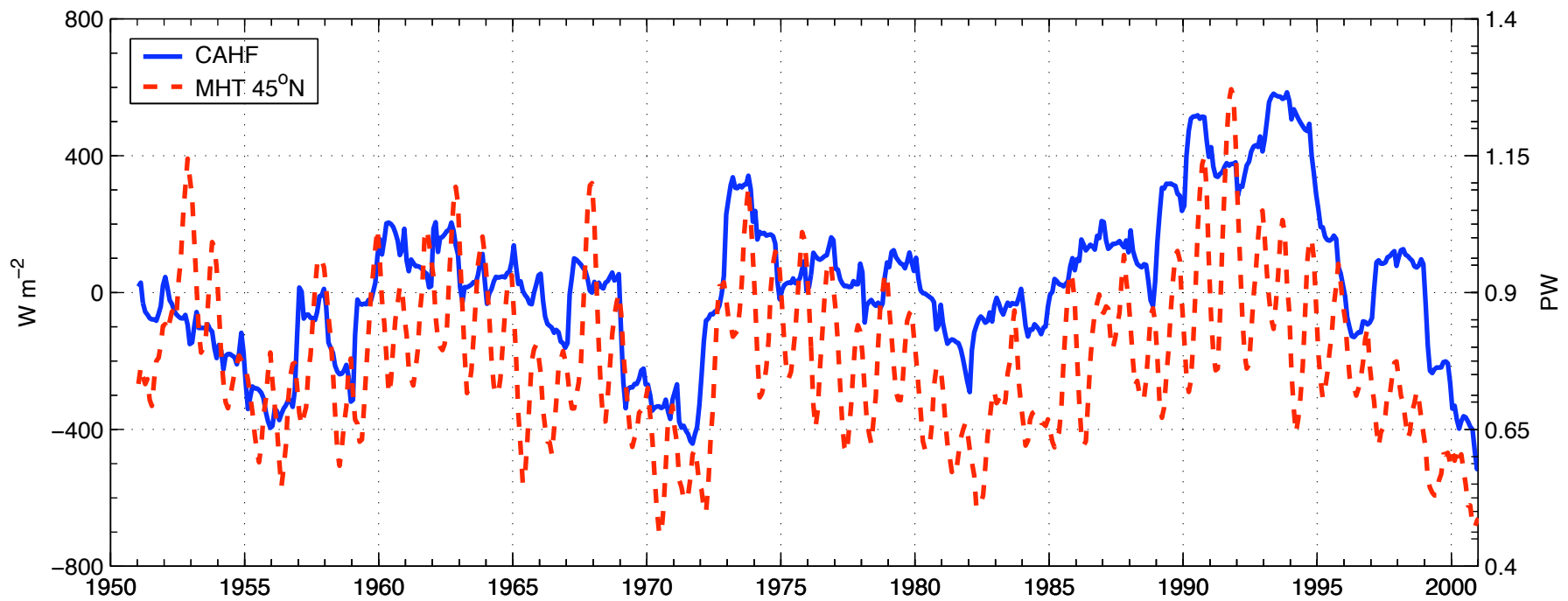
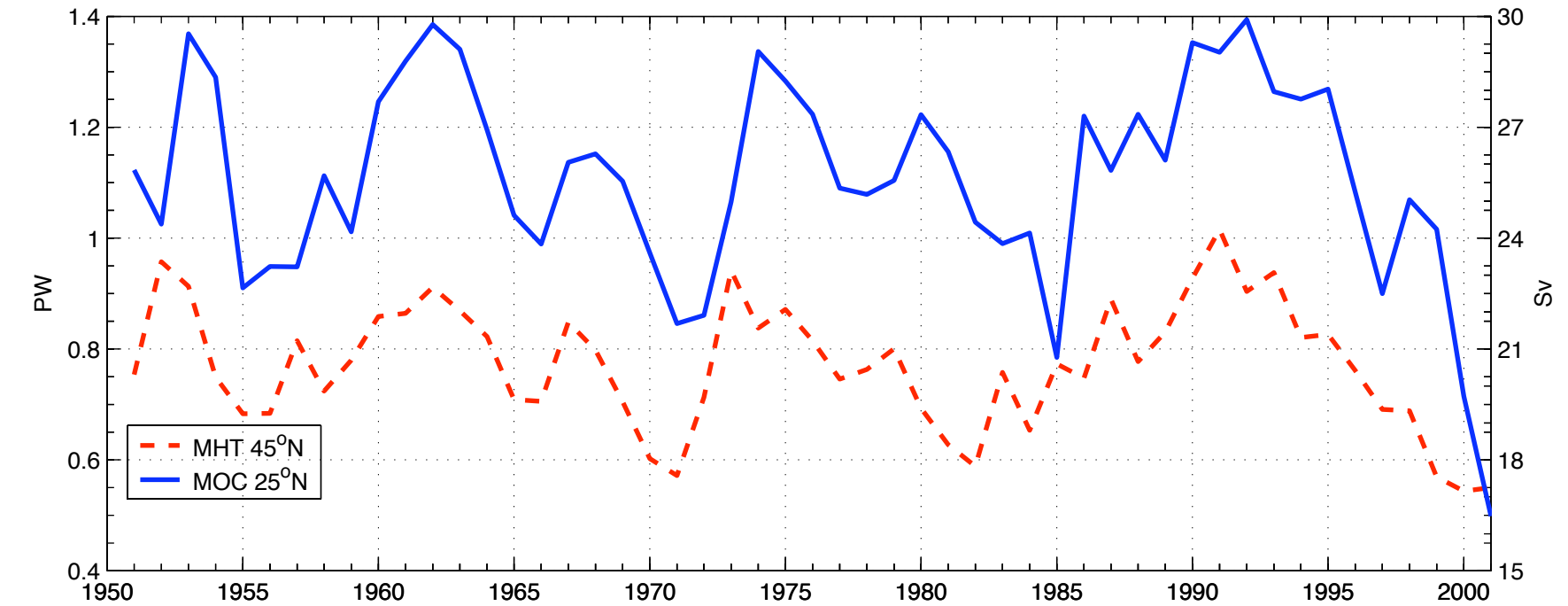
Hibler sea-ice dynamics



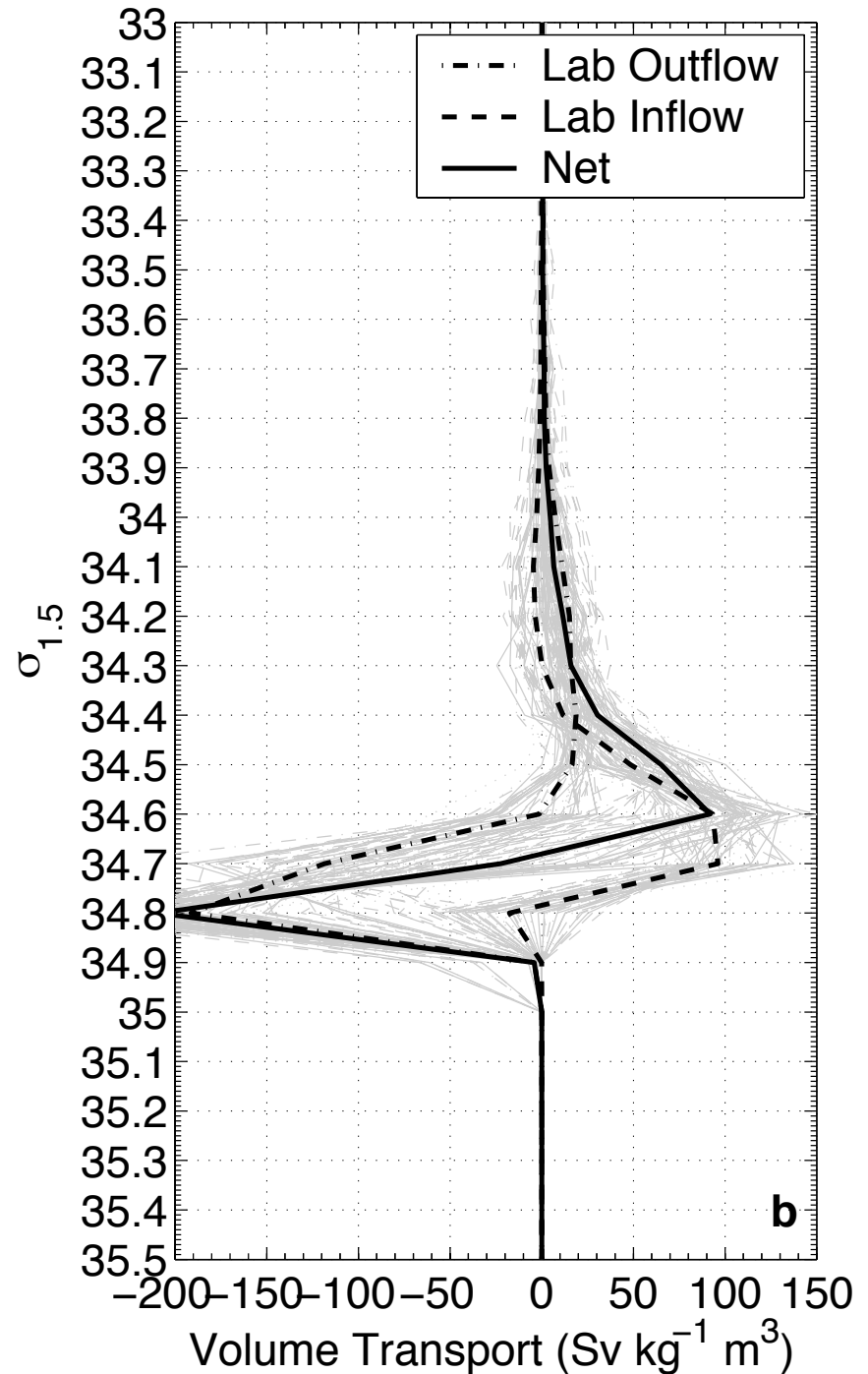
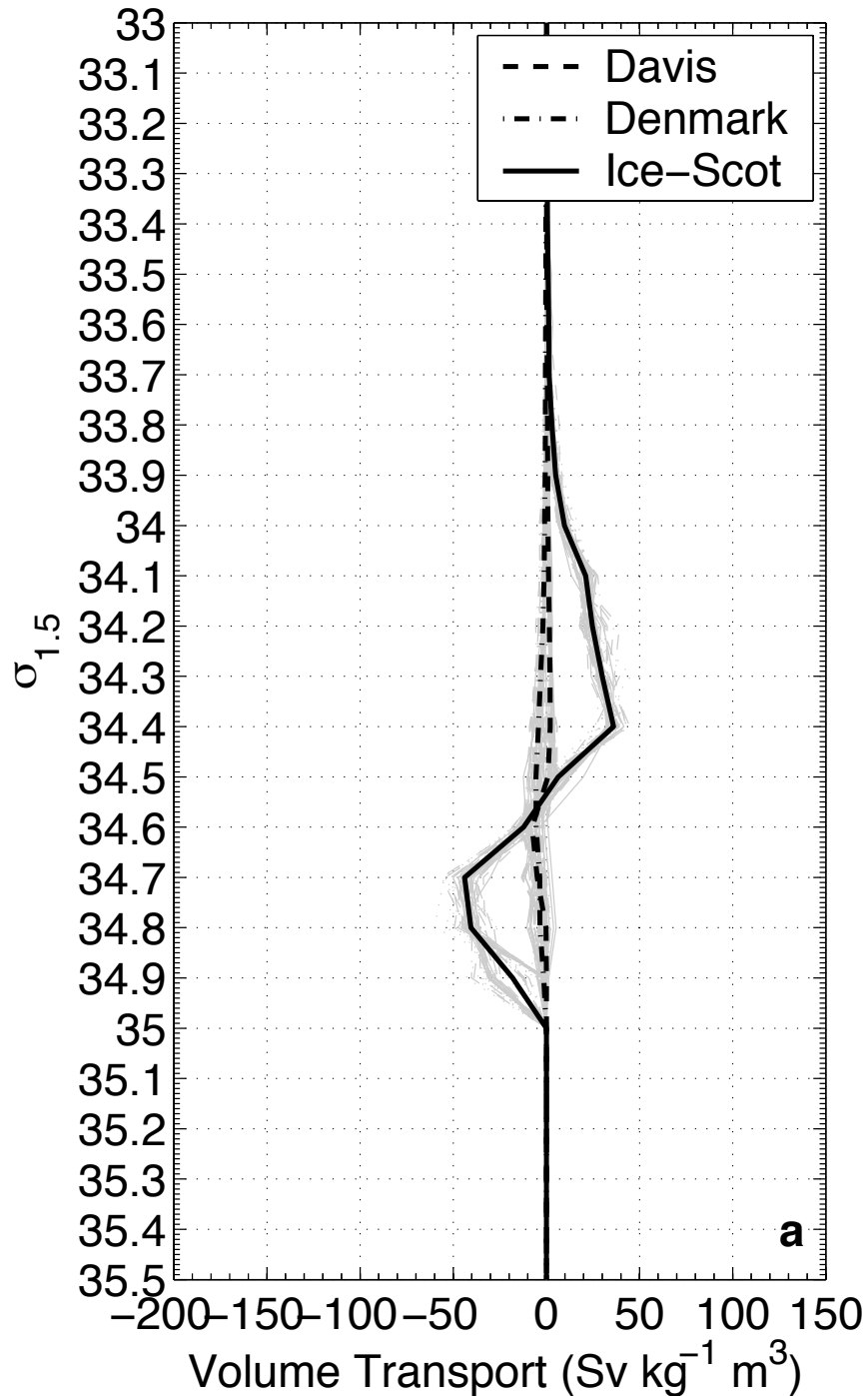
Correlation of NAO and Surface Heat Flux



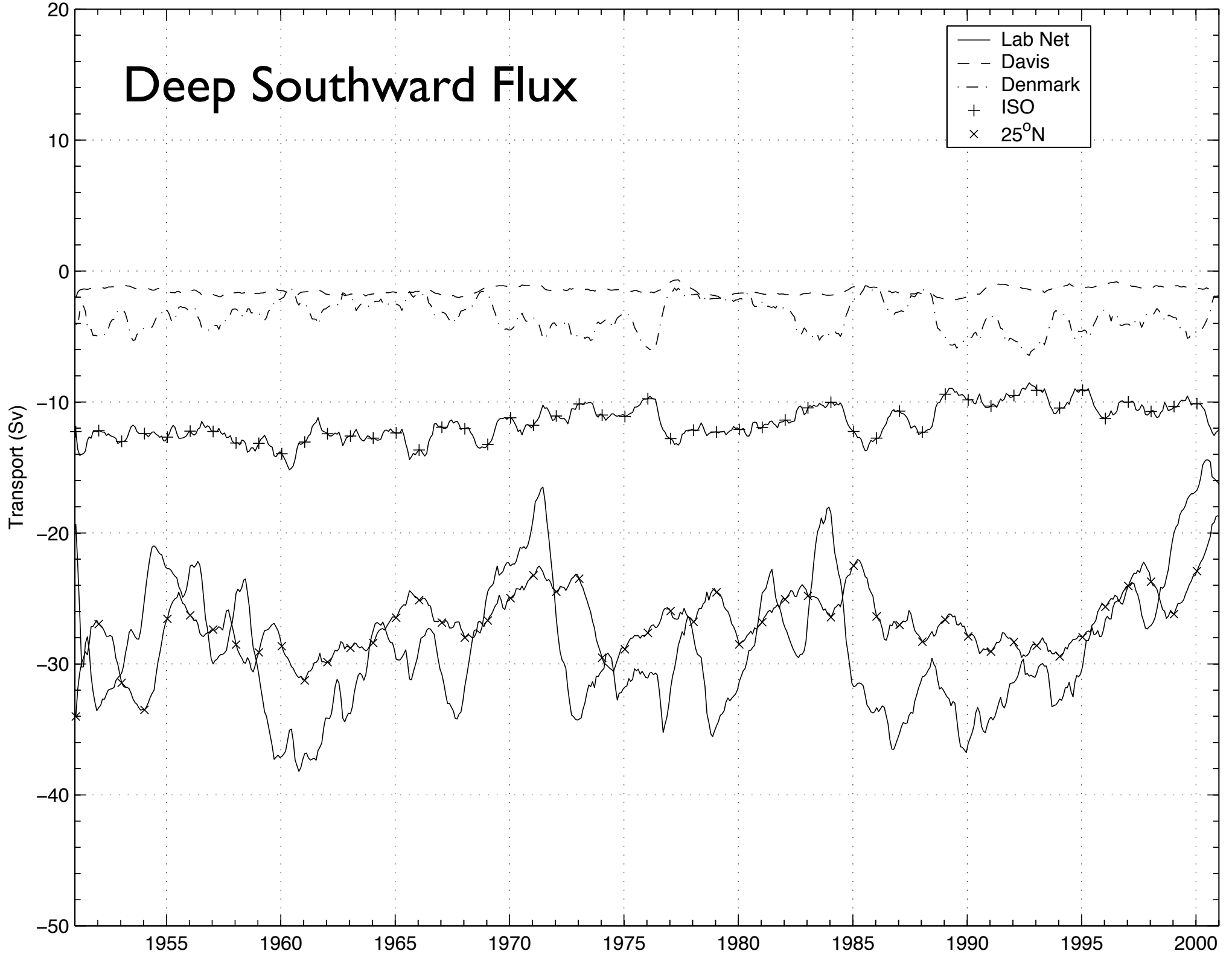
Meridional Overturning / Heat Transport and Cumulative Anomalous Heat Flux

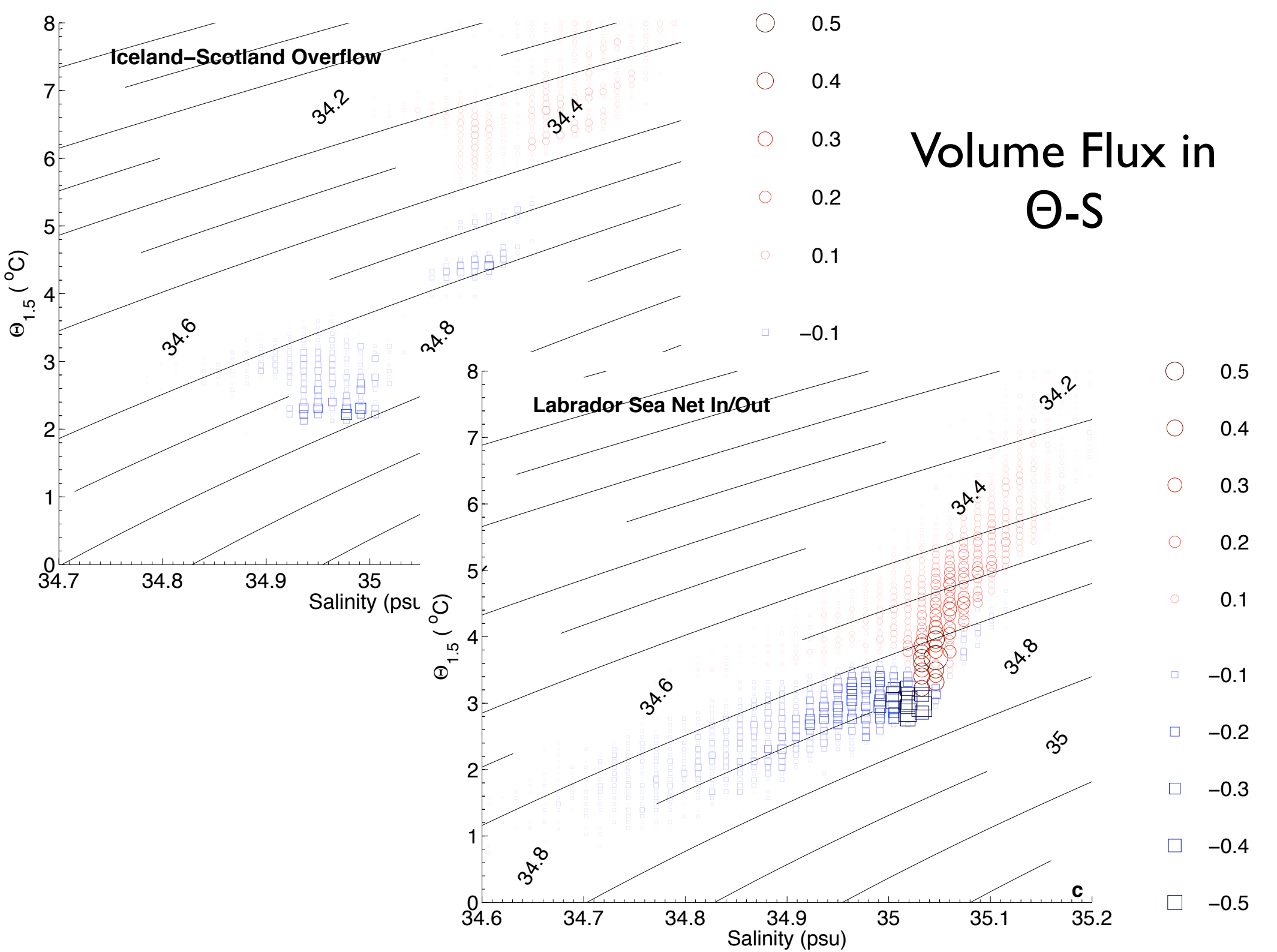


Volume Transport



Deep Southward Flux

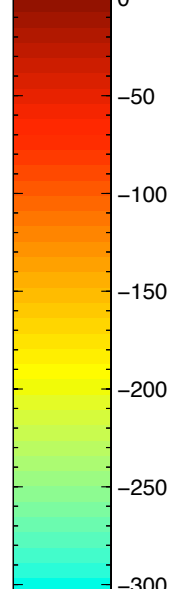
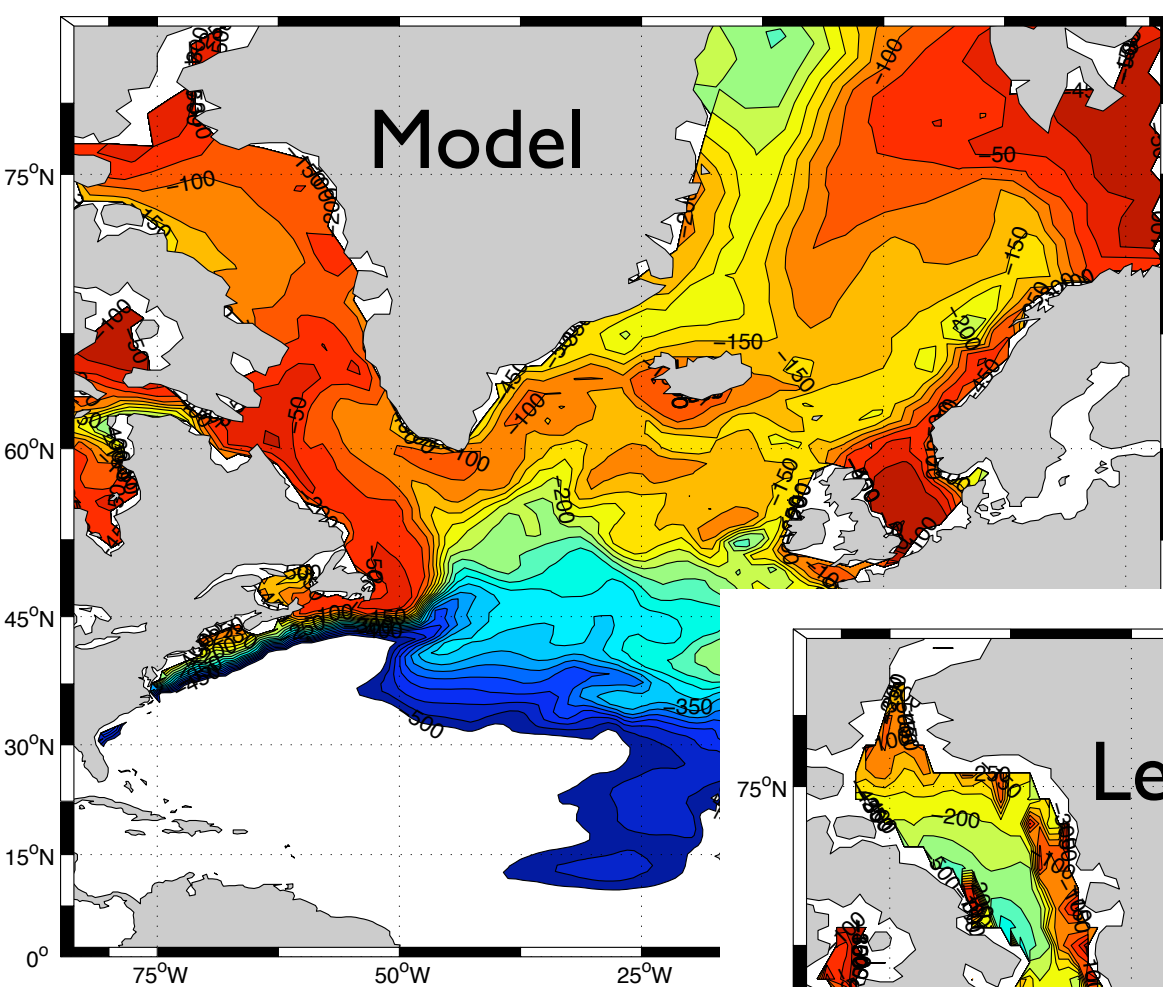




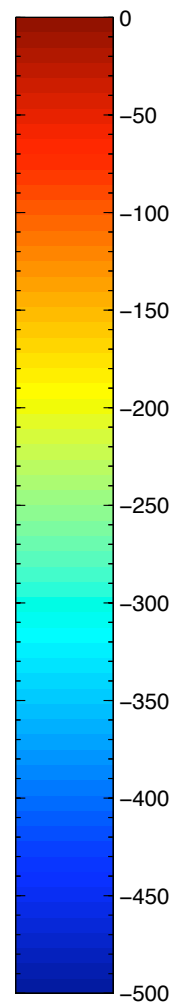
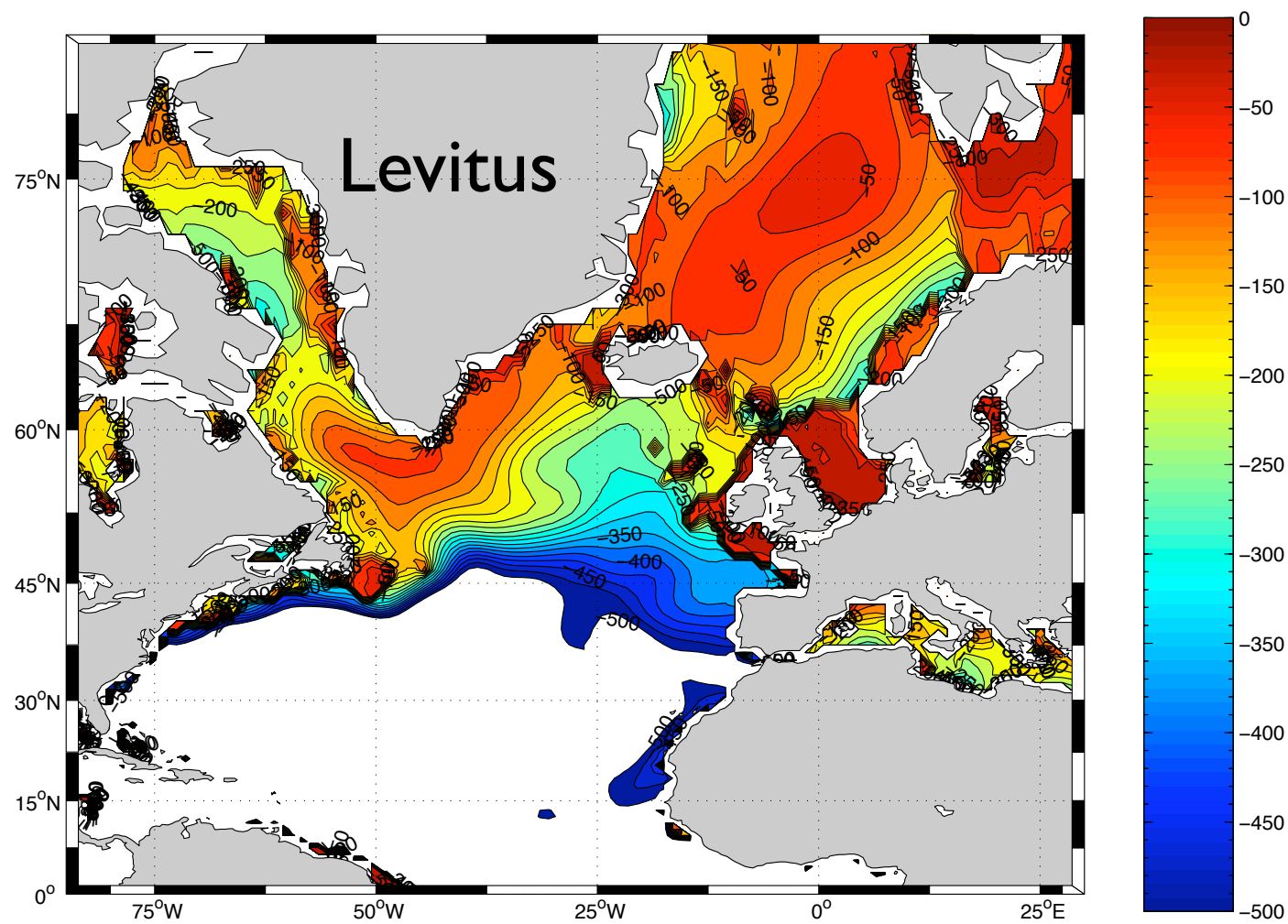
Integrated Buoyancy Anomaly

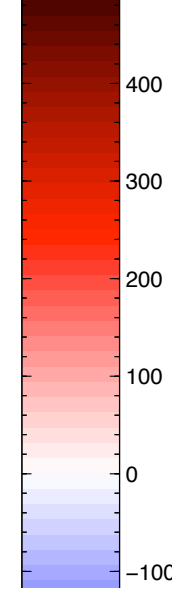
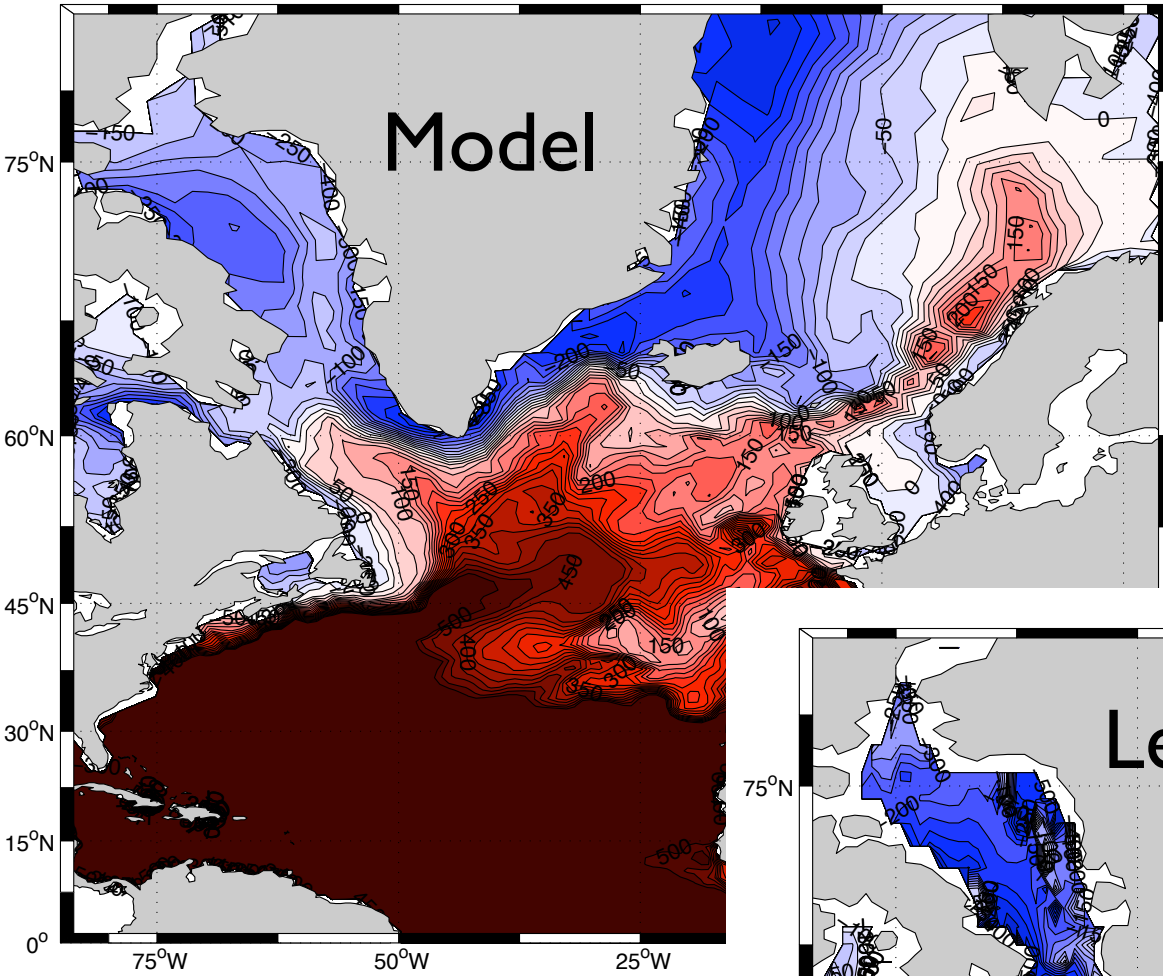
$$B_{anom} = \int_0^h \sigma_{1.5} dz - \sigma_{1.5} h$$

- Convection barrier
- Note that we can hold salinity or temperature fixed to approximate the relative contribution of Θ or S respectively.

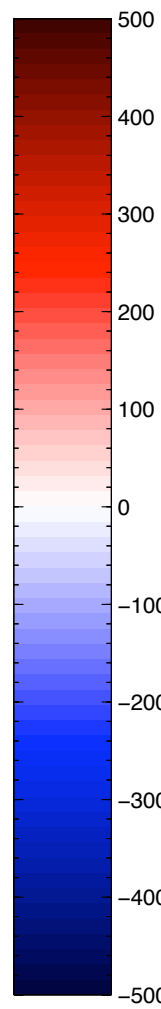
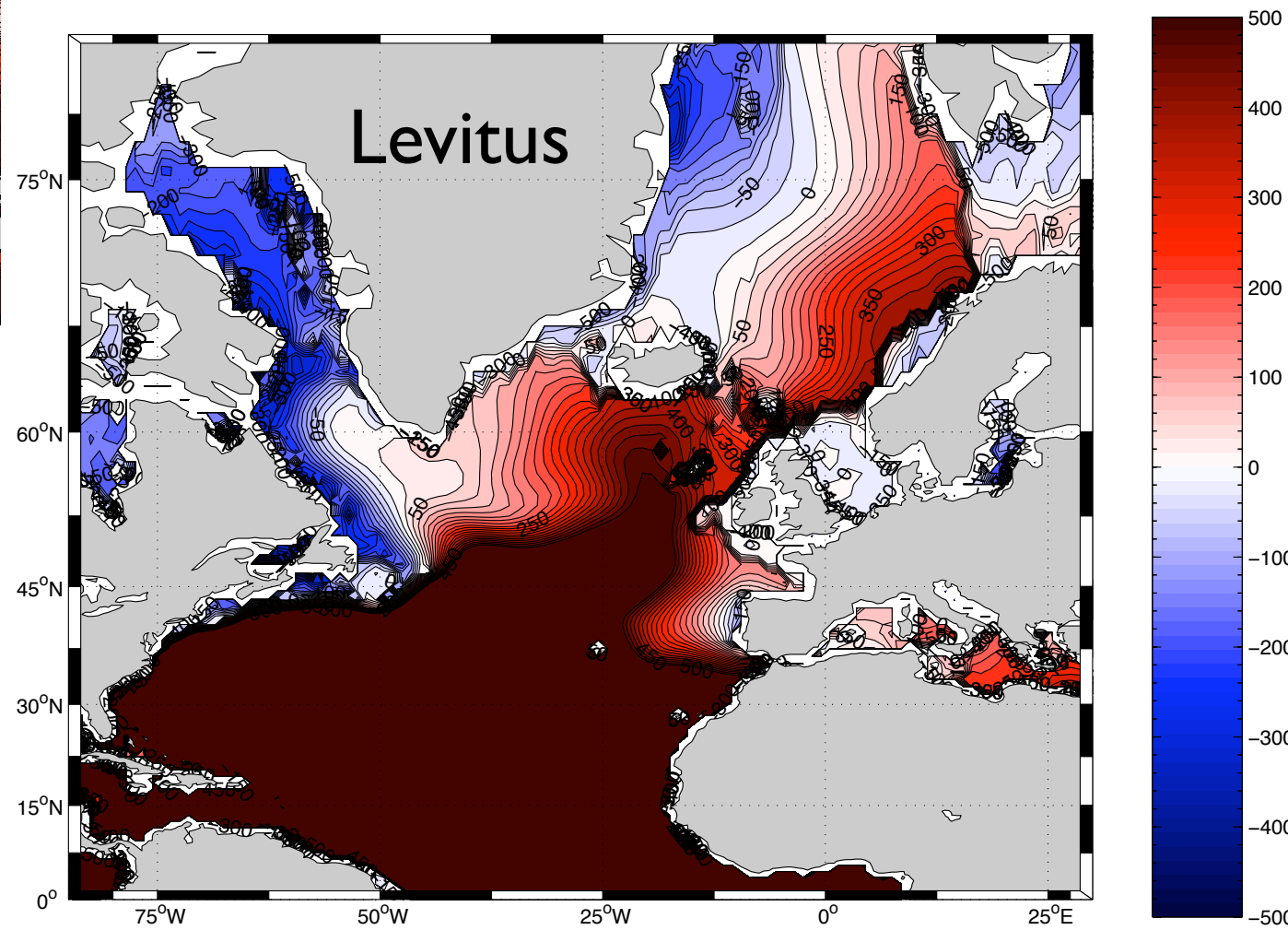


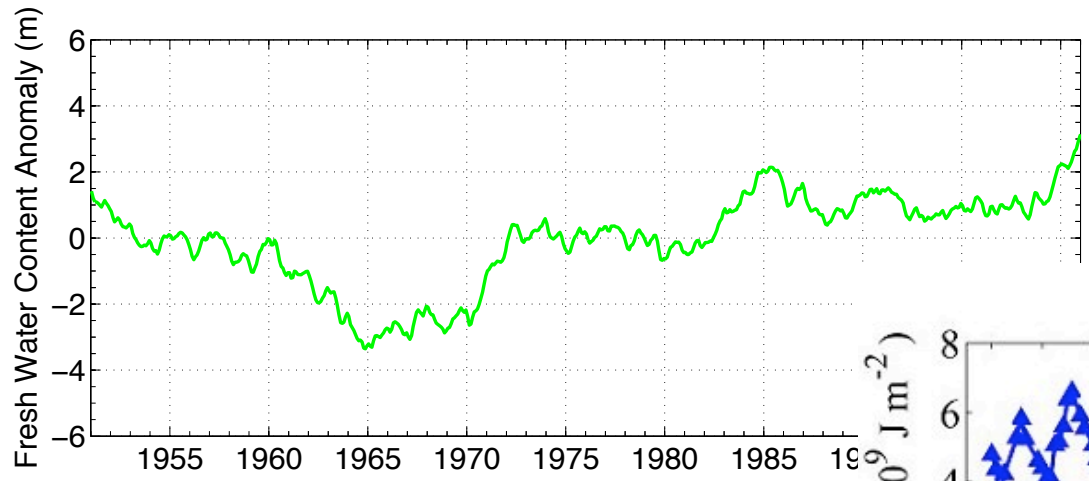
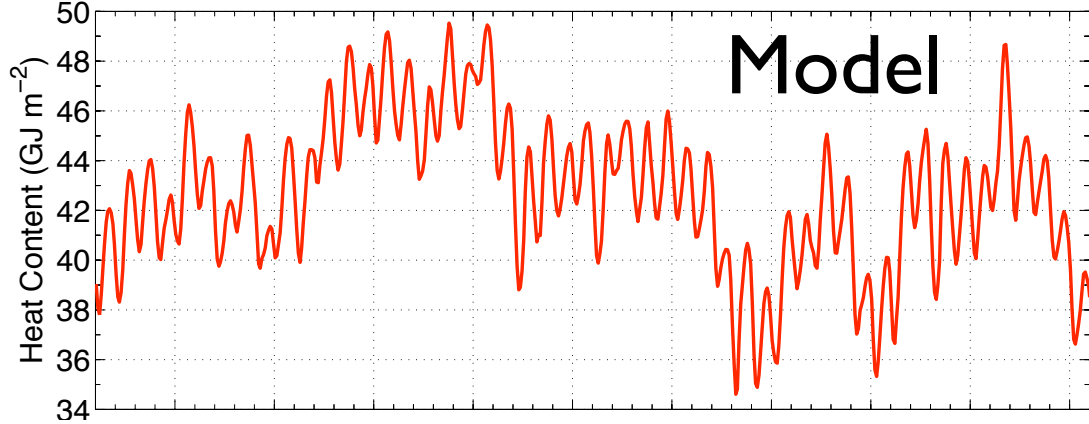
Integrated buoyancy anomaly at 1000 m.



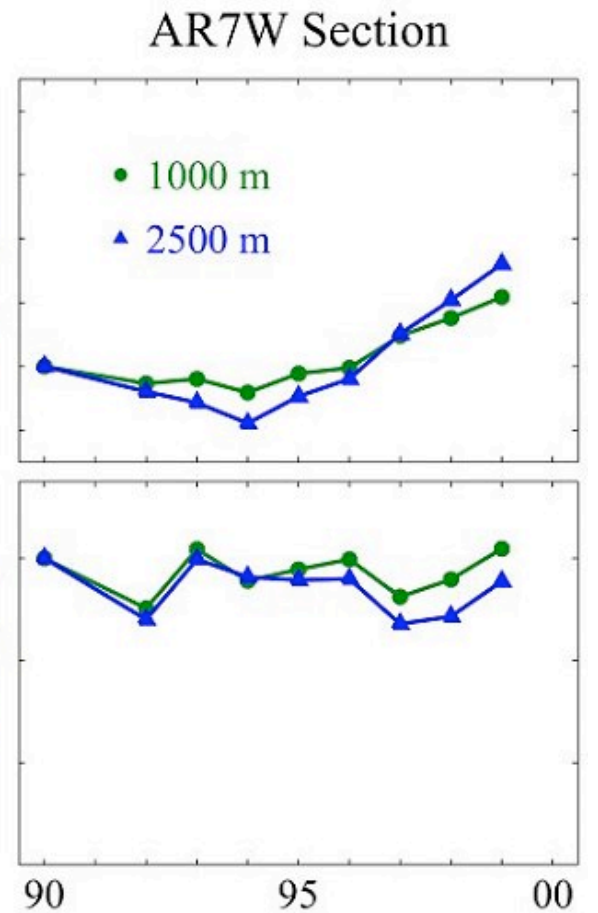
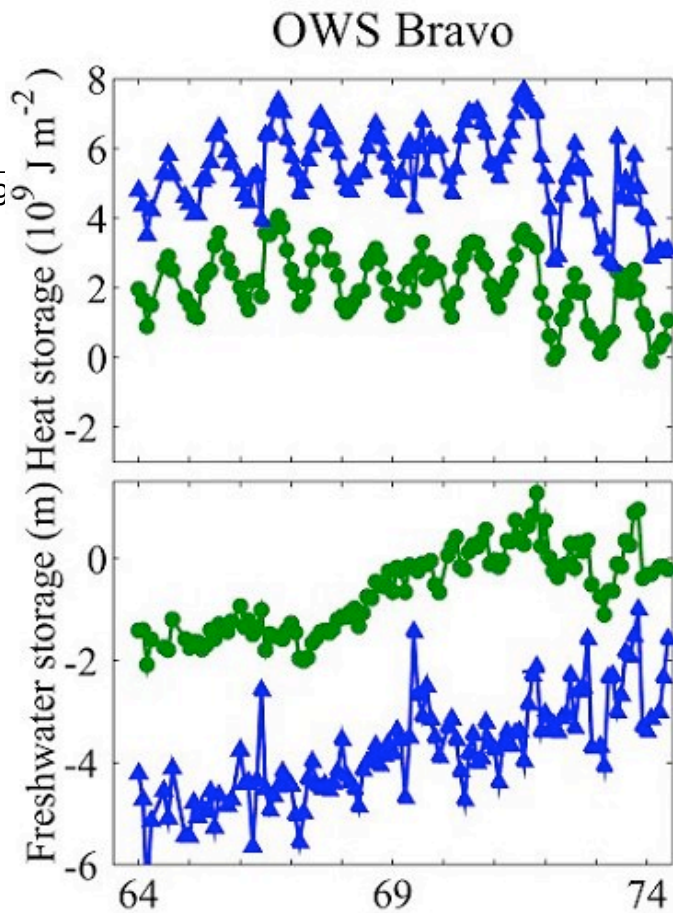


Difference of $\Theta - S$ contribution





Integrated Heat and Fresh Water Content



Summary

- Surface heat flux in the Labrador Sea appears to be the primary driver of MOC variability in the model.
- Short-circuit route of the North Atlantic Current directly into the Labrador Sea brings warm and salty waters in connection with surface heat loss.
- Subpolar gyre is a key region of convection in a number of ocean models regardless of overflow simulation.
- Useful techniques for model analysis.
- Relationship of convection to MOC?