Arctic Outflow West of Greenland: Fluxes at Davis Strait

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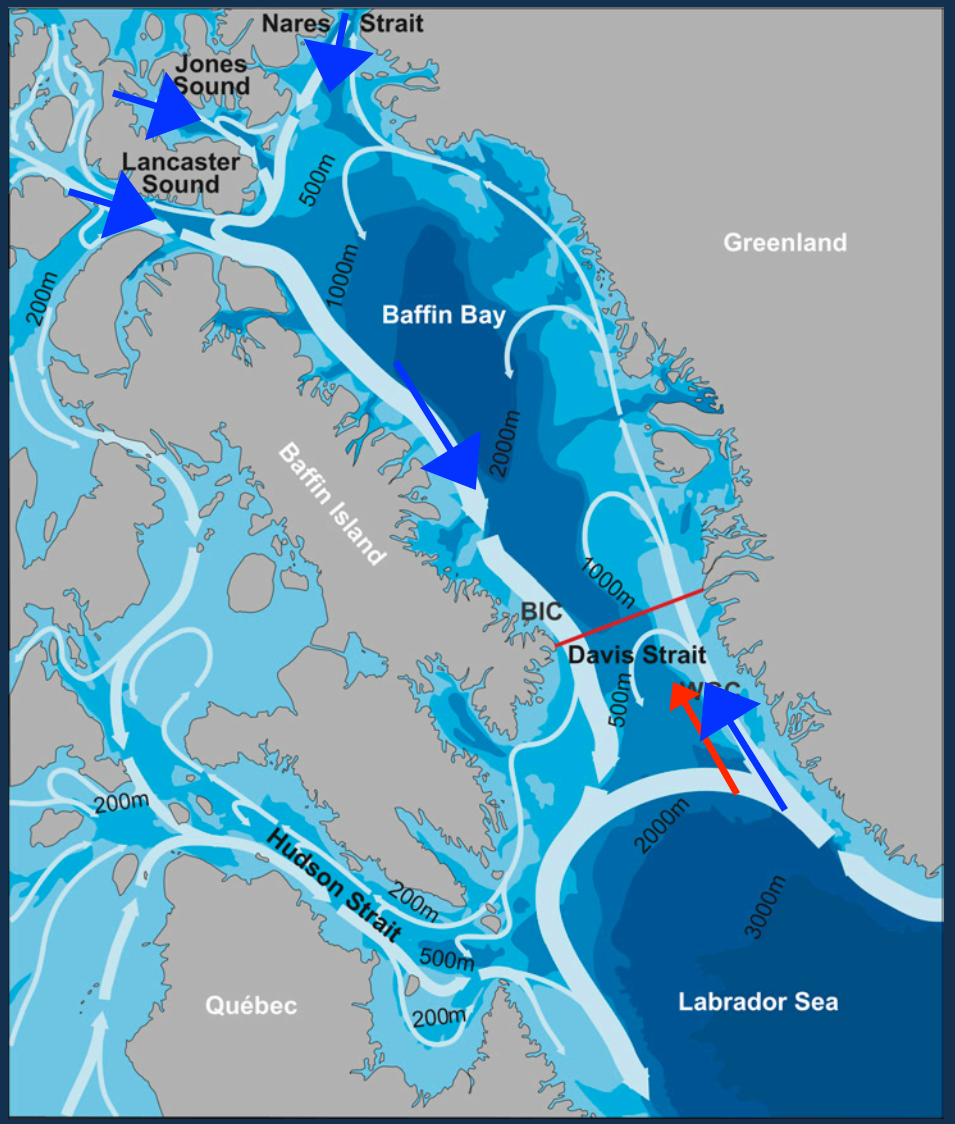
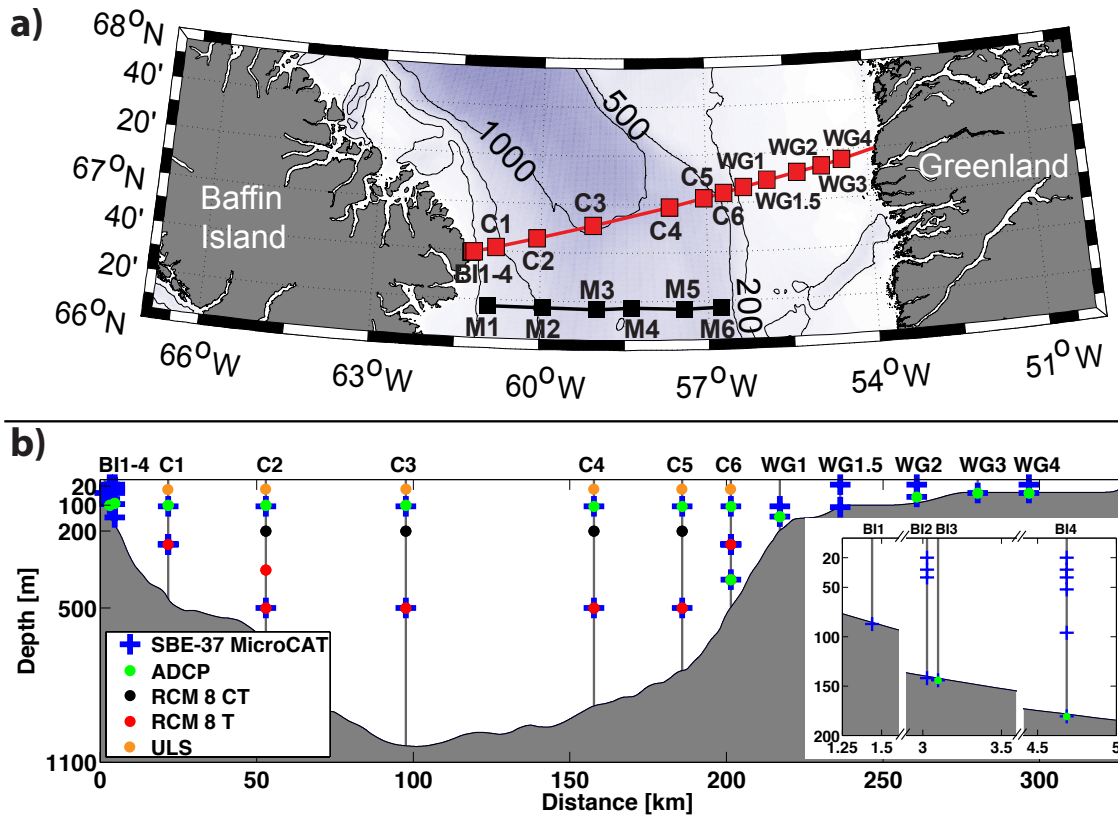
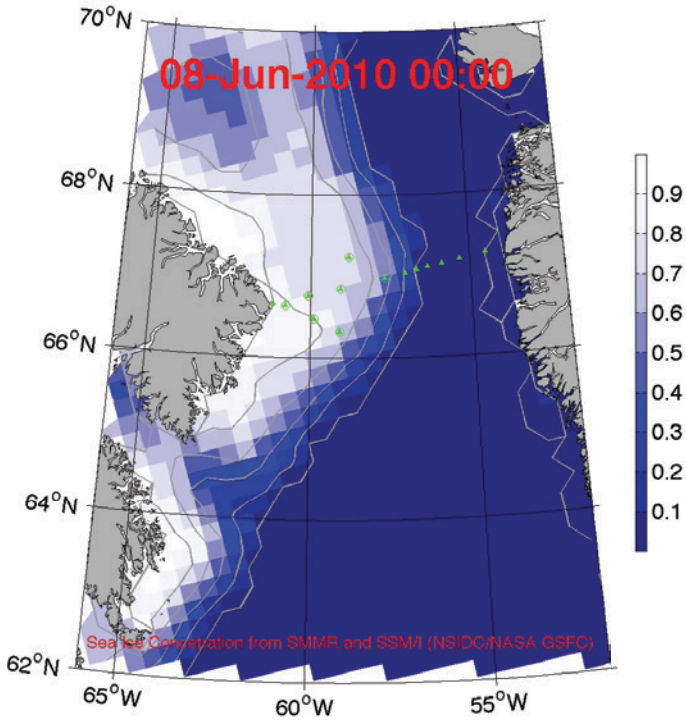
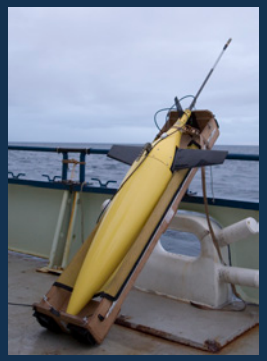


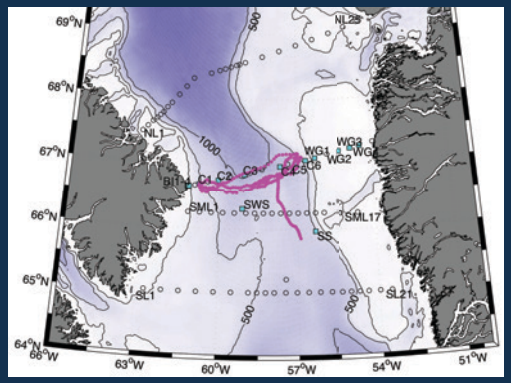
With thanks to: Captains Colburn, Shesley & Seamans and R/V Knorr, Captain Martin and CCGS Hudson, Captain Renk and the crew of R/V Sanna, GINR, Kunuk Lennart, Eric Boget, James Johnson, Keith Van Thiel, James Abriel, Murray Scotney, Robert Ryan and Mathieu Ouellet

The Davis Strait Observational Program



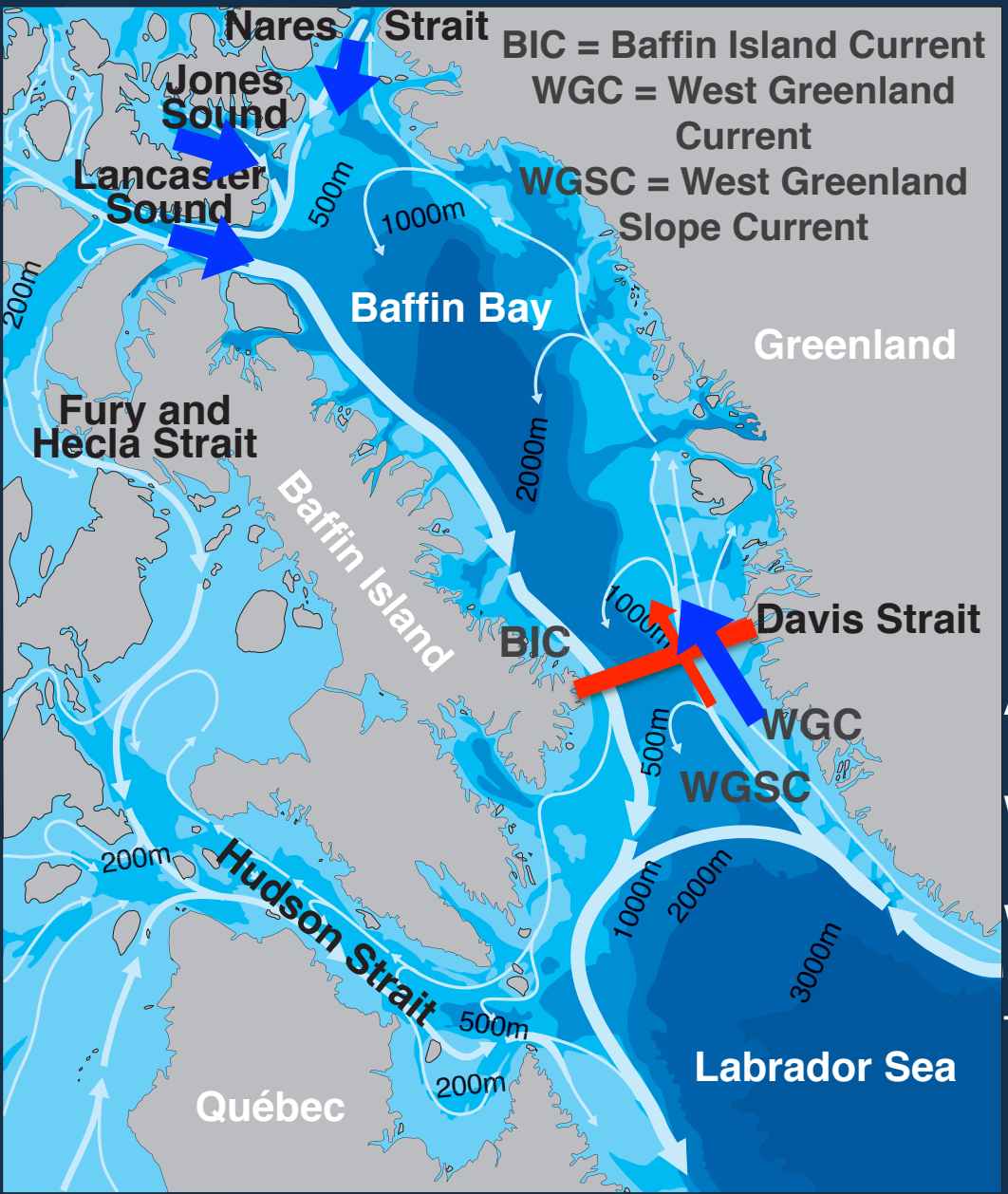


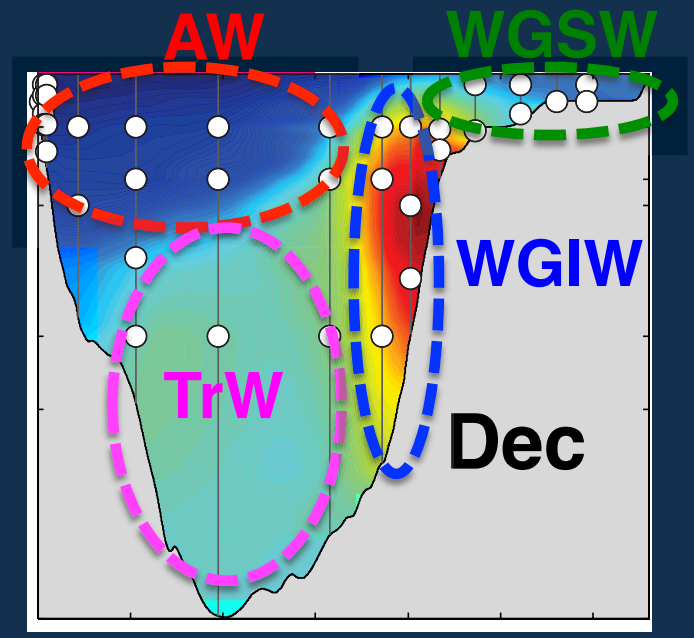




- Moorings (u, T, S, ice thickness, marine mammal acoustics), including ice-ocean interface and shelves.
- Glider-based sections. Year-round.
- Annual (biennial) hydrography with extensive chemistry.

Circulation and Water Masses





Water Masses

Arctic Water (AW)

$\theta \leq 2\,^{\circ}C$ $S < 33.7$

West Greenland Irminger Water (WGIW)

$\theta > 2^{\circ}C$ $S > 34.1$

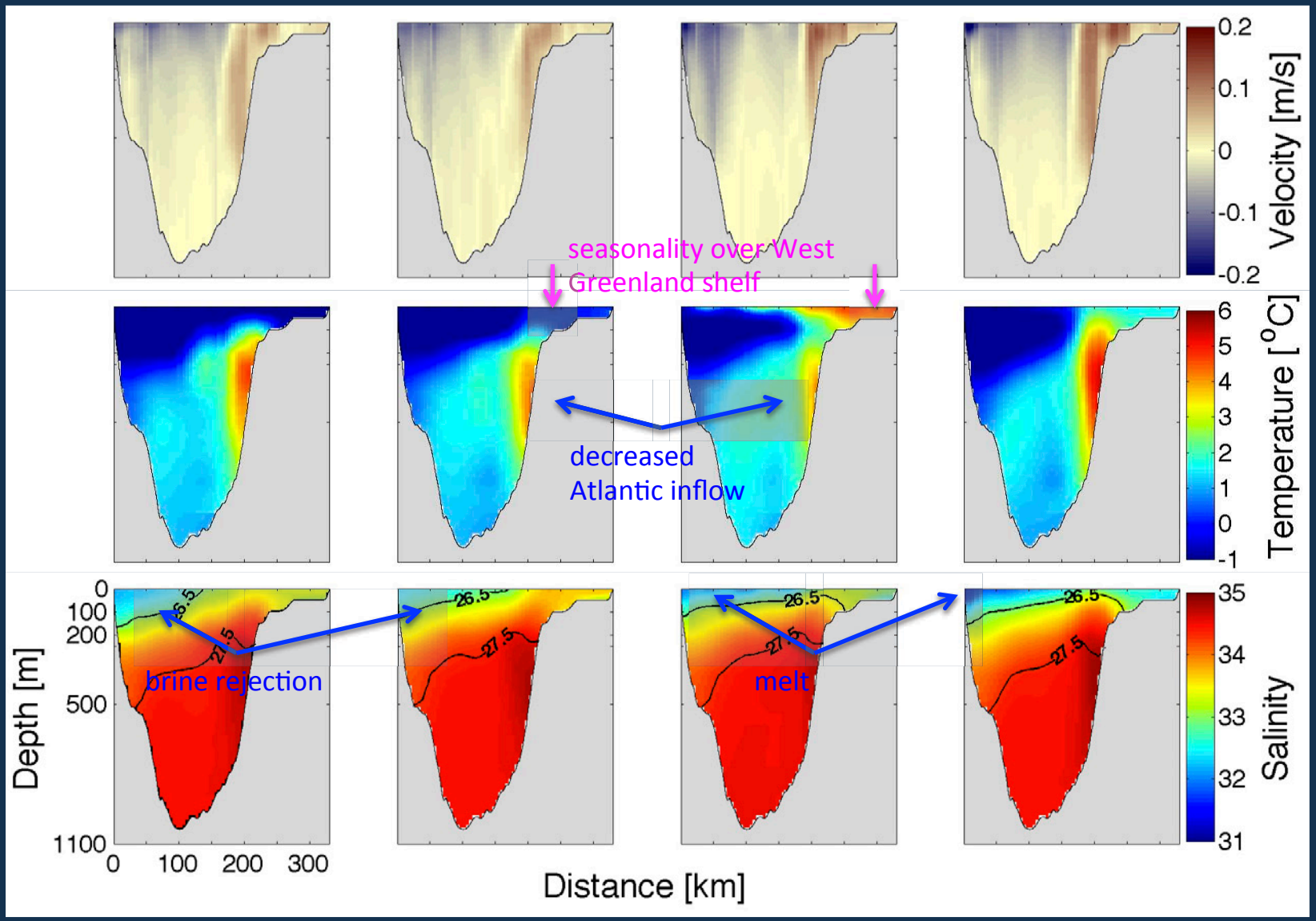
West Greenland Shelf Water (WGSW)

$\theta < 7^{\circ}C$ $S < 34.1$

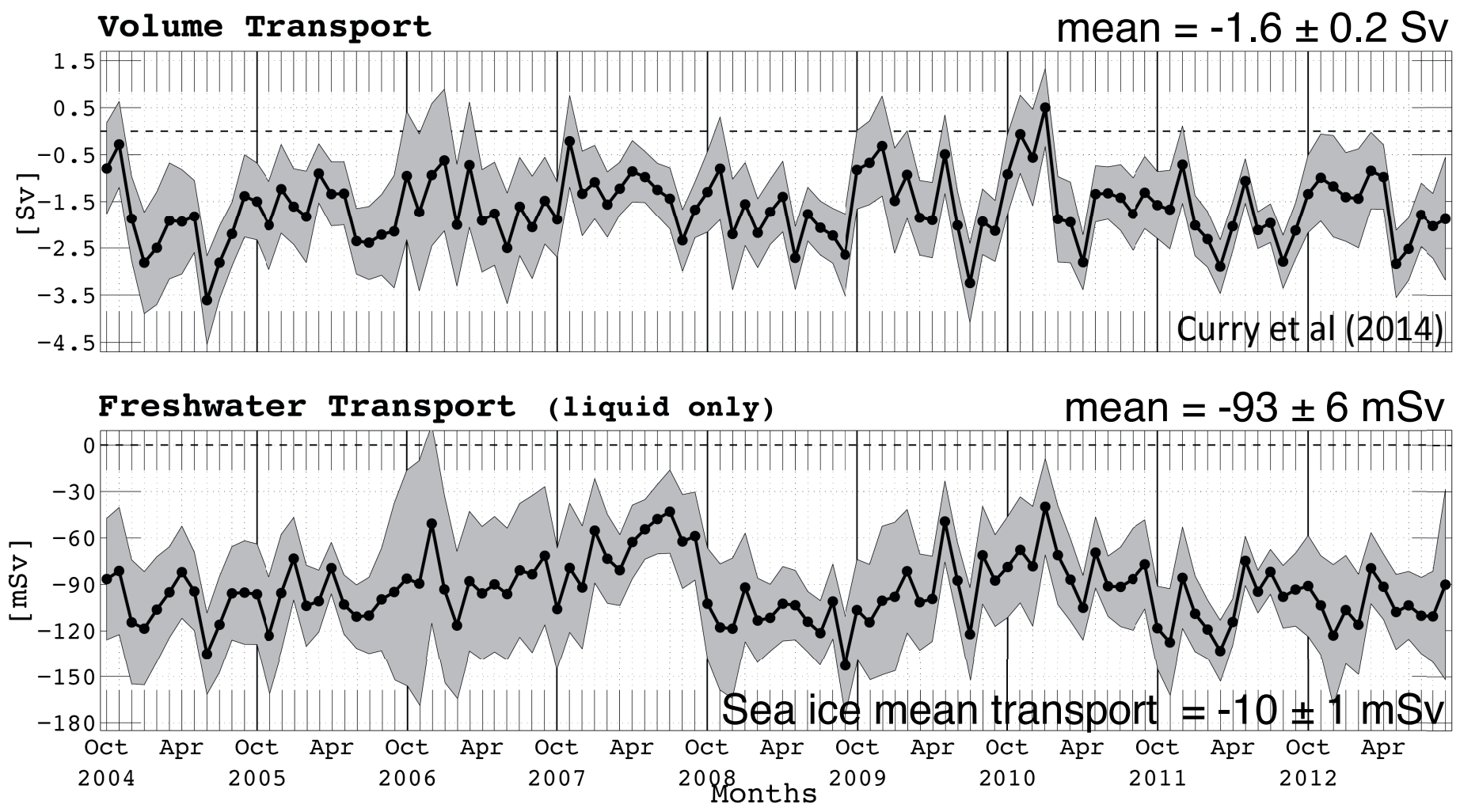
Transitional Water (TrW)

$\theta < 2^{\circ}C$ $S > 33.7$

Seasonal Structure



2004-2012 Volume & Freshwater Transports

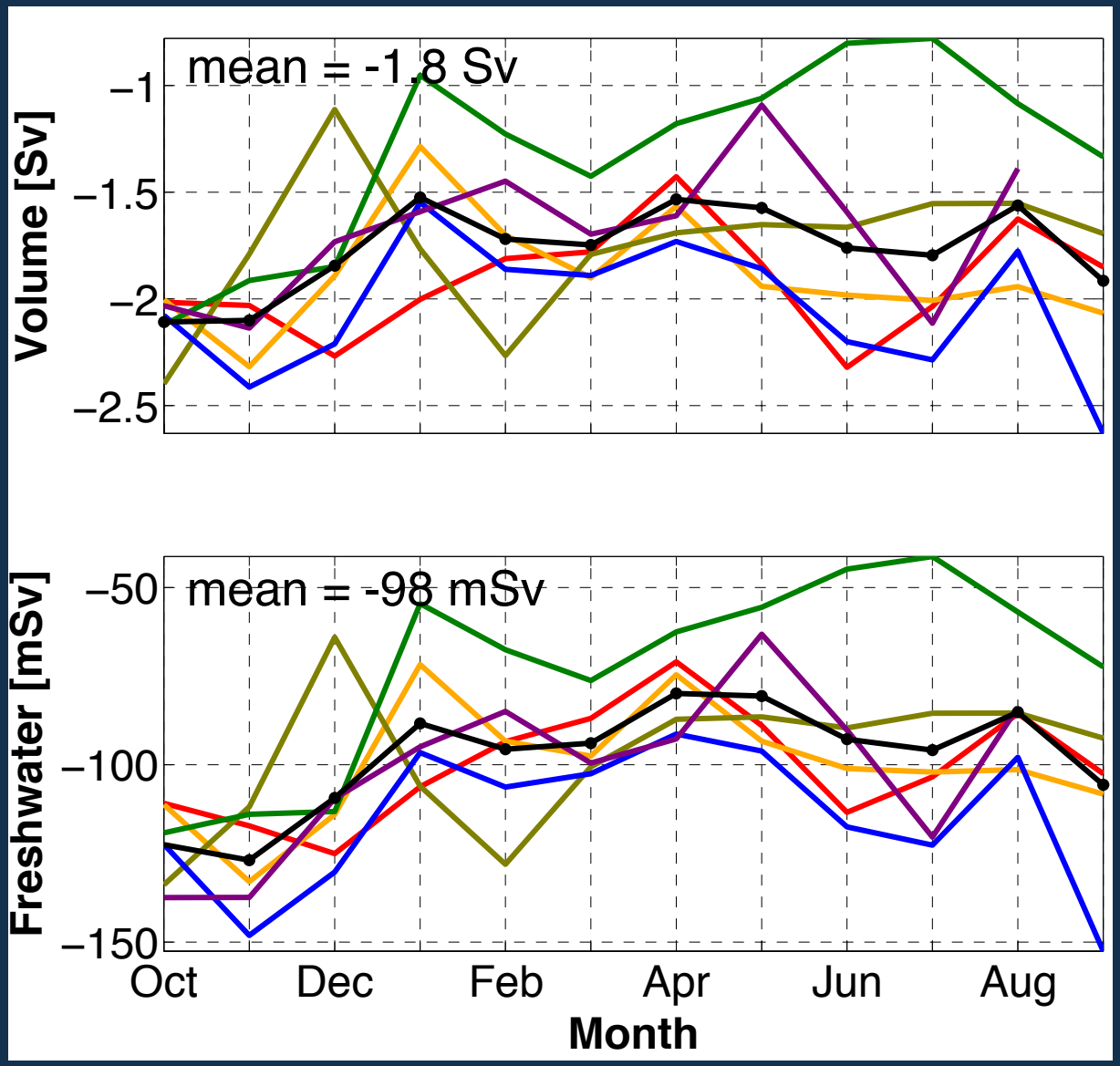


$$FW_{Transport} = \sum V_i \frac{S_o - S_i}{S_o} A_i$$

V = Velocity
S = Salinity

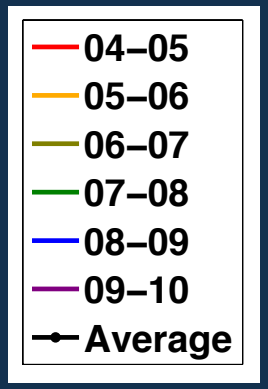
A = Area
S_o = reference salinity, 34.8

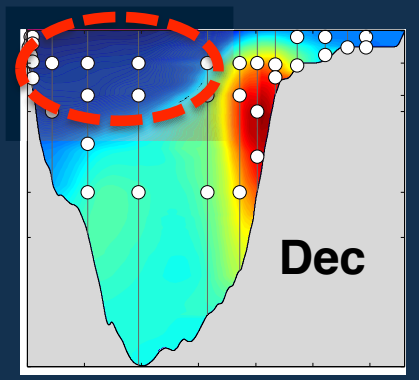
Arctic Water (AW)



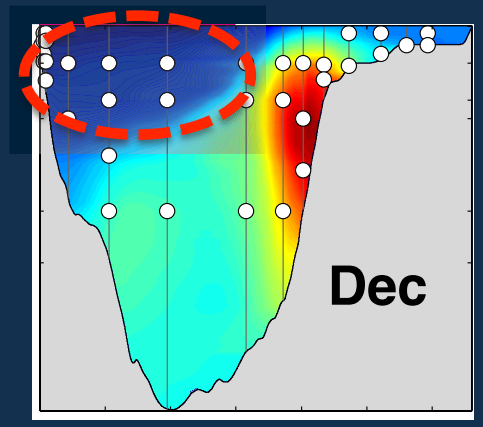
Summer/Autumn

- Peak volume export
- Peak FW export: volume + freshening

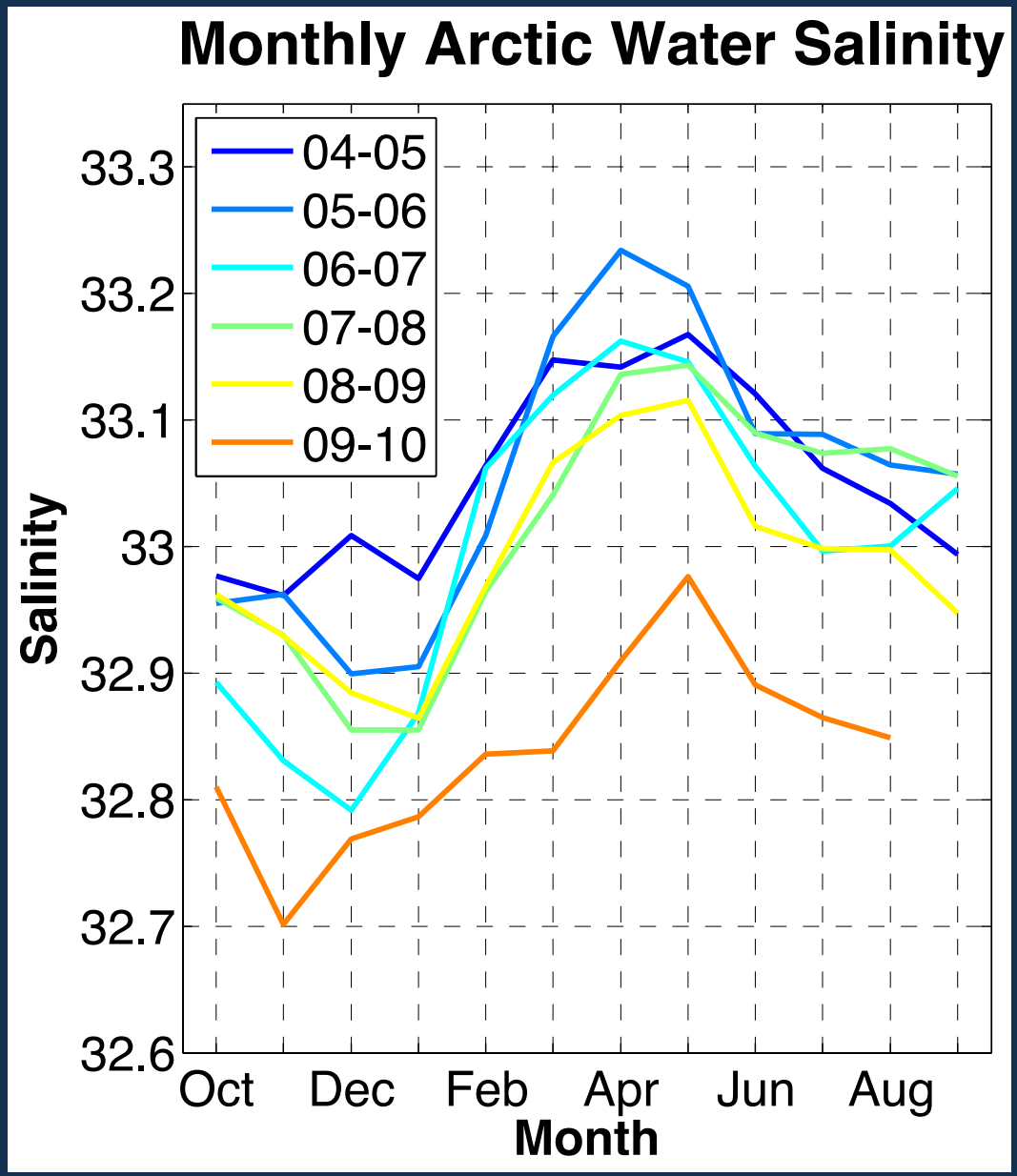




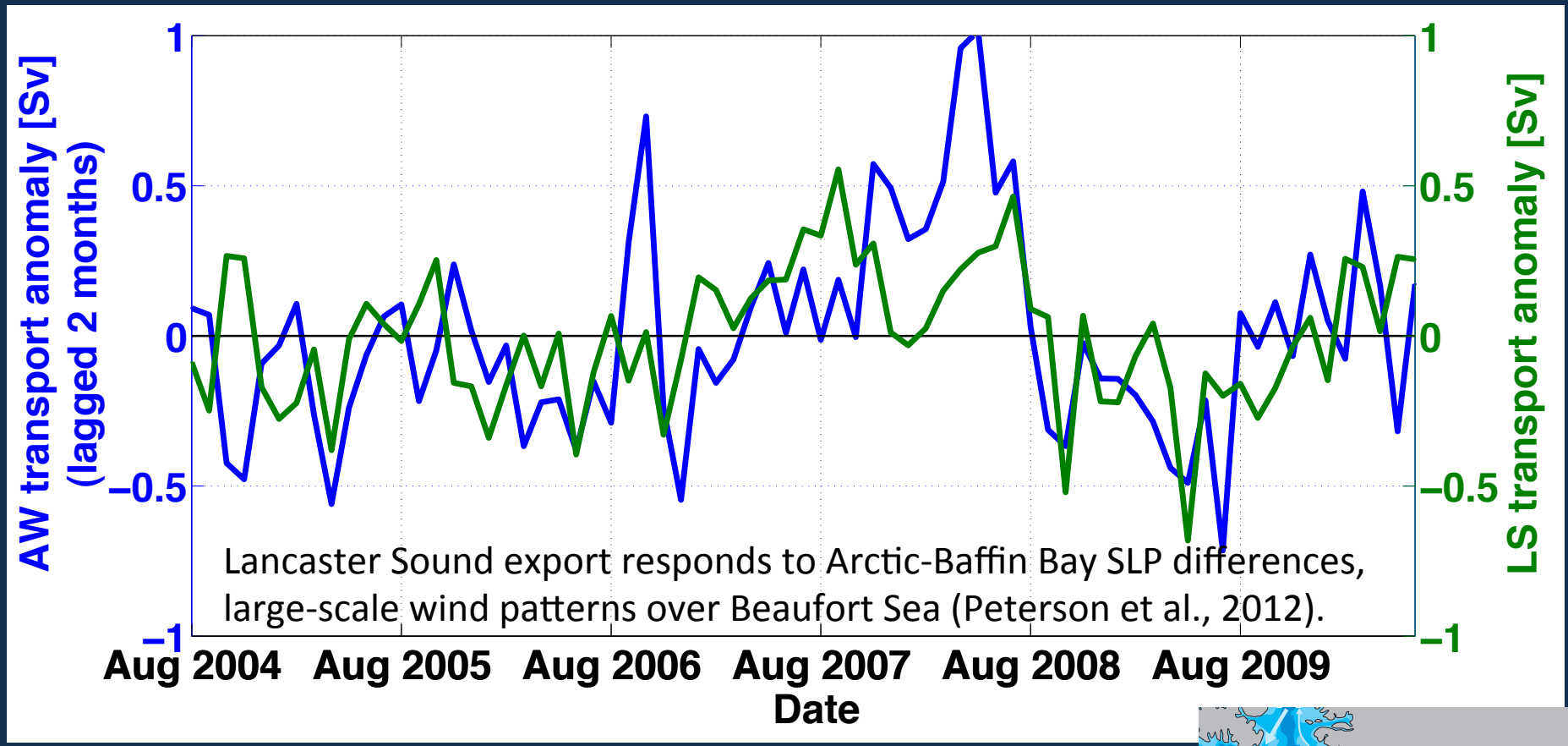
Arctic Water Salinity Changes

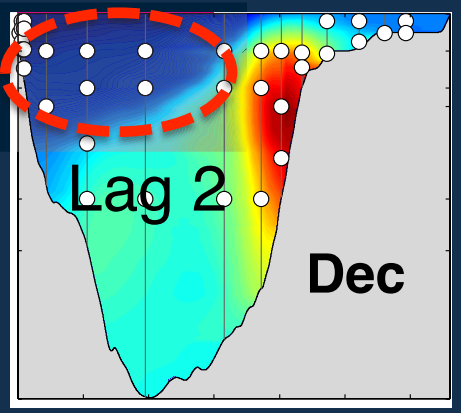


2009-2010 freshening follows observed upstream freshening (Lincoln Sea; Jackson et al. 2013) with 11 month lag.



AW export and CAA inflow





Anomalies

$r^2 = 0.19$, $p < 0.01$

Annual cycle

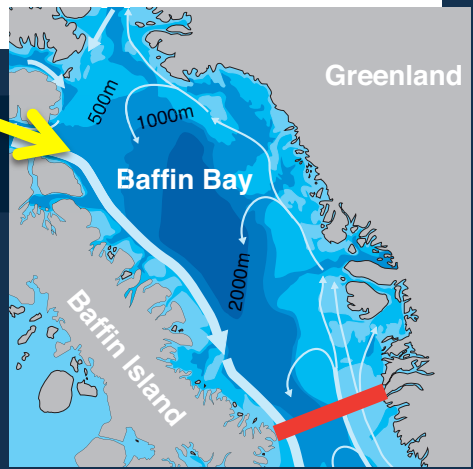
$r^2 = 0.55$, $p < 0.01$

Lancaster Sound

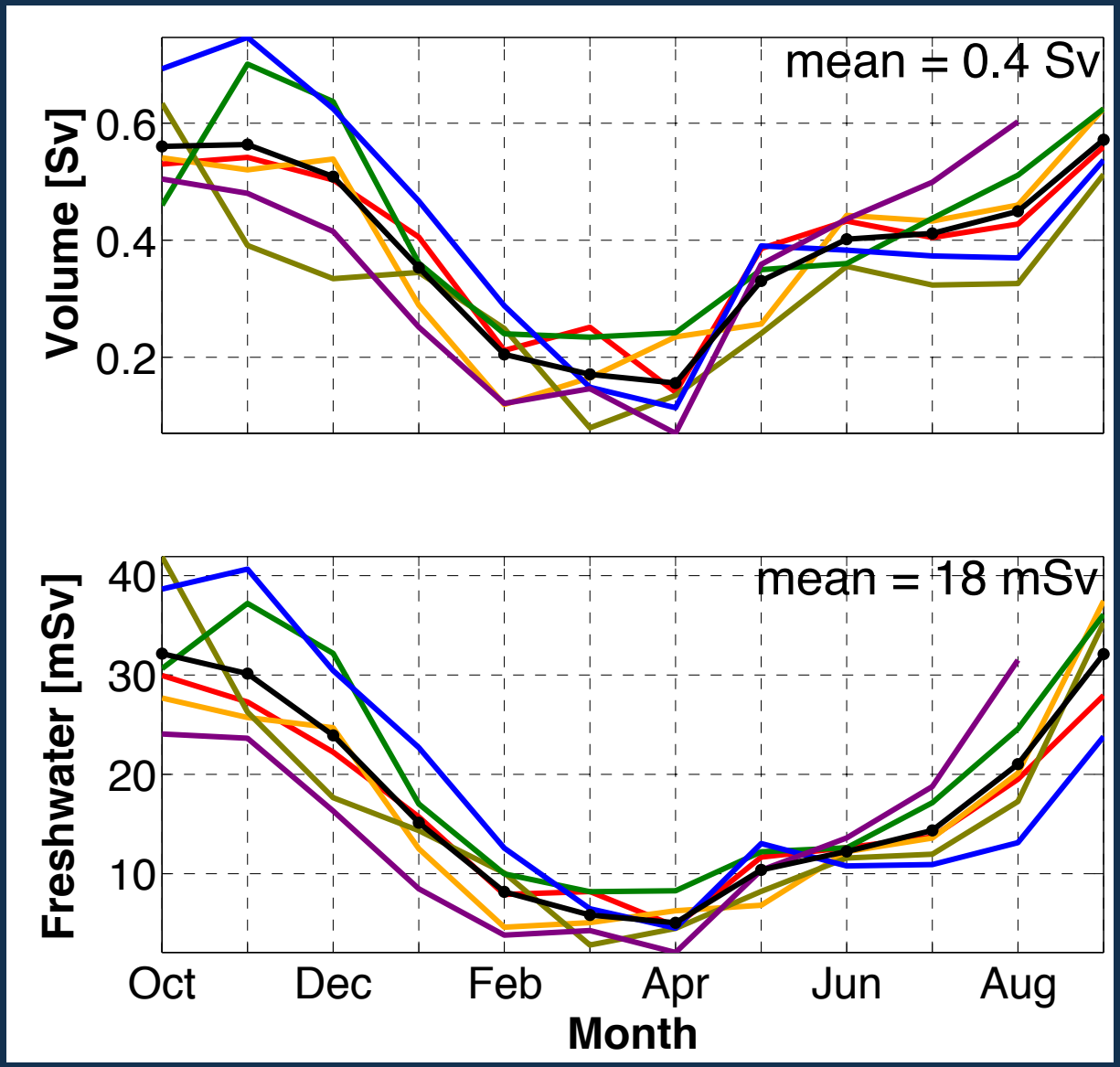
1998-2011

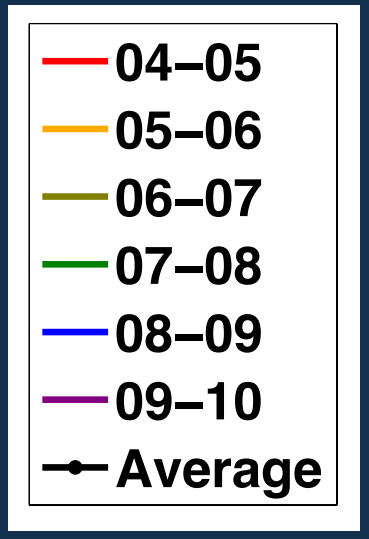
0.46 ± 0.09 Sv

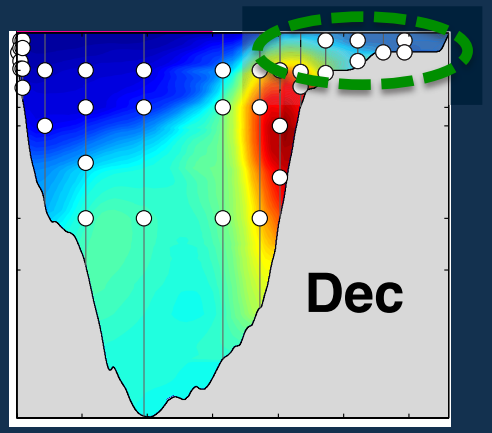
26% AW total



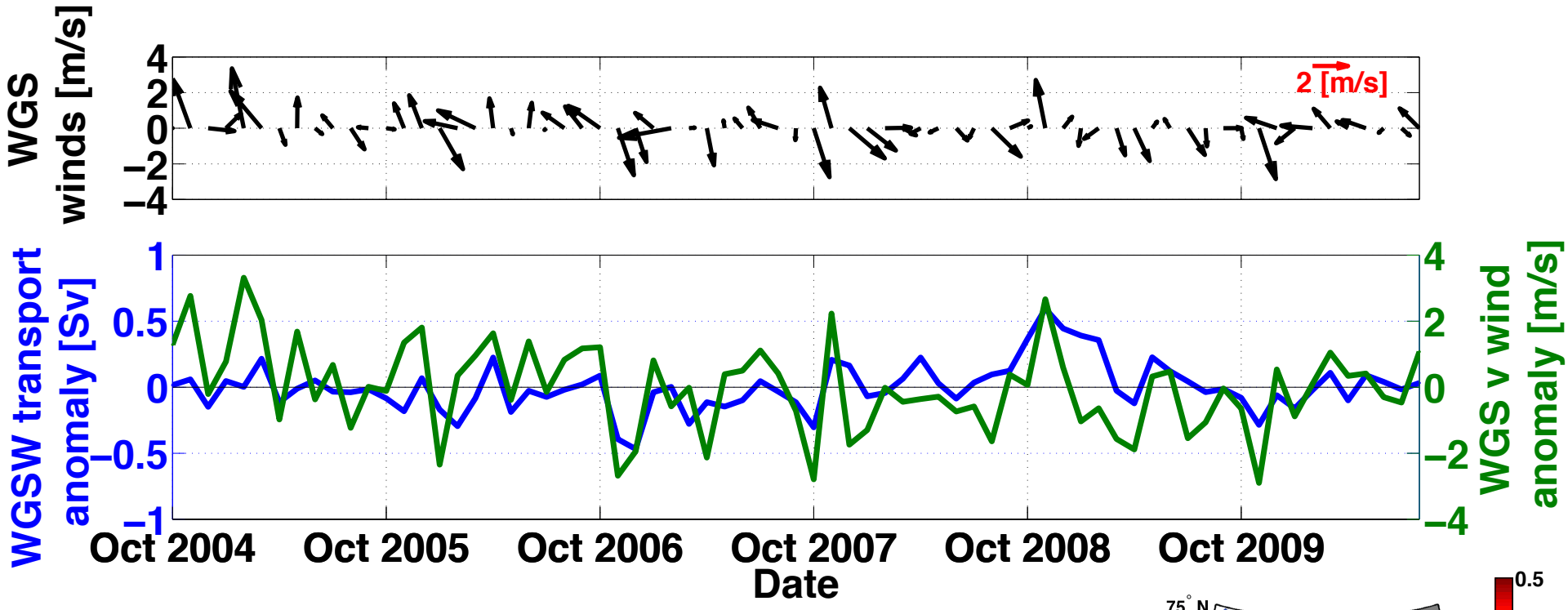
West Greenland Shelf Water (WGSW)

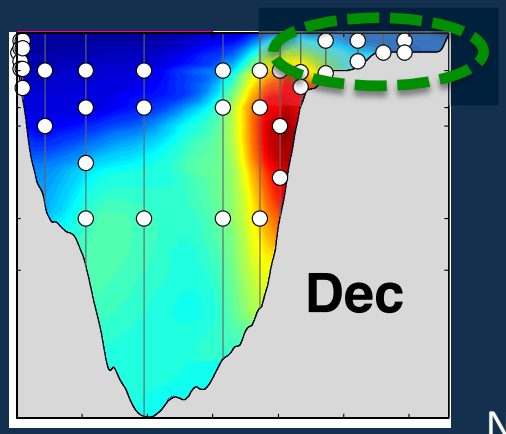






WGSW responds to shelf winds





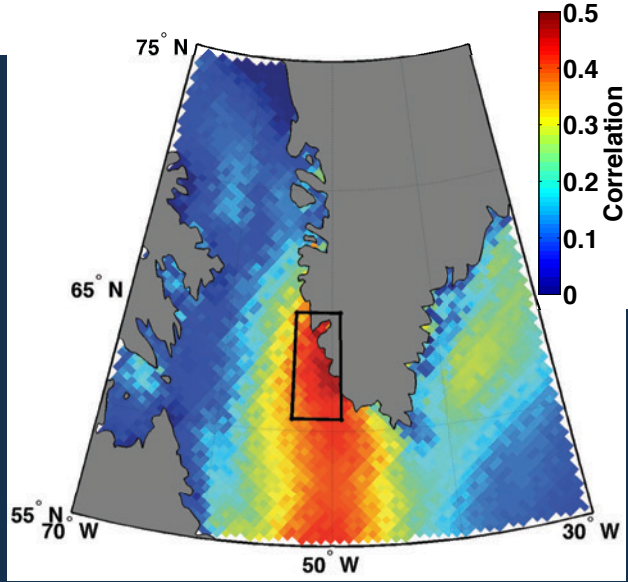
Anomalies

$r^2 = 0.18$, $p < 0.01$

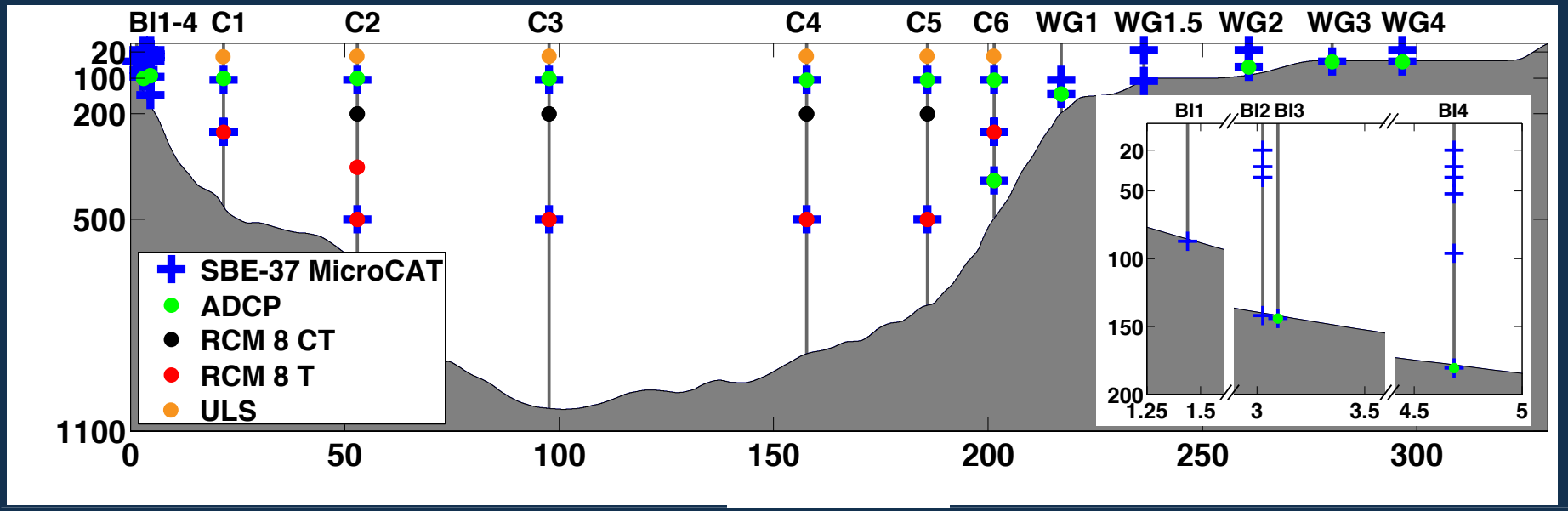
Annual cycle

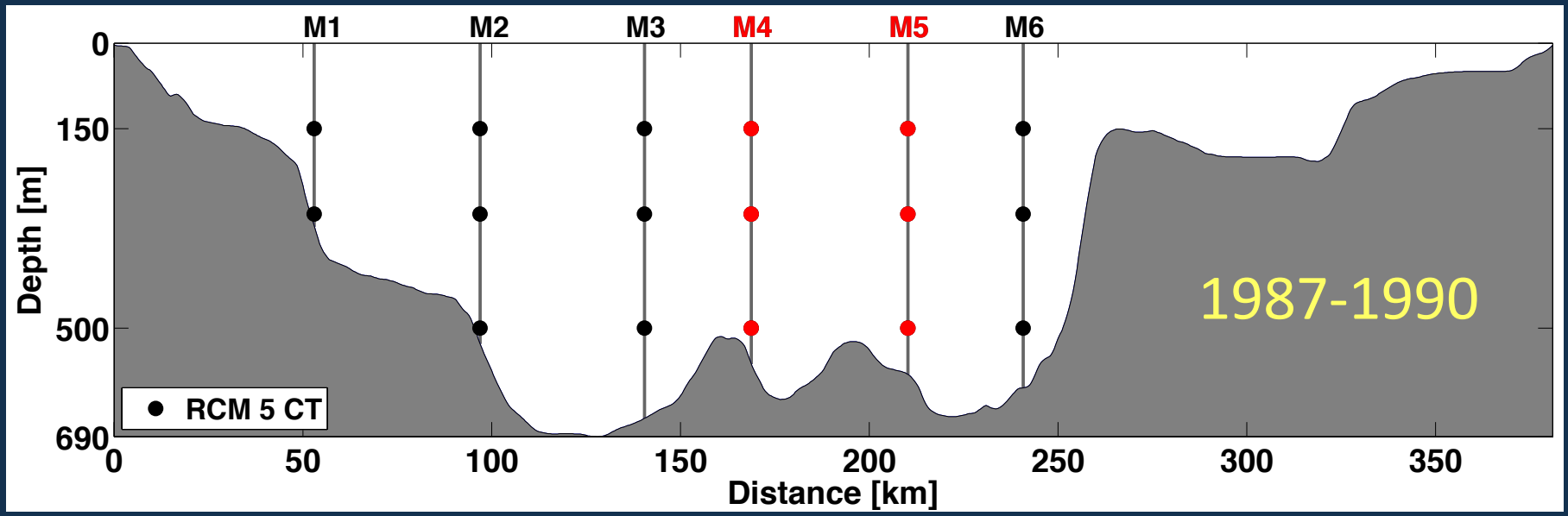
$r^2 = 0.58$, $p < 0.01$

NCEP North American Regional Reanalysis

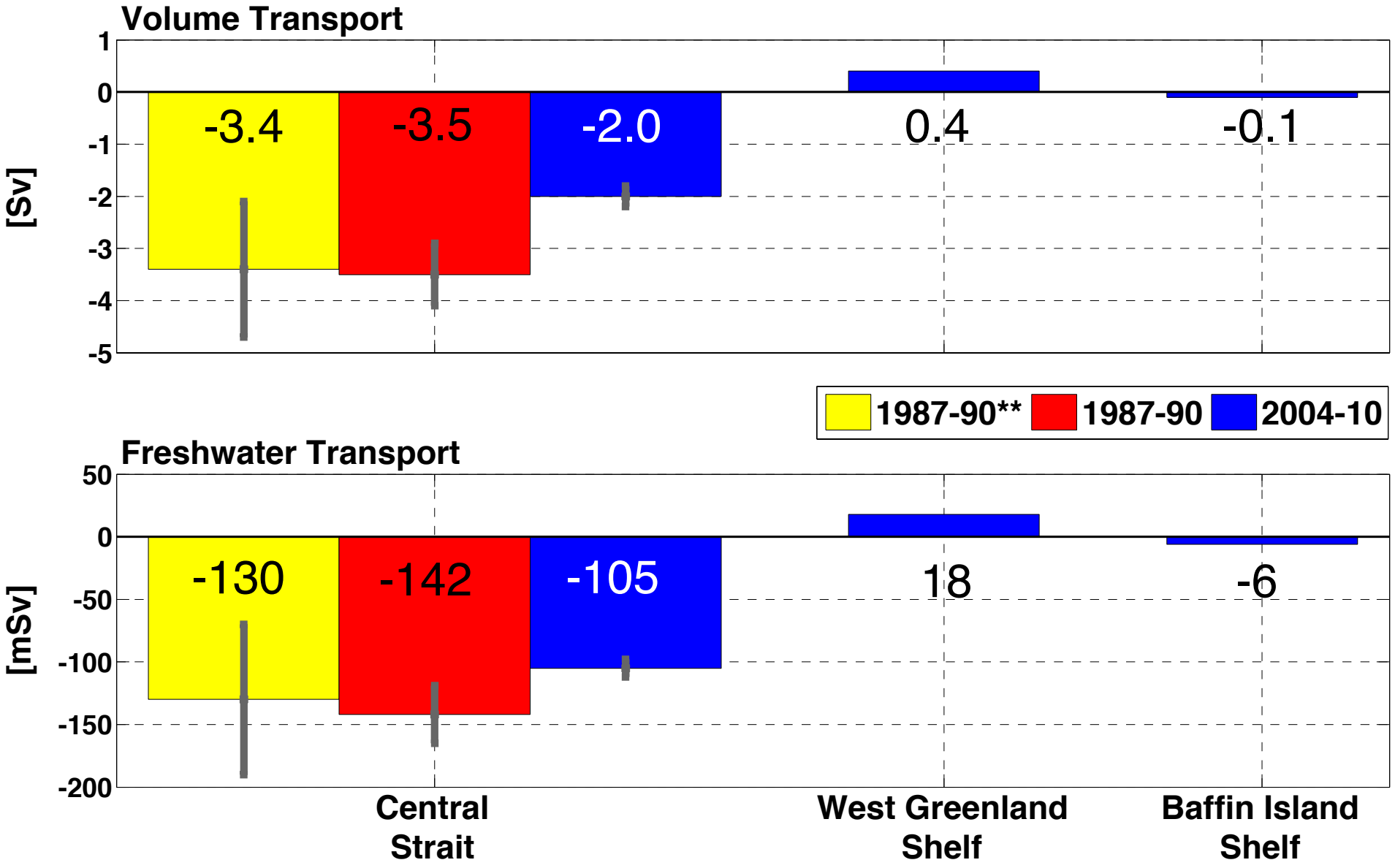


Observed Transports: 1987-90 & 2004-10





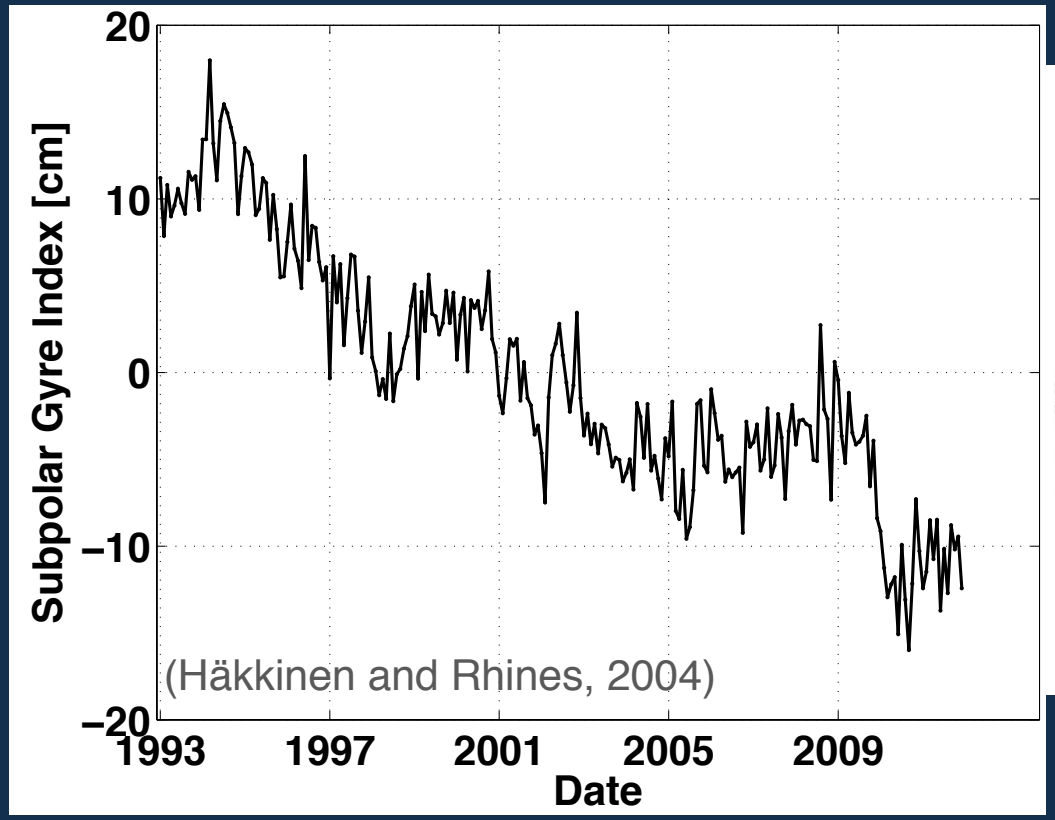
Comparison with 1987-90

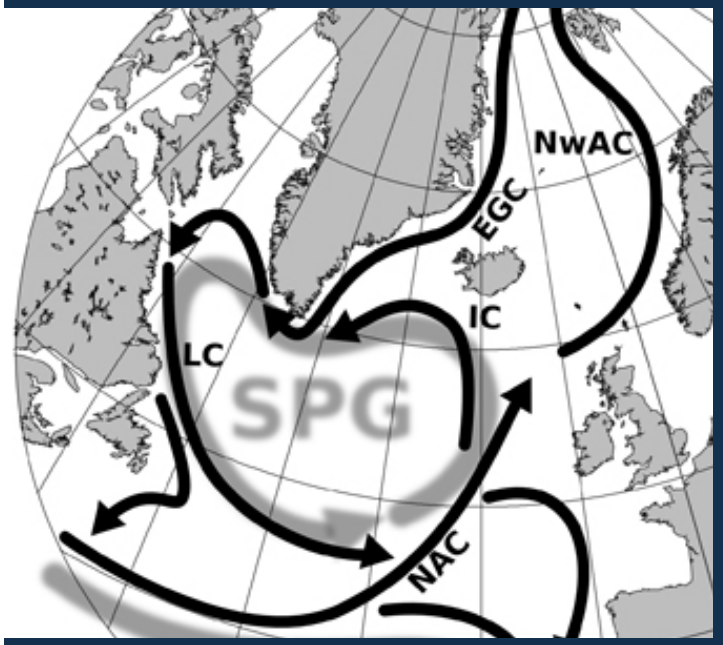


**(Cuny et al., 2005)

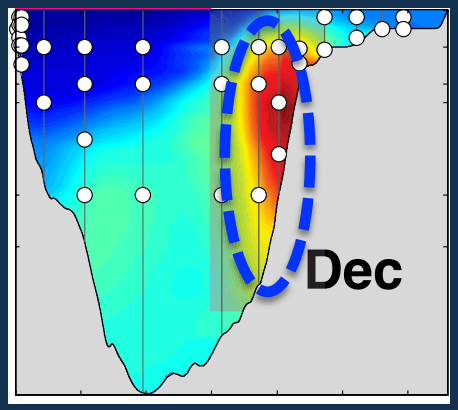
Changes in the Subpolar Gyre

1st principal component of North Atlantic SSH





(A. Bjorn, Bjerknes Centre)

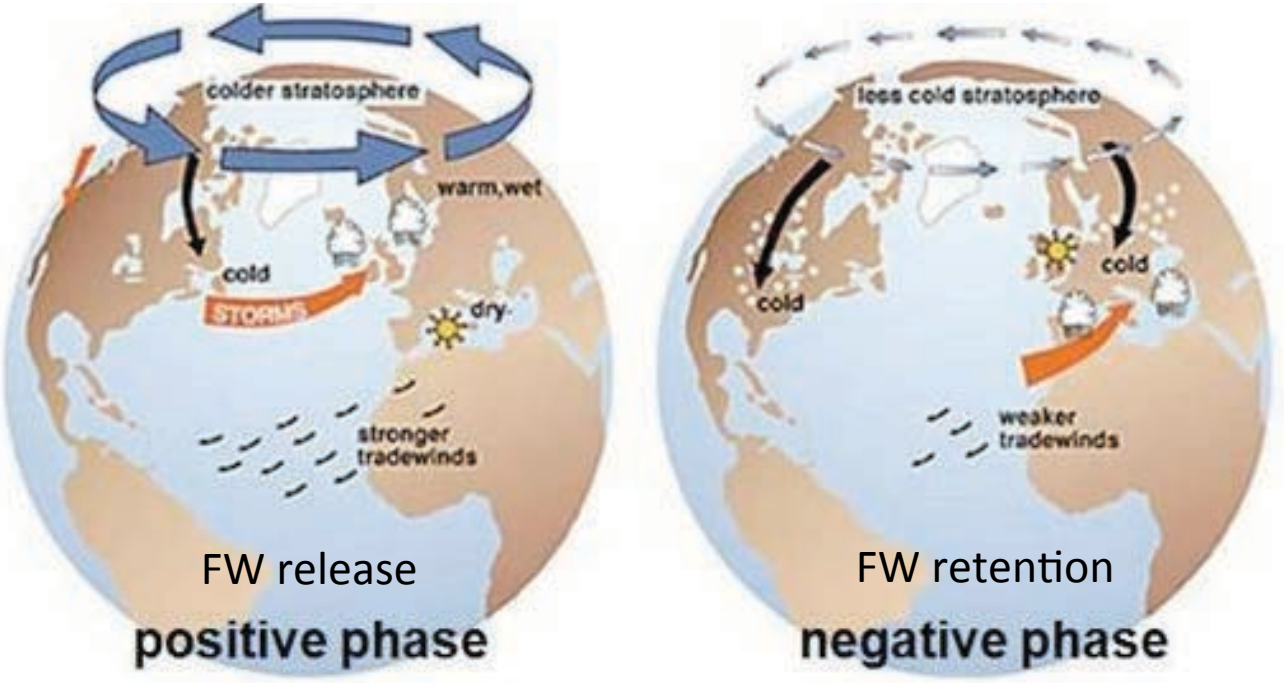


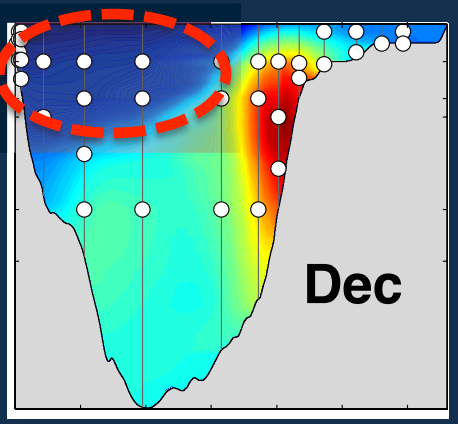
	Volume Transport (Sv)	
Year	Net Central	WGIW
1987-90 (+SPG)	-3.5	0.1
2004-10 (-SPG)	-2.0	0.7

Changes in Arctic Circulation

Arctic Oscillation (AO) Phases

http://nsidc.org/arcticmet/patterns/arctic_oscillation.html





	Volume Transport (Sv)	
Year	Net Central	AW
1987-90 (+AO)	-3.5	-2.2
2004-10 (-AO)	-2.0	-1.7

Davis Summary

Davis Strait annual-average transports (2004-2010)

- Volume = -1.6 ± 0.2 Sv
- Freshwater = -93 ± 6 mSv (reference 34.8)

Significant interannual variability with no clear trends

- 1987-1990: more AW outflow, less WGIW inflow relative to 2004-2010
- Fresh outflow events
- Ongoing investigation of governing processes

Fluxes, mapped, gridded fields available as products along with processed data.

Operations through autumn 2015 will provide 11-year time series. Intend to continue beyond 2015.

New technology developments: long-endurance glider operations under ice, moored instruments for ice-threatened environments.