AWAKE-2

Arctic climate system study of ocean, sea ice and glaciers interactions in Svalbard area

WP2

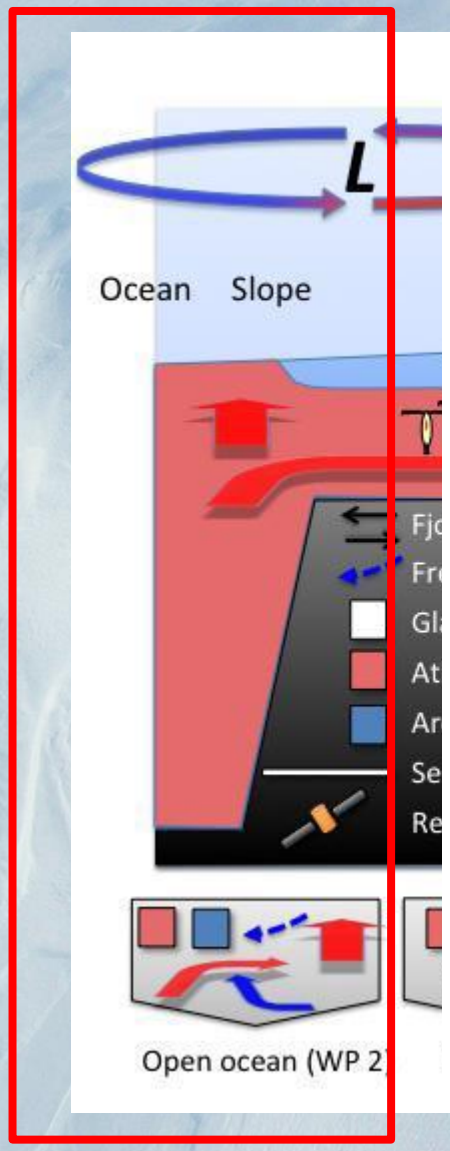
Open ocean oceanography

A. Beszczynska-Möller, W. Walczowski









Main objectives of WP2

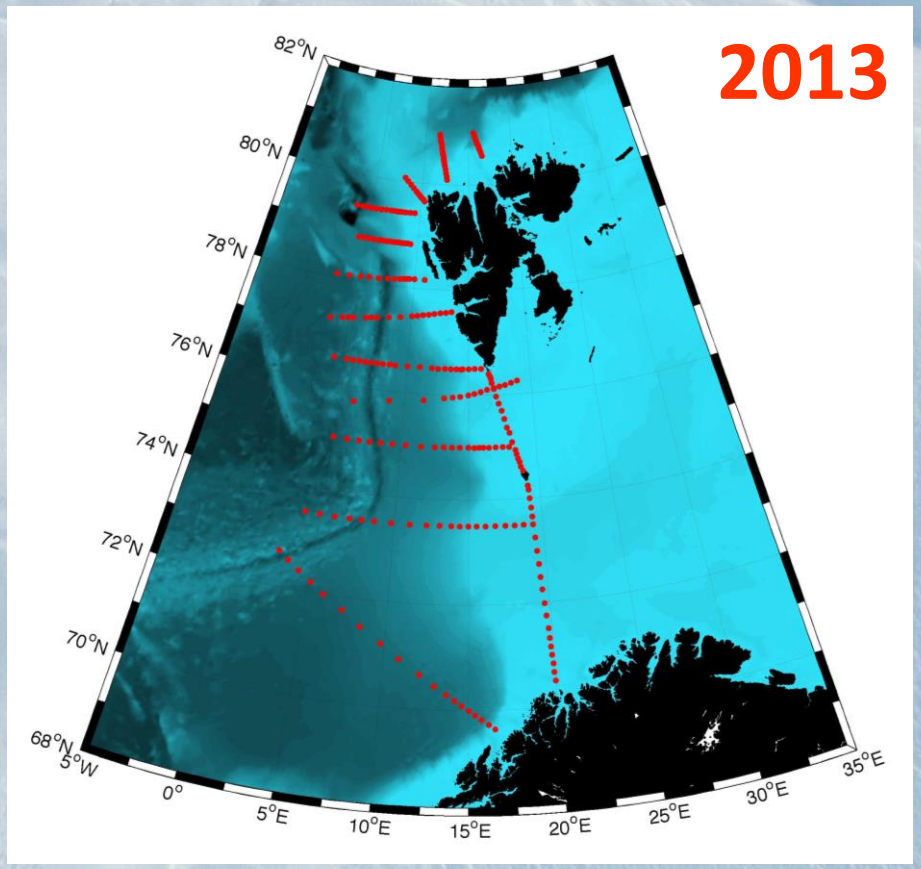
- Understanding the Atlantic water variability in the West Spitsbergen Current on different time scales based on available historical data and new measurements.
- Describing and quantifying of the inter-annual variation of Atlantic and Arctic water and freshwater content on the shelf from available historical hydrographic data and new dedicated observations
- Explaining the mechanisms of the AW circulation onto the shelf and its interaction with the fjords

Main tasks in WP2

- **T2.1** To analyze historical data from available archives and to collect dedicated new data to describe and understand the variability of AW properties in the WSC on different time scales (IOPAS)
- **T2.2** To investigate the local and remote forcing mechanisms responsible for inter-annual variability of the AW in the West Spitsbergen Current using the available hydrographic and atmospheric data, reanalysis and results of numerical model (IOPAS)
- **T2.3** To investigate topographically guided mechanisms of the AW circulation onto the West Spitsbergen shelf. To develop the analytical model and use existing numerical model to study the shelf circulation. (UNIS)

AREX Cruises

- 10-11 sections
- ~200 CTD profiles
- ~200 LADCP profiles
- Towed CTD high resolution section
- Measurements in fjords



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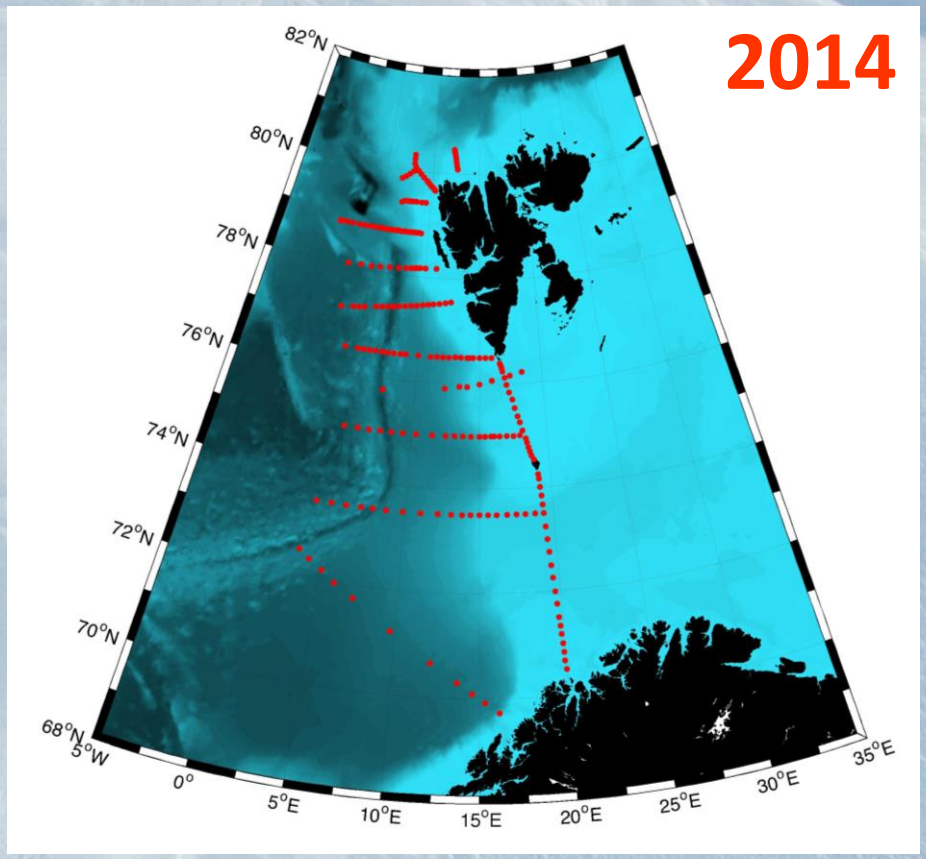

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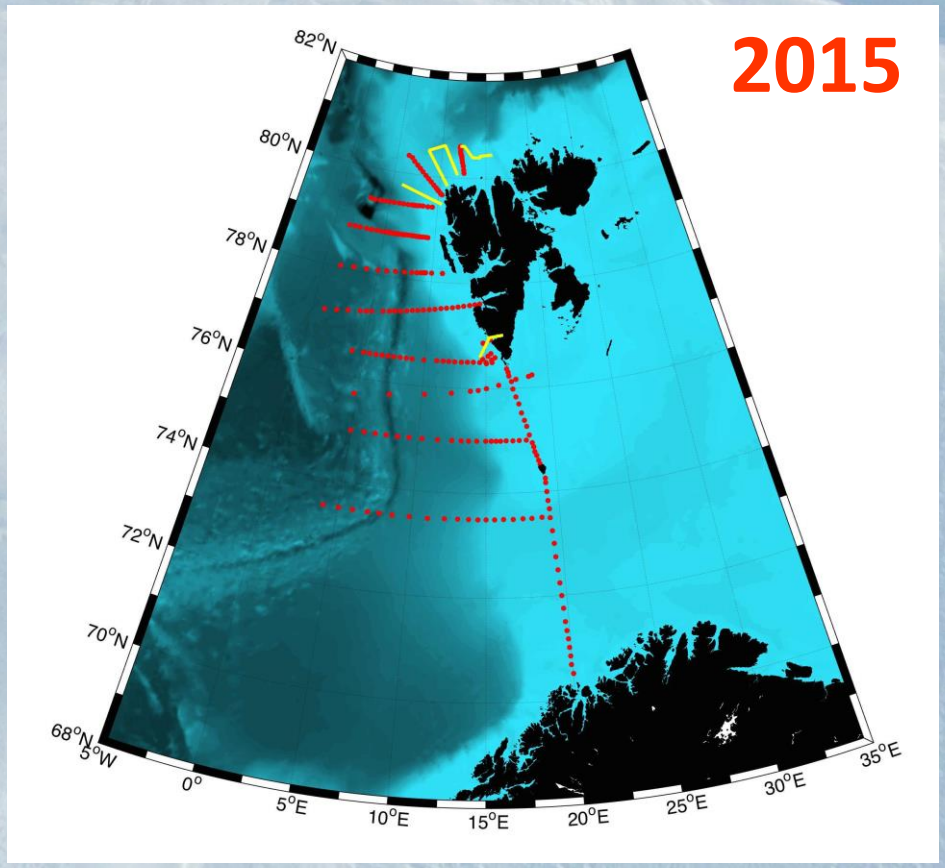
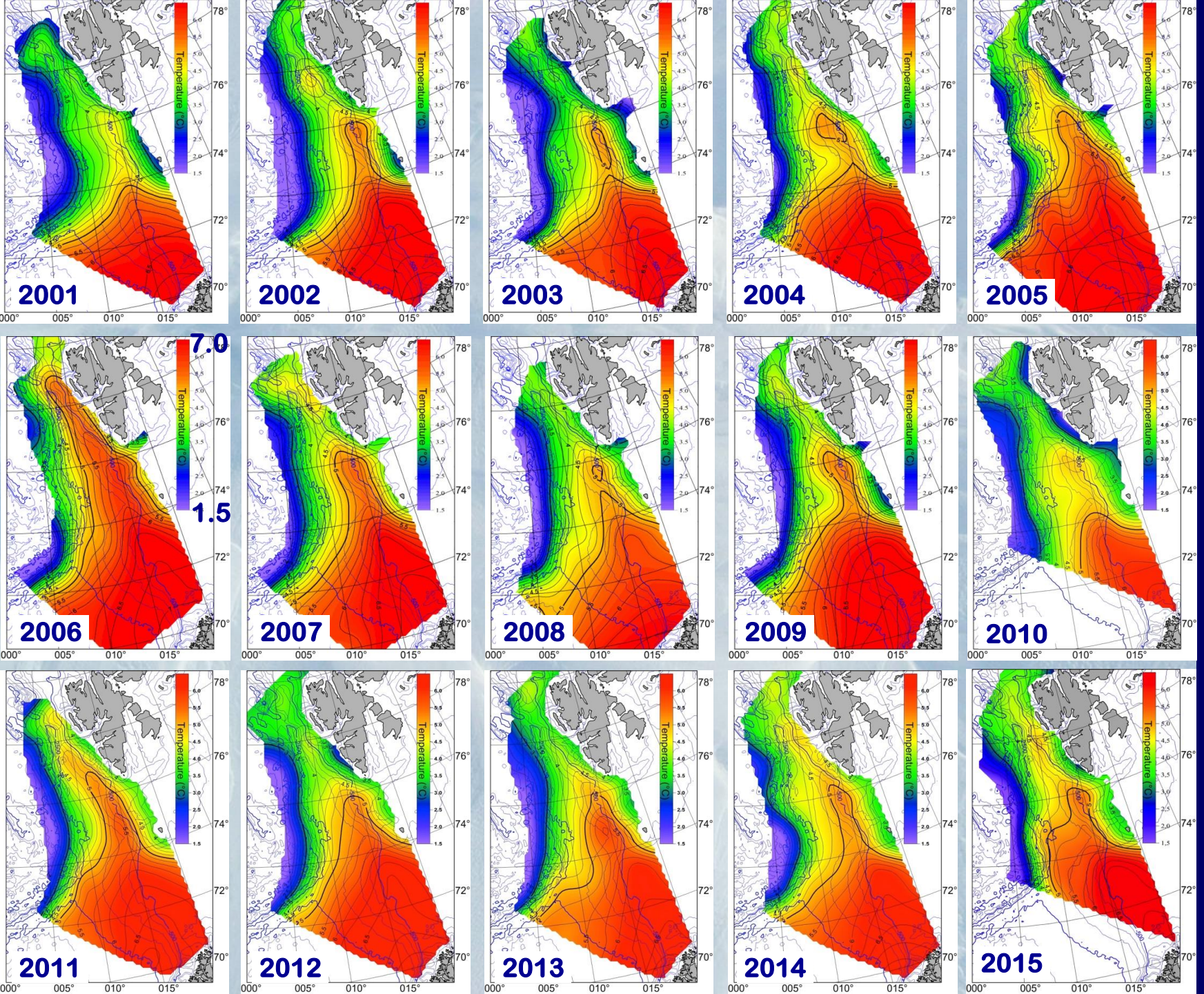
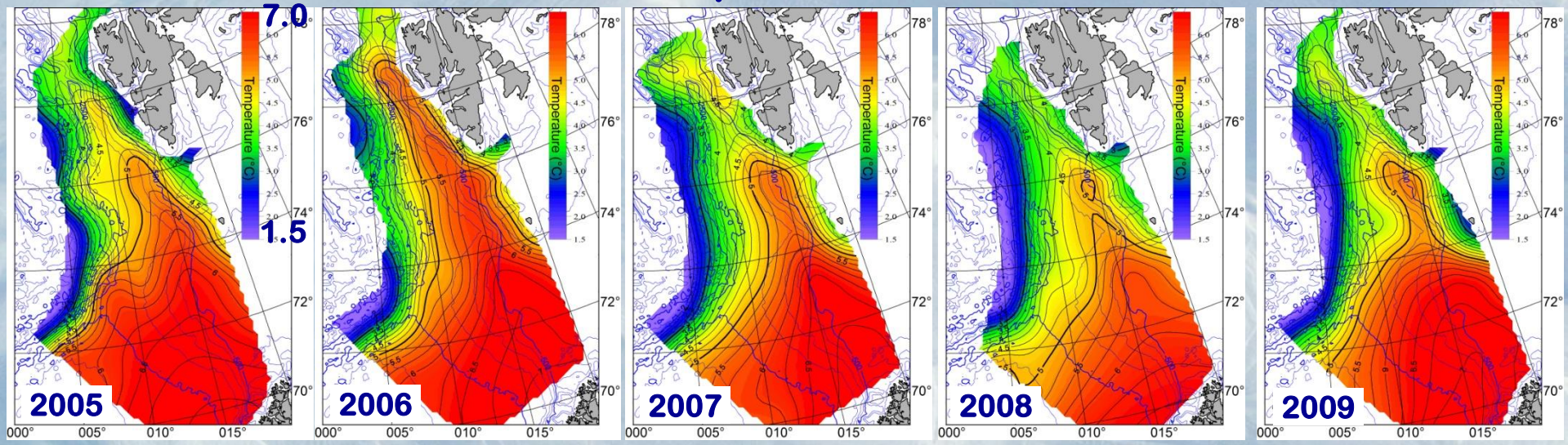




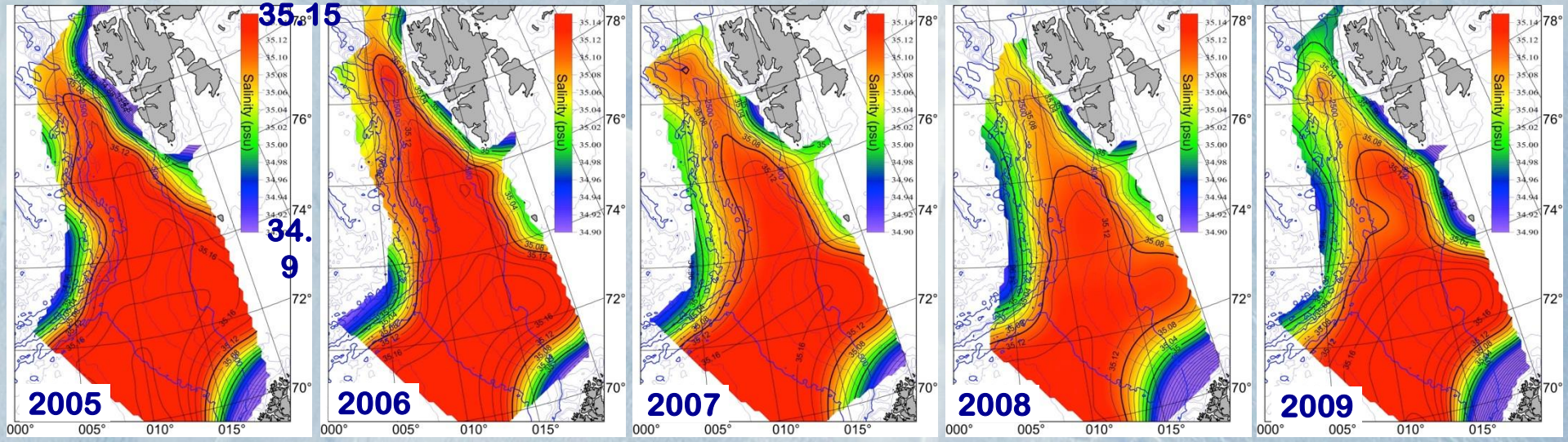
Temperature distribution at 100 dbar in 2001-2015 (June-July)

Temperature and salinity at 100 dbar in 2005-2009

Temperature

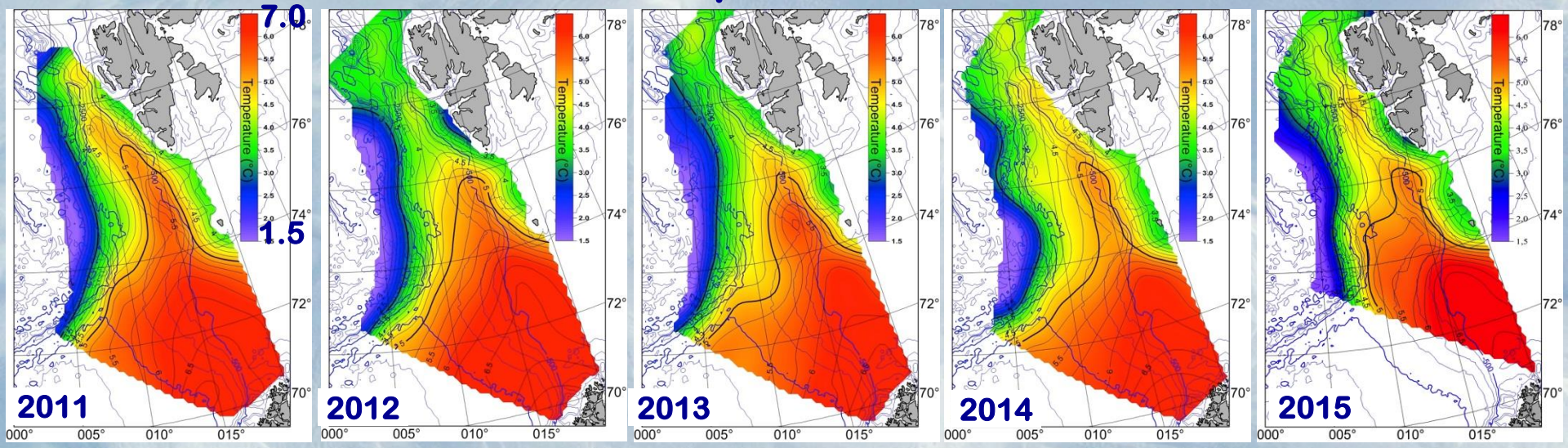


Salinity

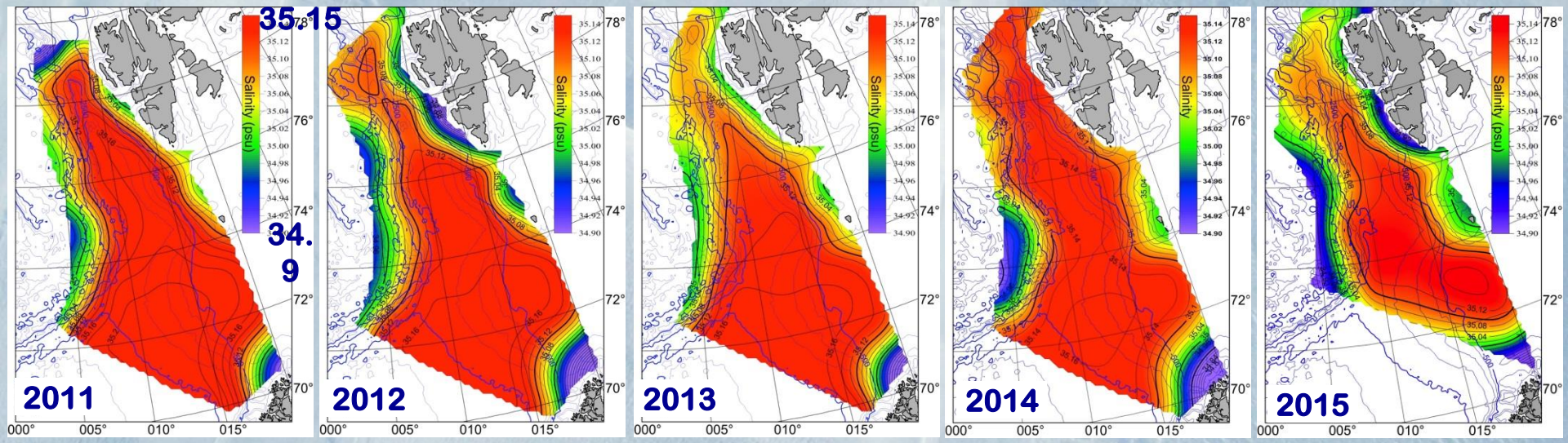


Temperature and salinity at 100 dbar in 2011-2015

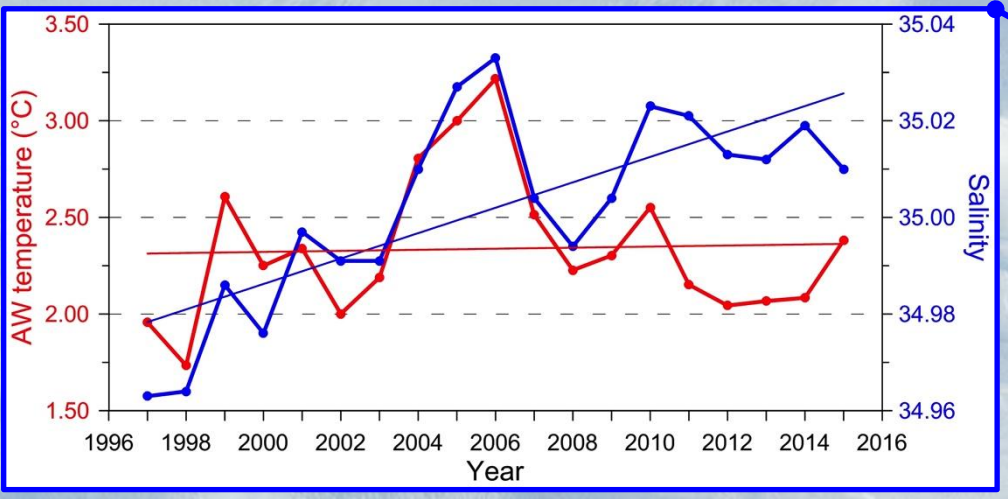
Temperature

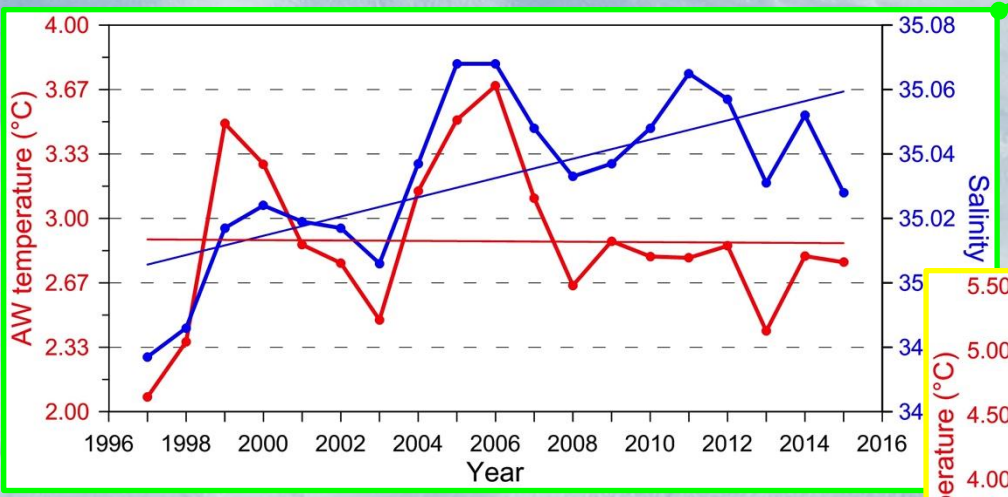


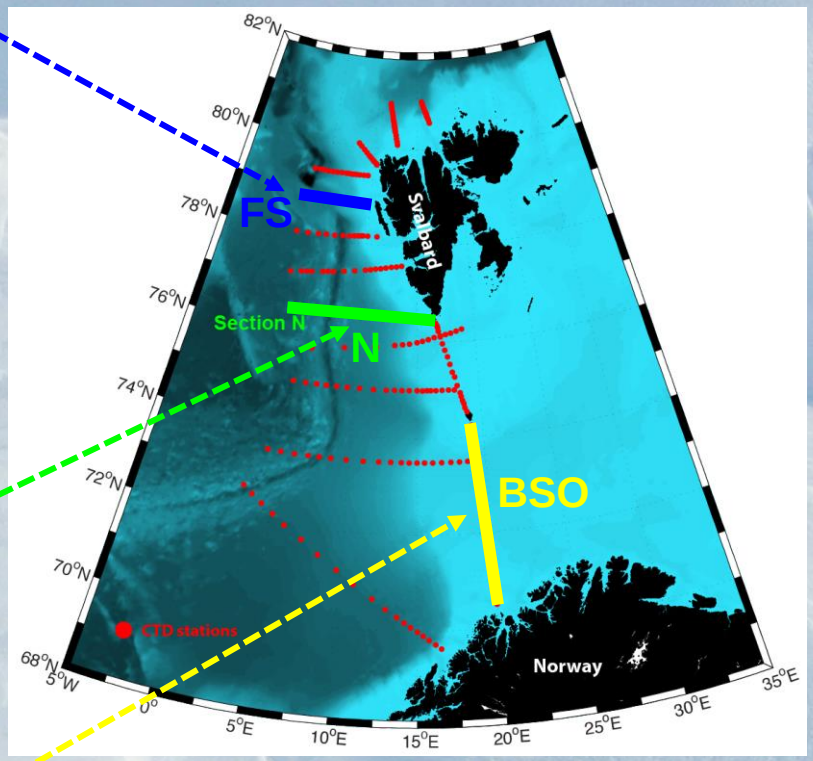
Salinity

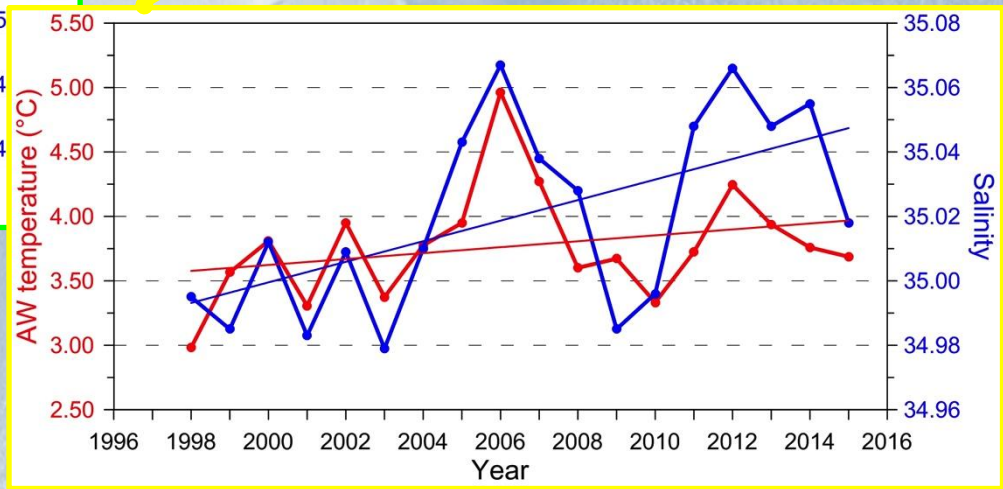


Mean AW temperature and salinity in 1997-2014 at sections V1 (BSO), N (76° 30'N) and AWI FS (78° 50'N)



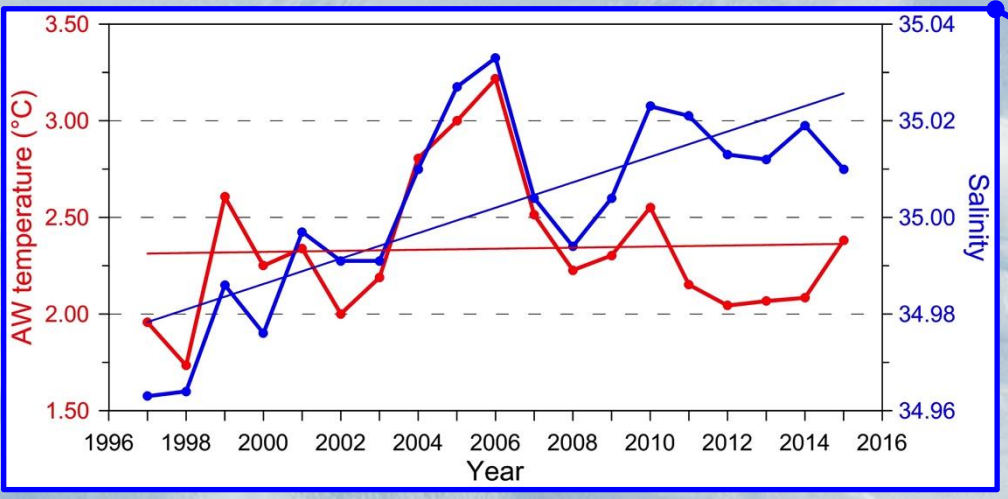


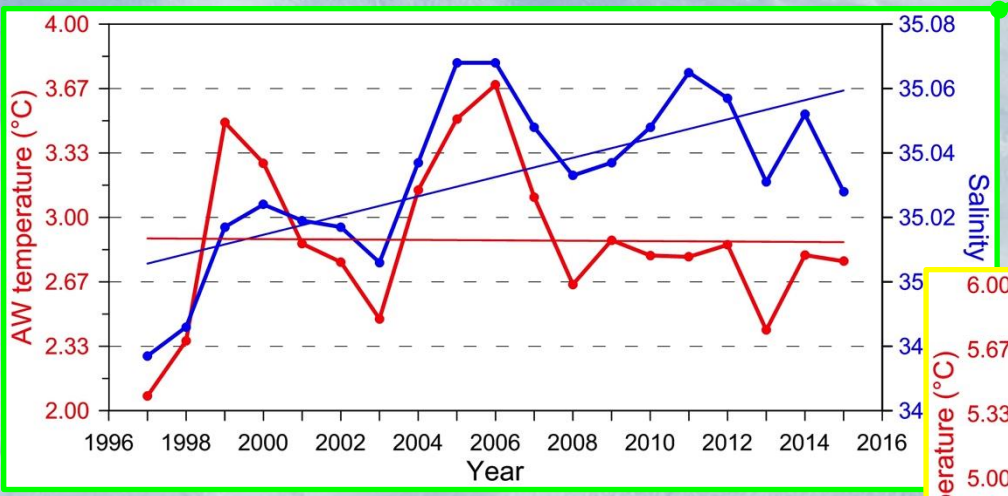


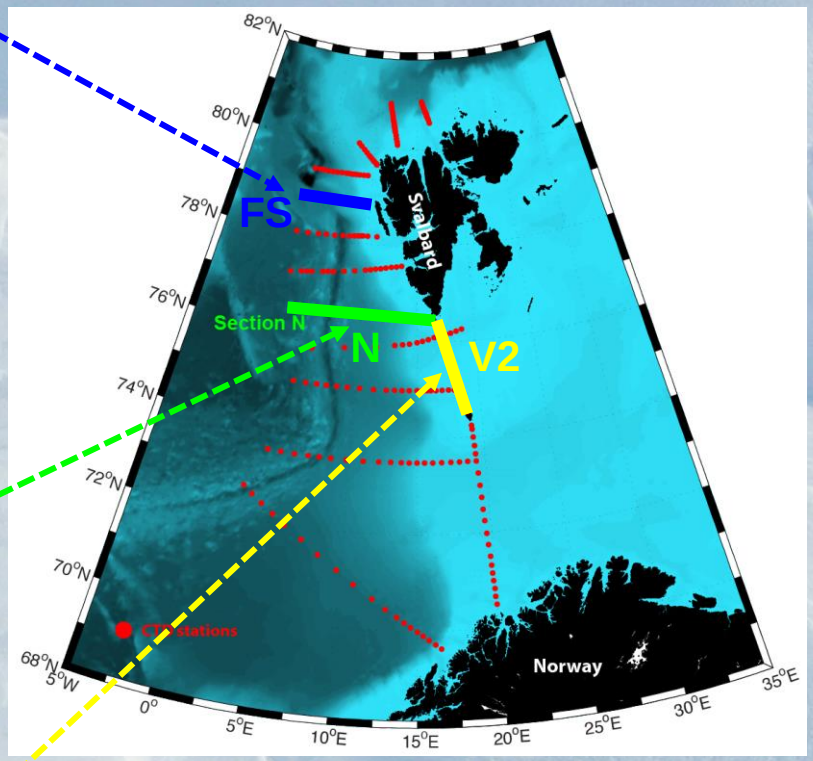


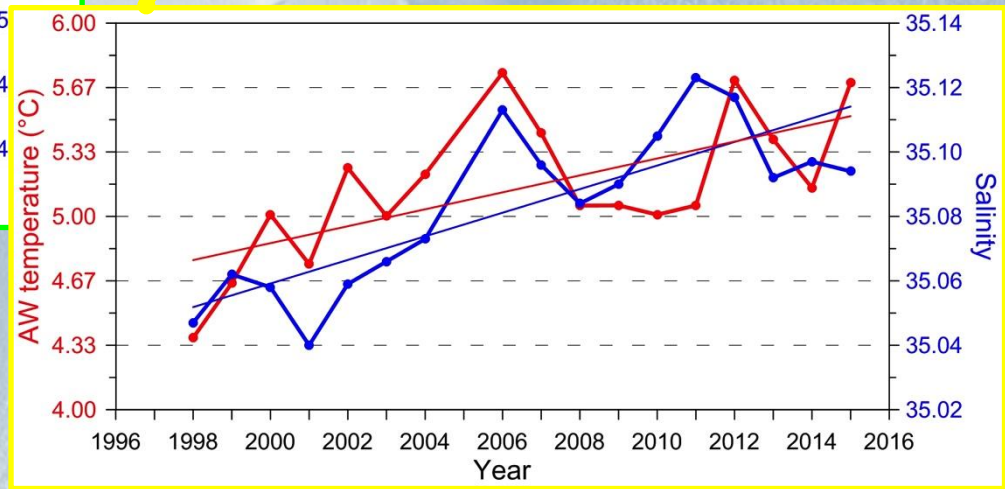
Periodic cycle ~5-6 years

Mean AW temperature and salinity in 1997-2015 at sections V1 (BSO), N (76° 30'N) and AWI FS (78° 50'N)



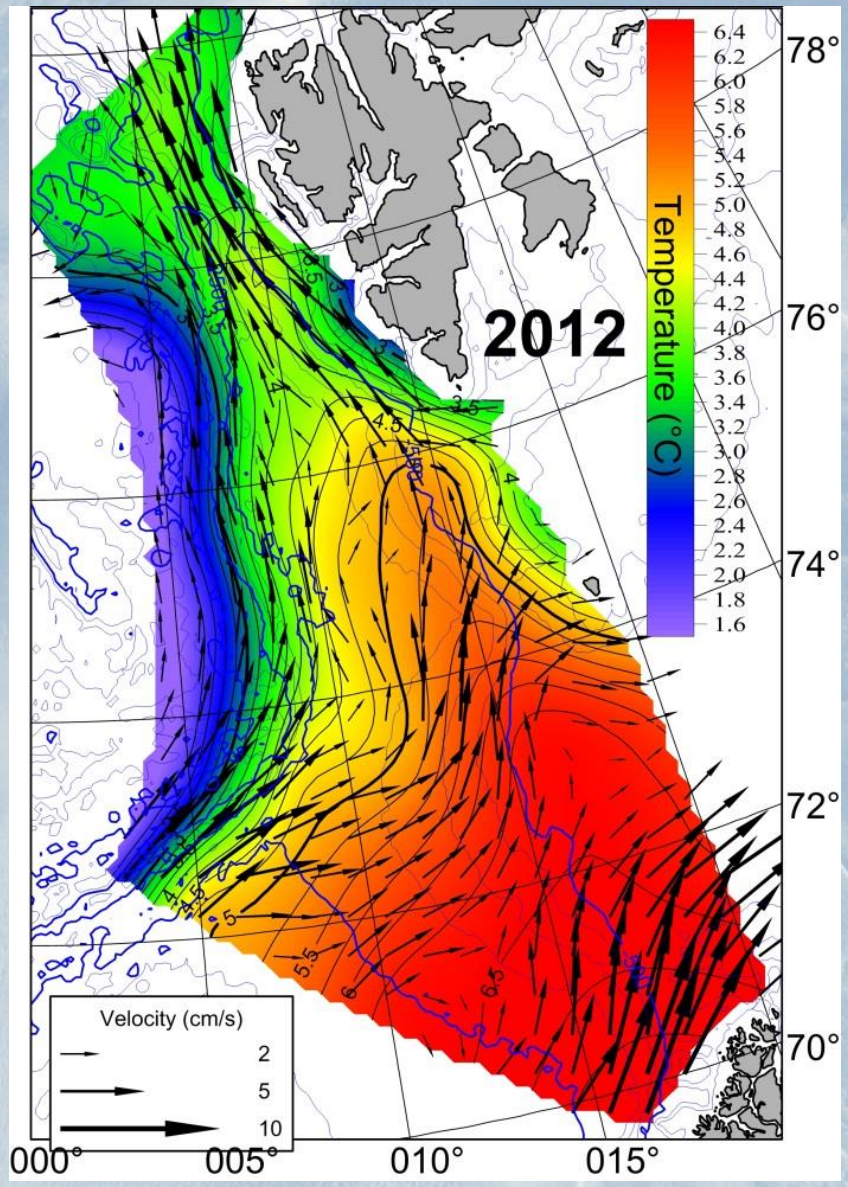






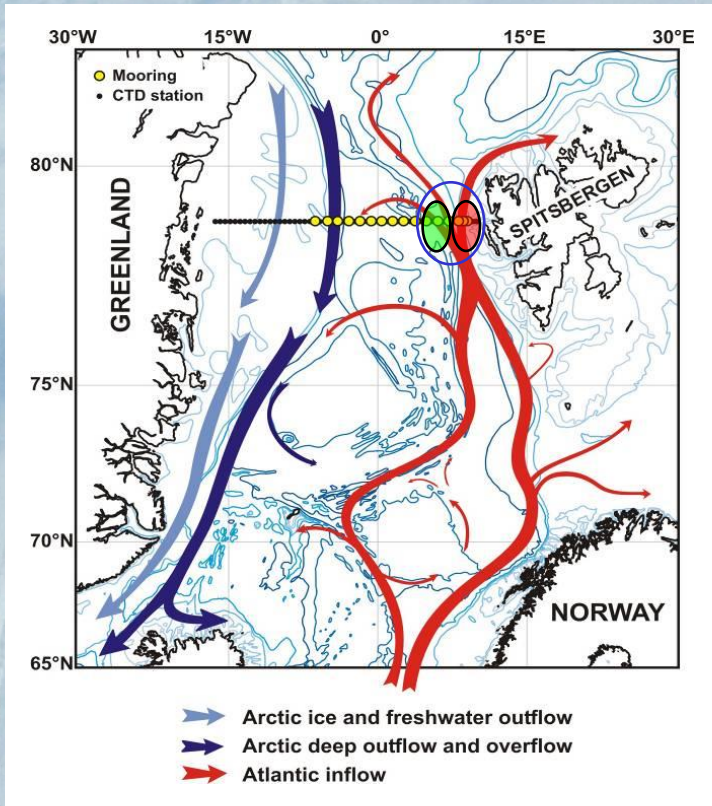
Periodic cycle ~5-6 years

Temperature and geostrophic baroclinic currents at the depth of 100 m in 2000-2012



Interannual variability of volume transport in WSC in 1997-2012

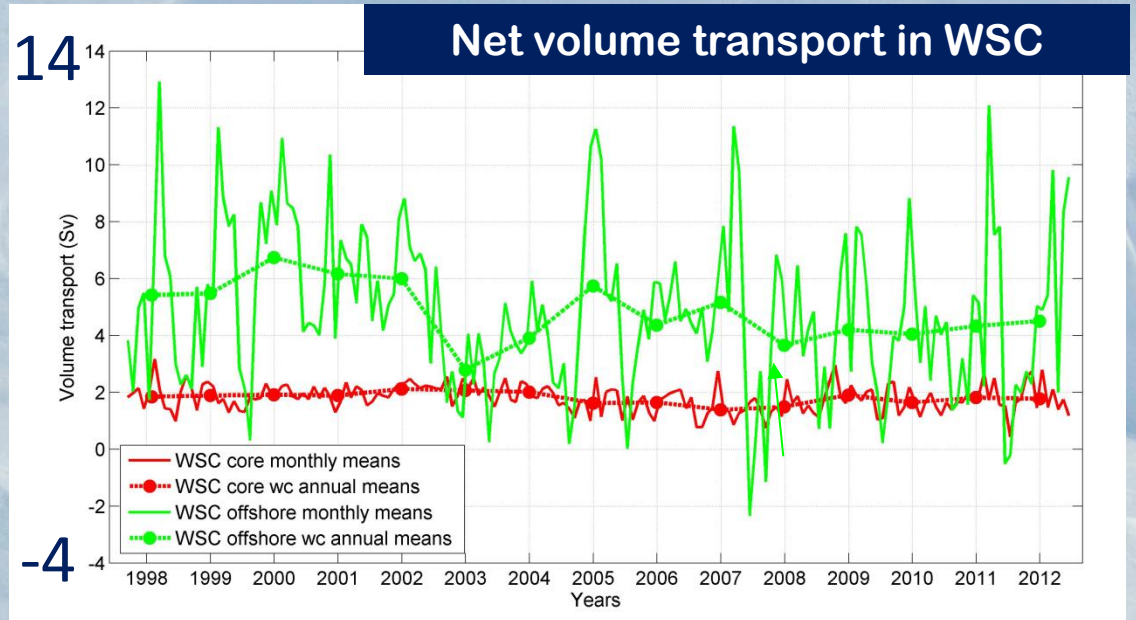
WSC core ⇒ 2 Sv
WSC offshore ⇒ 3-6 Sv



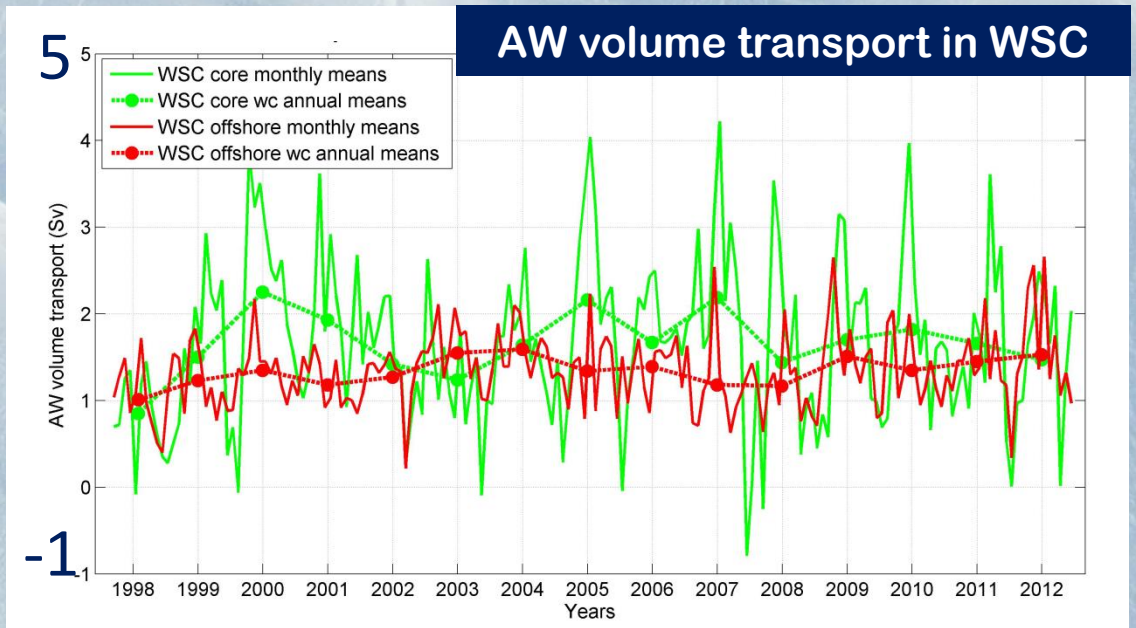
Beszczynska-Möller et al., 2012

AW in WSC core ⇒ 1-1.5 Sv
AW in WSC offsh. ⇒ 1-2 Sv

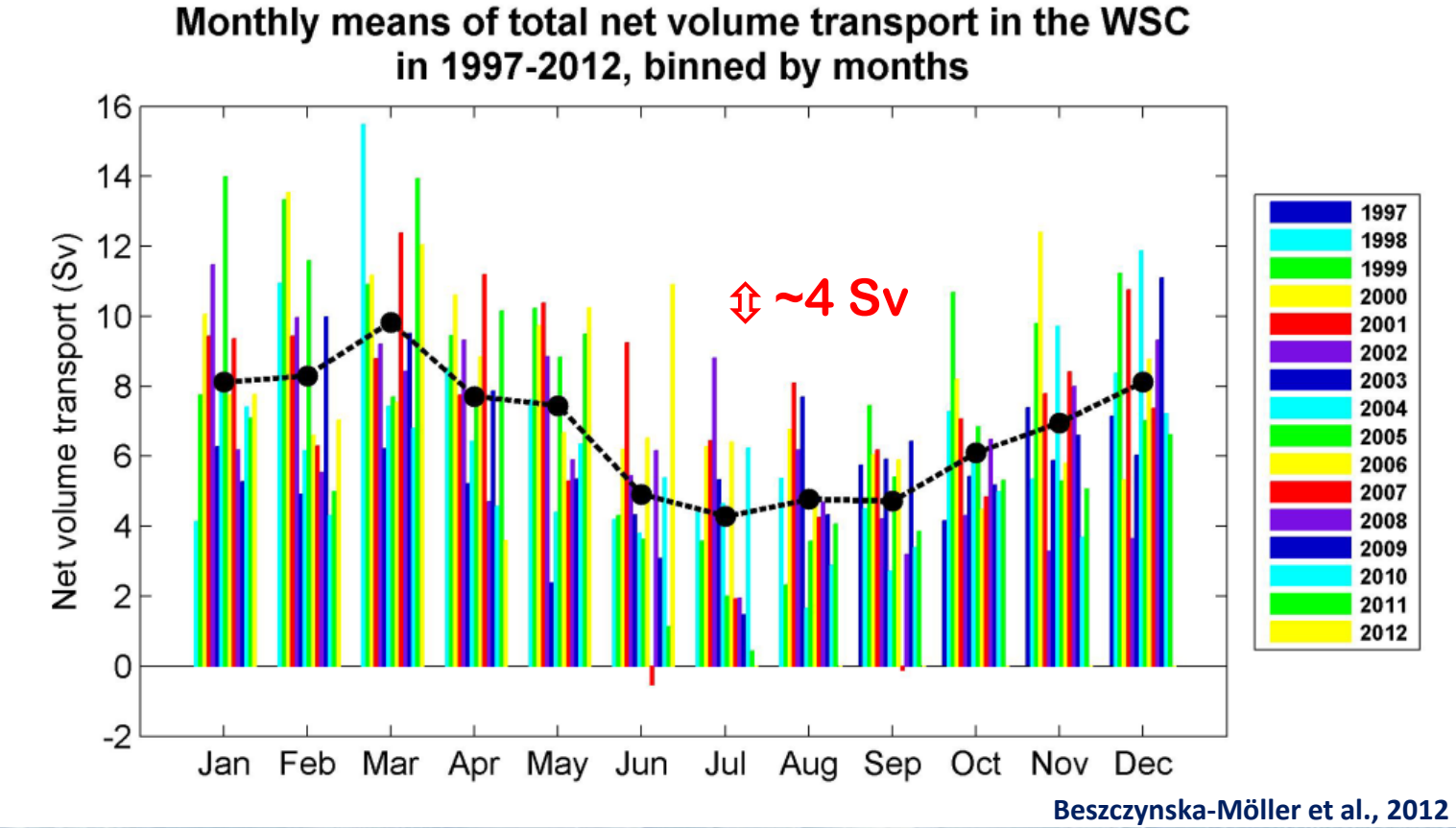
Net volume transport in WSC



AW volume transport in WSC



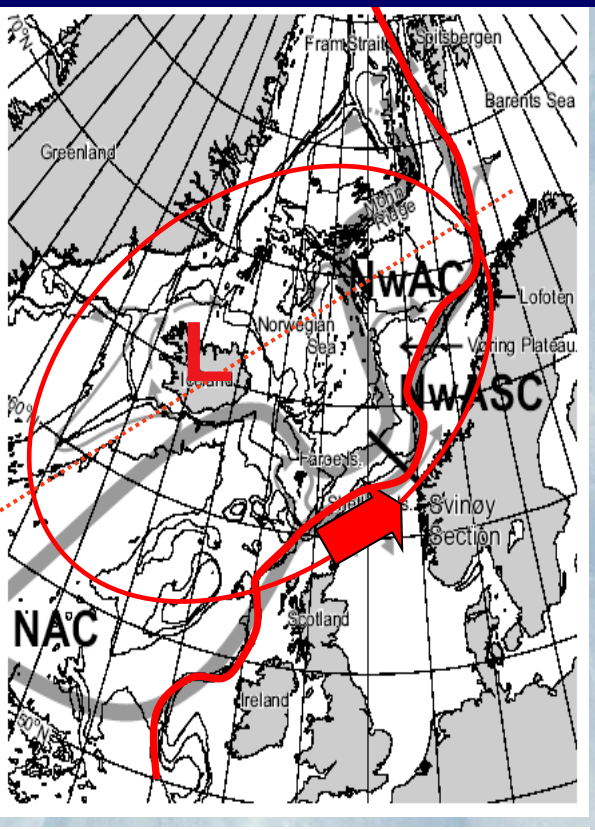
Annual cycle of volume transport in the West Spitsbergen Current



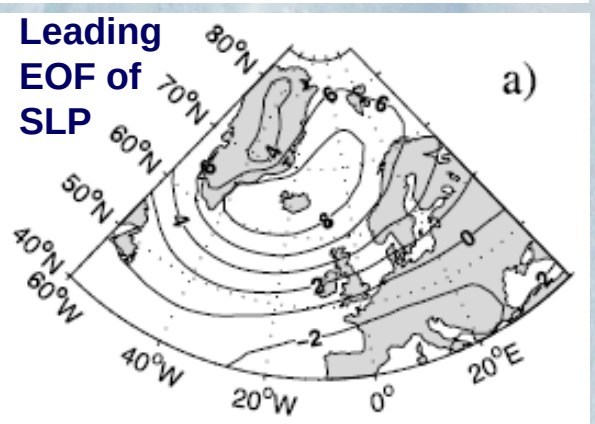
Beszczynska-Möller et al., 2012

- Larger transport in winter
- Max in February-March
- Min in summer (June-July)
- Similar as inter-annual variability

Coherent changes in the slope current (NwASC nad WSC)

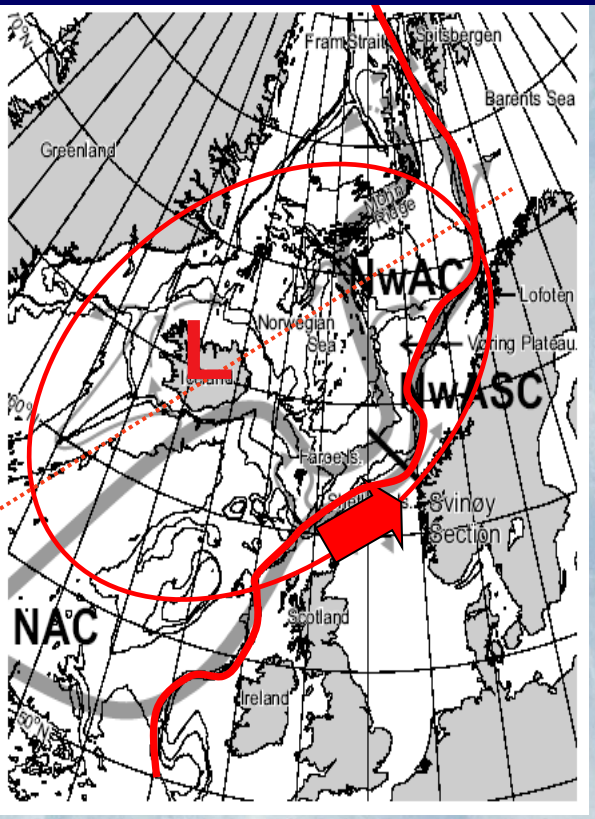


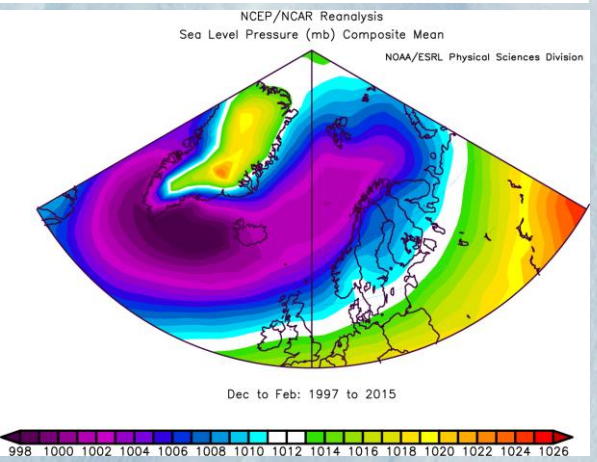
Leading EOF of SLP



Skagseth et al., GRL 2004

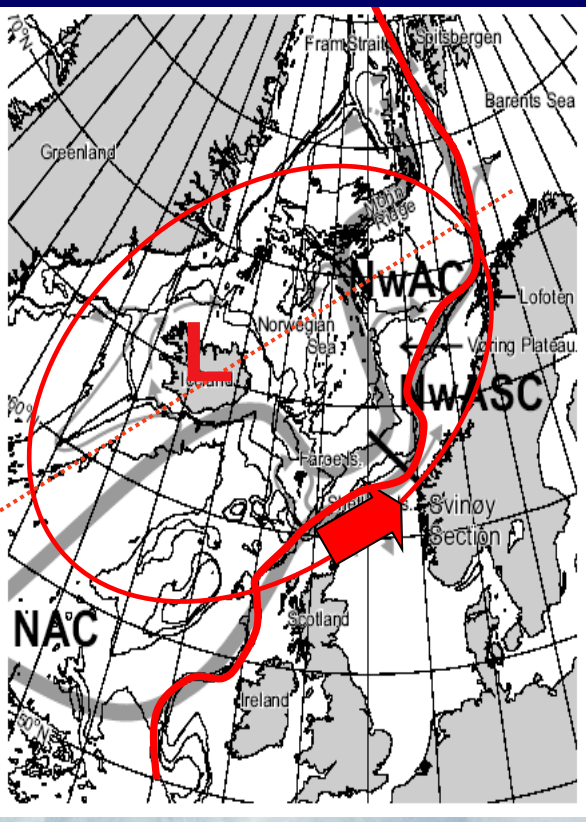
Coherent changes in the slope current (NwASC nad WSC)



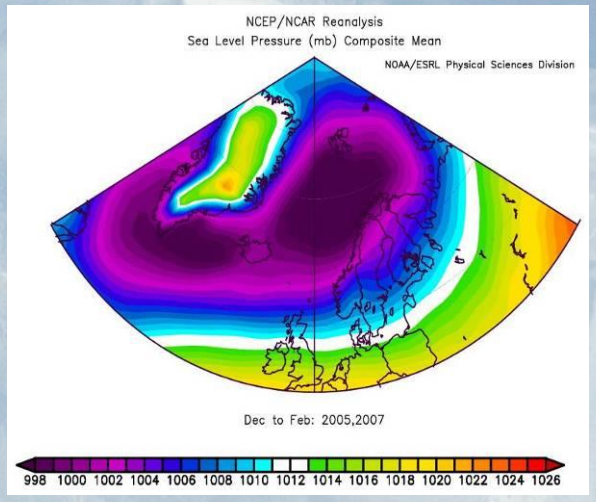


mean 1997-2015

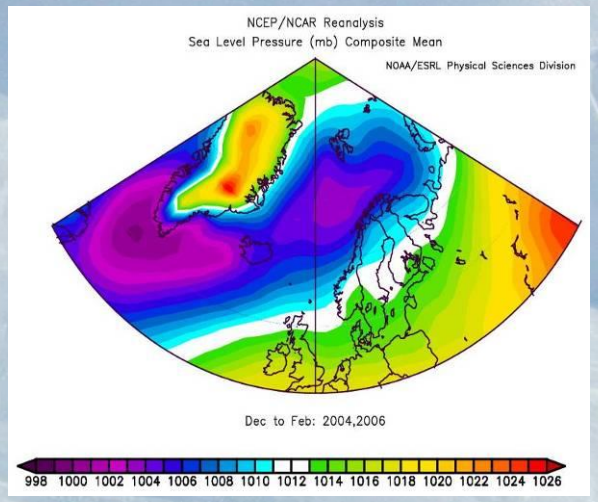
Coherent changes in the slope current (NwASC nad WSC)



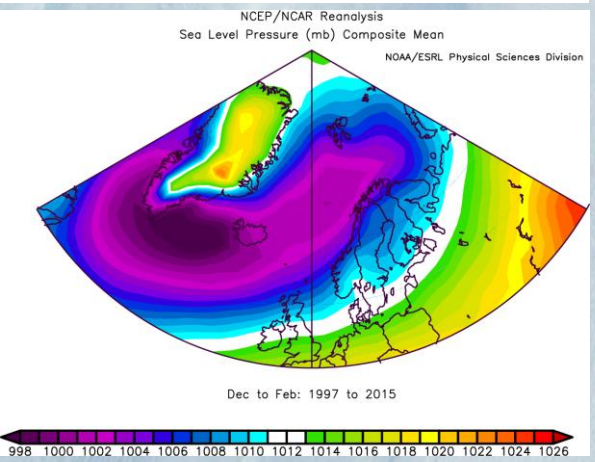
Composites of SLP for winter (DJF) for strong and weak inflow in the WSC



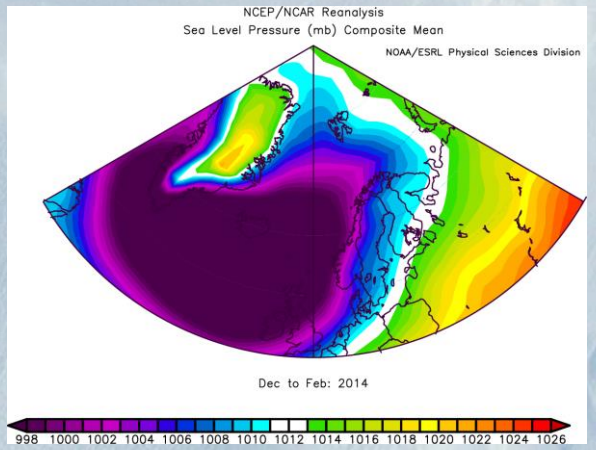
for maximum WSC transport winters (2005, 2007, 2009)



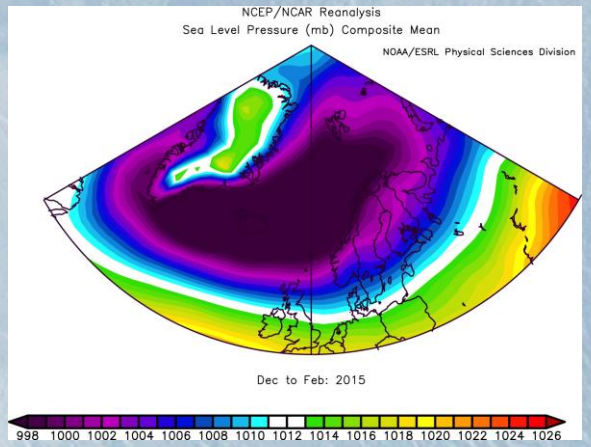
for minimum WSC transport winters (2004, 2006, 2010)



mean 1997-2015



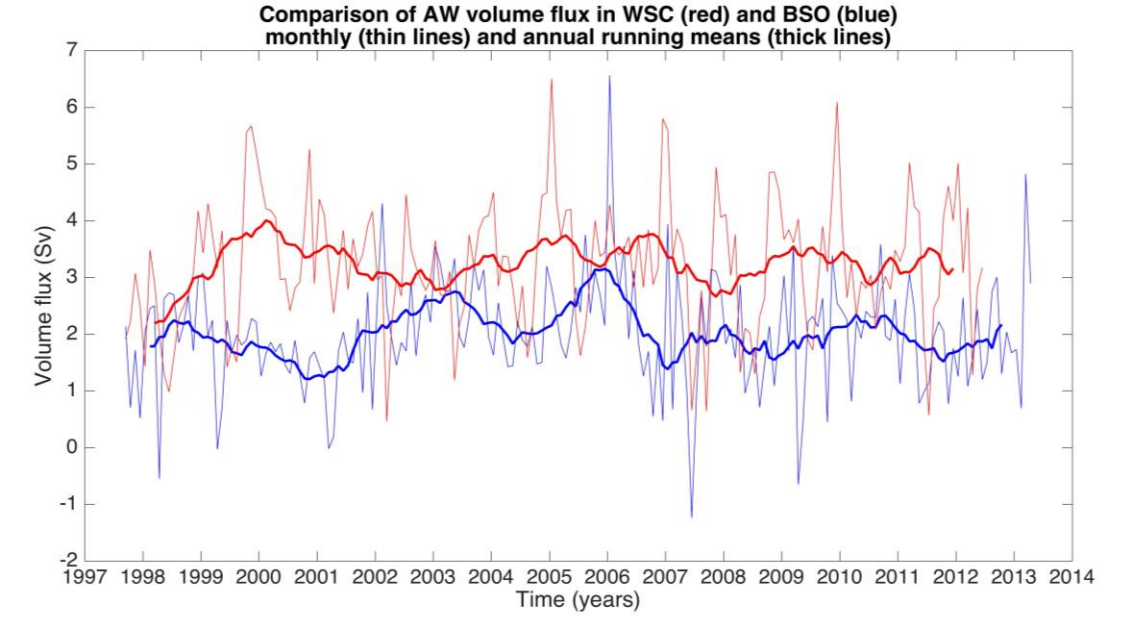
winter 2014

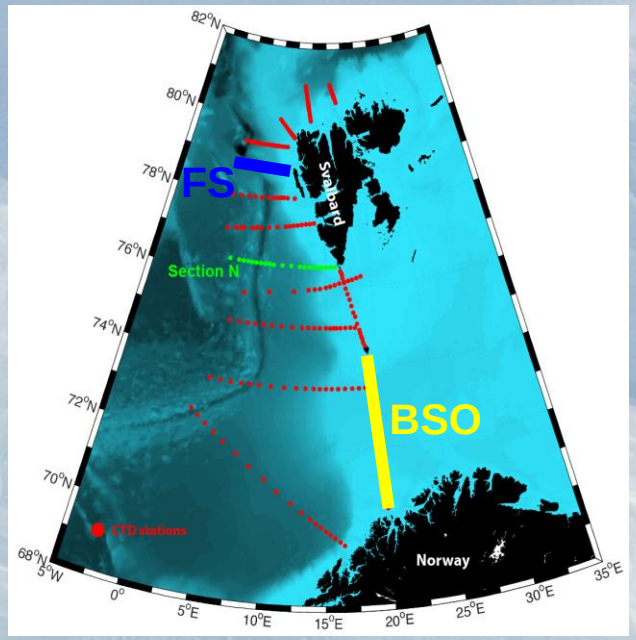


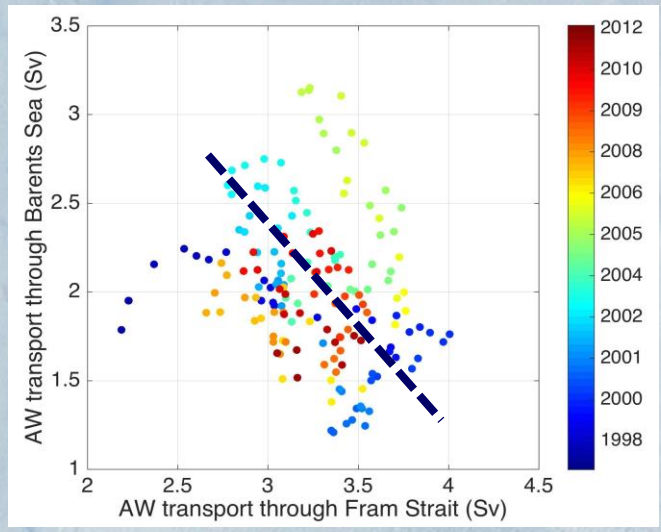
winter 2015

Data from the NCEP/NCAR Reanalysis Project (Kalnay et al., 1996)

AW transport through BSO and Fram Strait

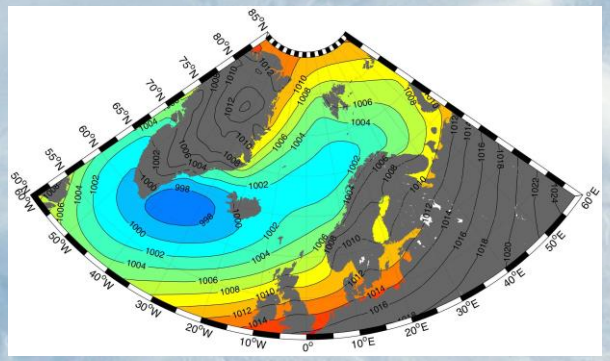




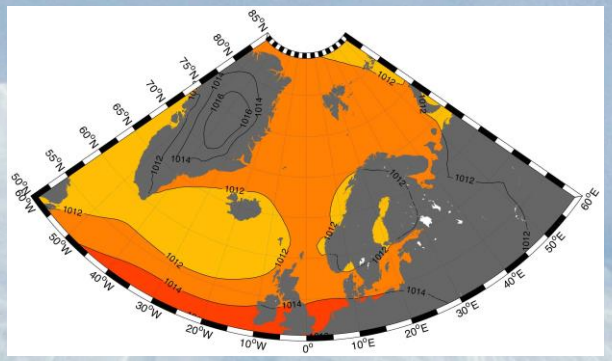


MSLP composites and AW transport through BSO and Fram Strait

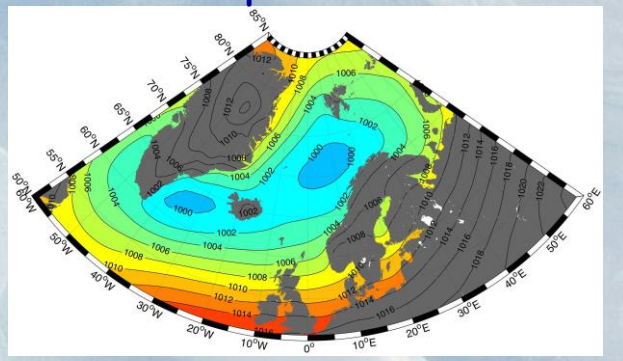
winter (DJF) 1997-2014 mean



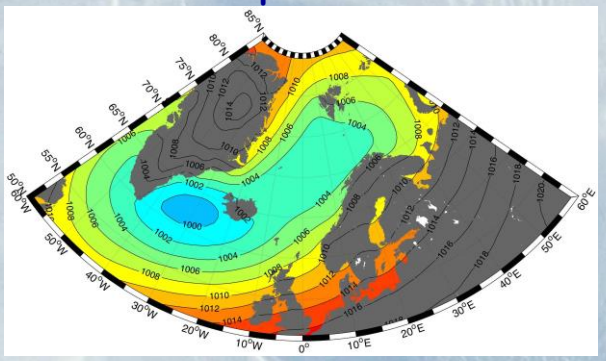
summer (JJA) 1997-2014 mean



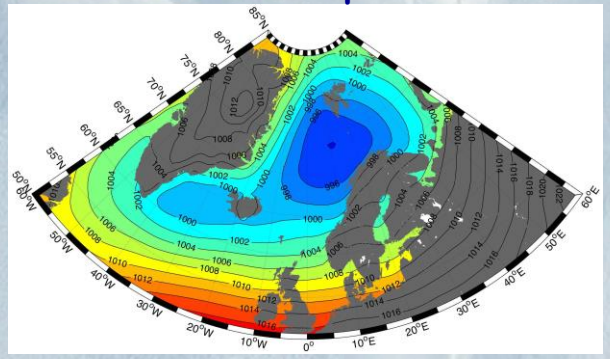
FS AW transport > mean + 1 std



BSO AW transport > mean + 1 std

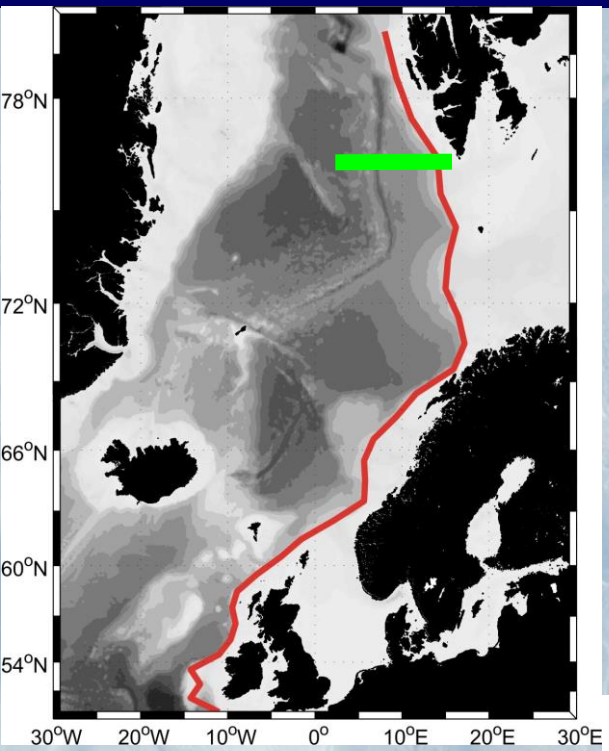


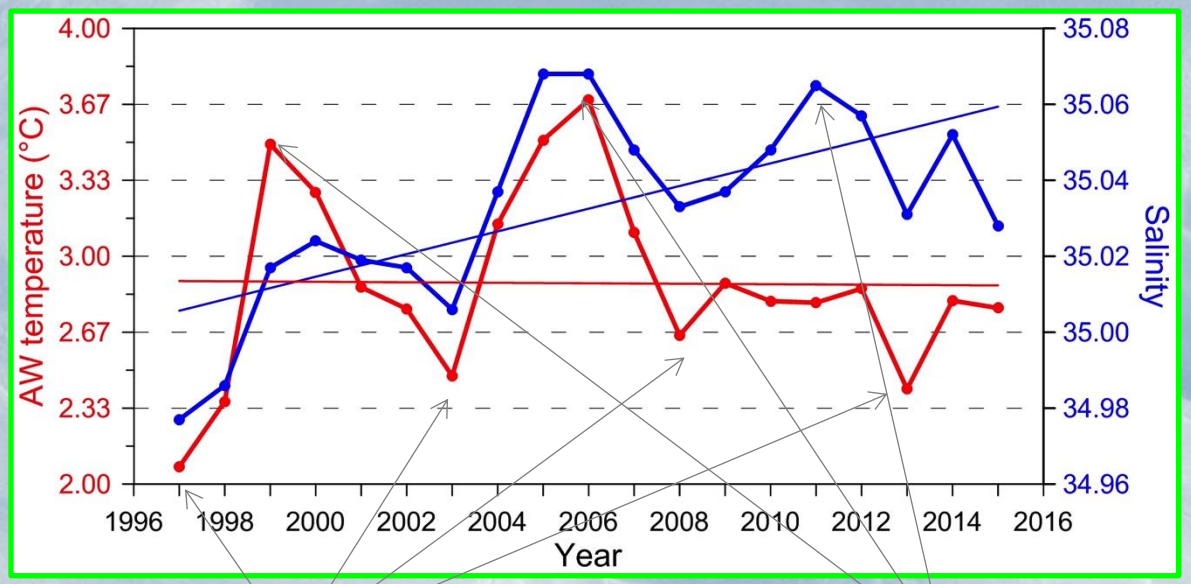
FS and BSO AW transports > mean + 1 std

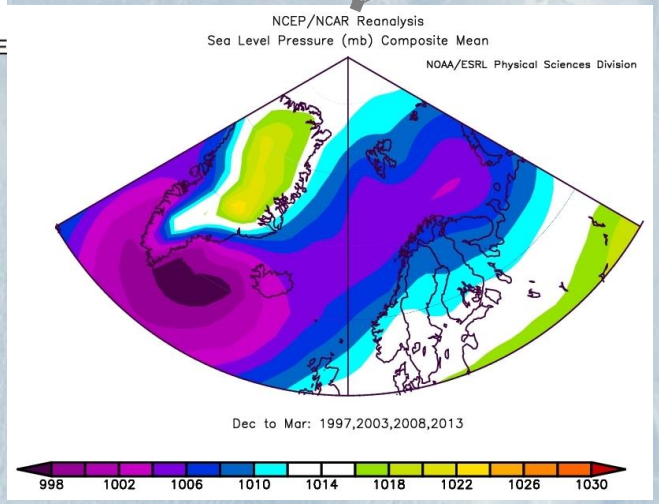


Data from ERA Interim (Dee et al.,2011)

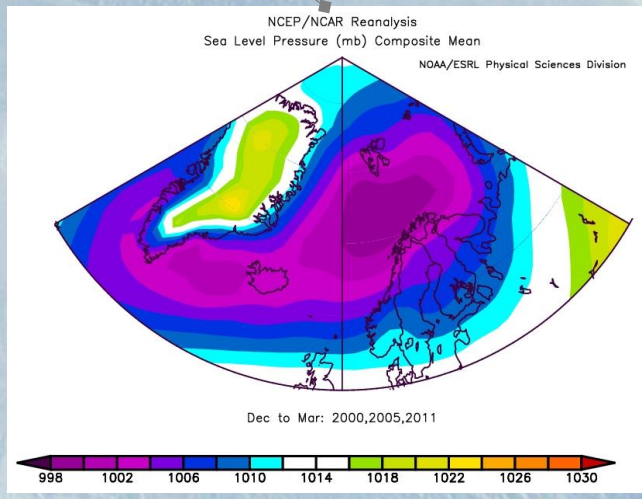
SLP for positive and negative cycles of temperature and salinity in Fram Strait





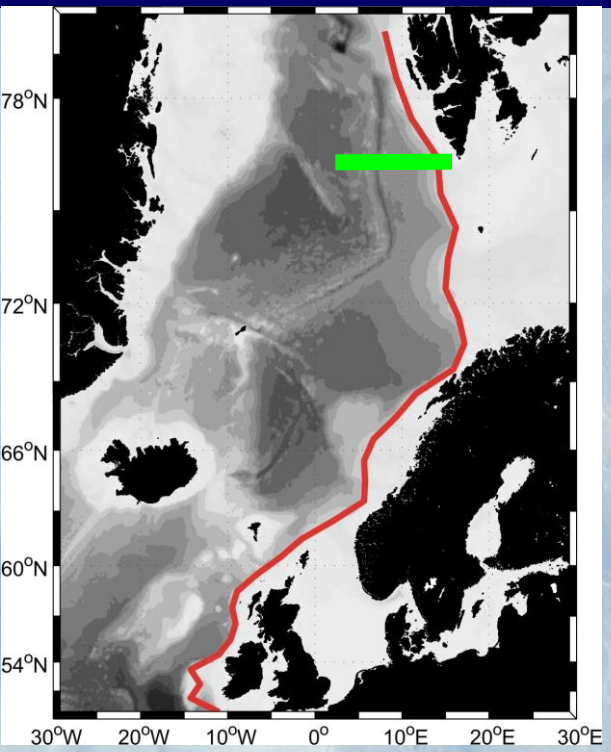


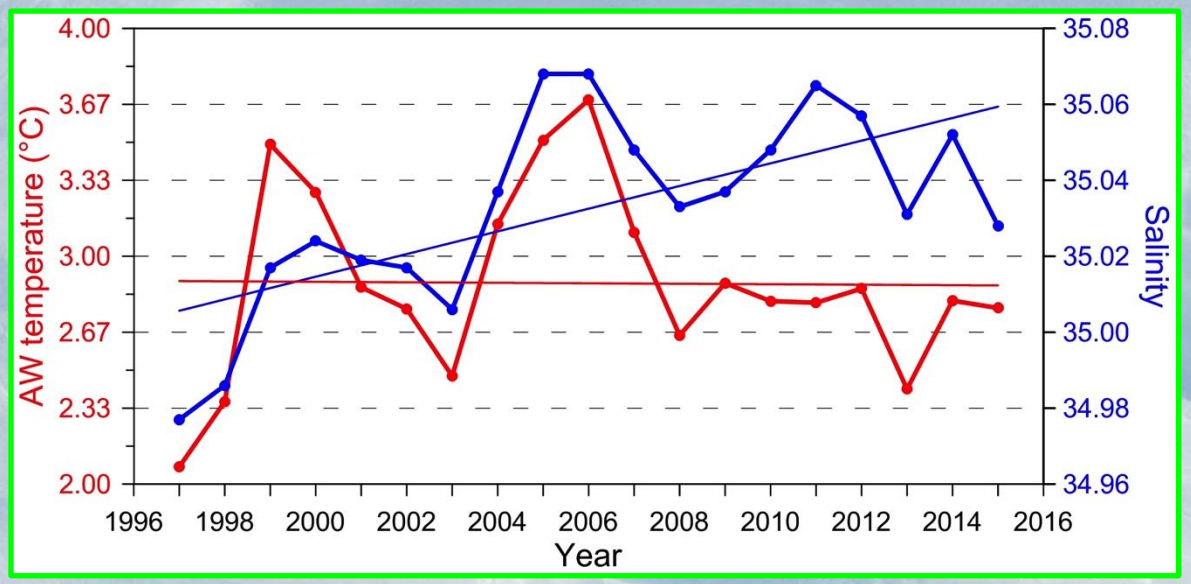
SLP in winter preceding low temperature and salinity

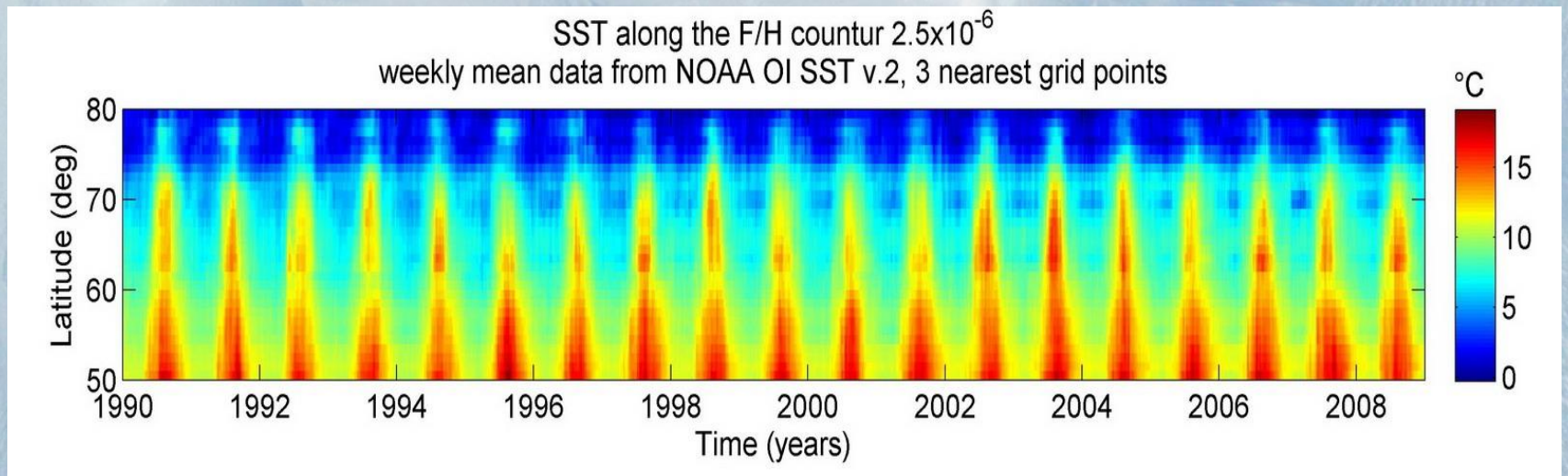


SLP in winter preceding high temperature and salinity

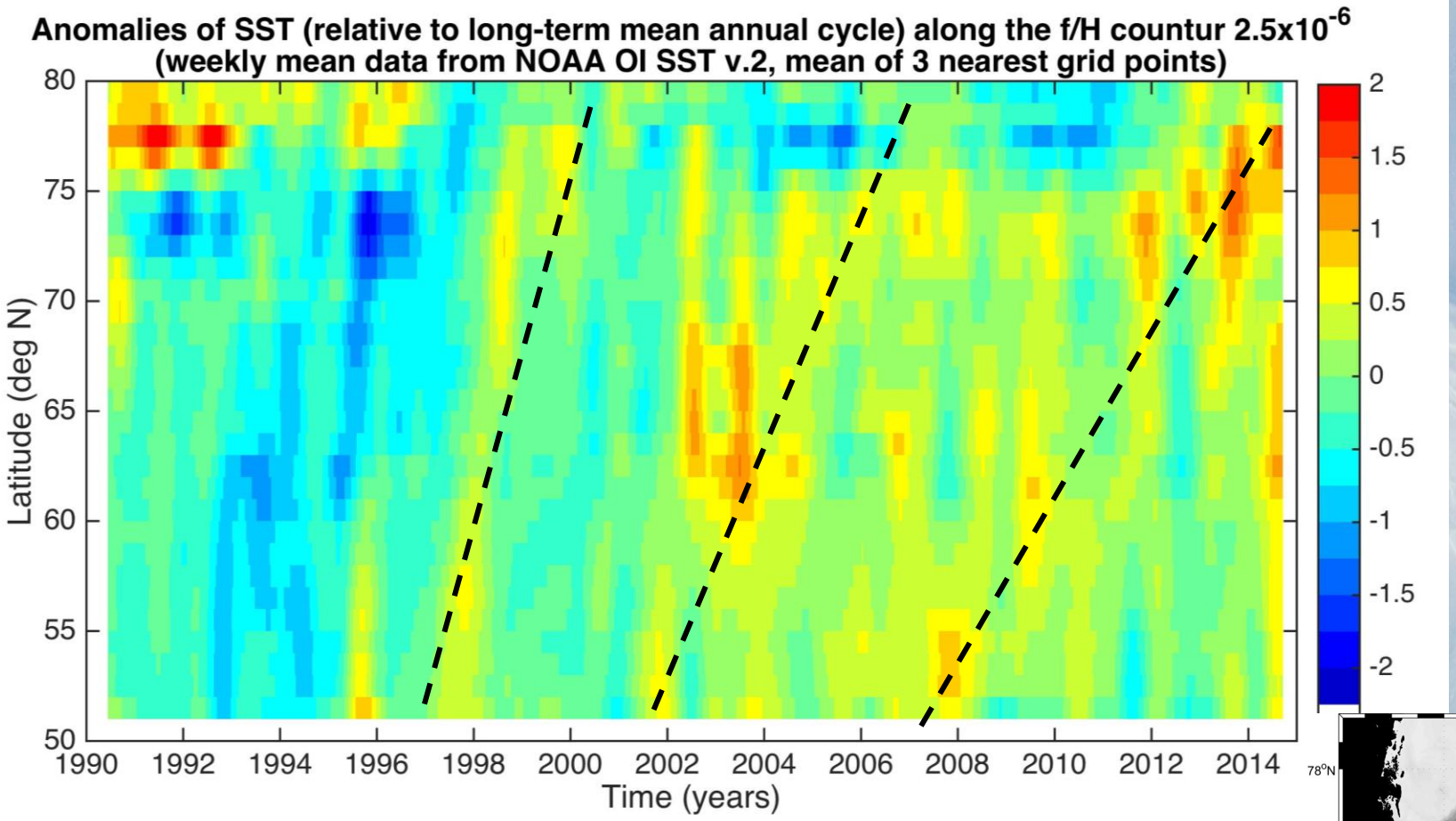
Sea surface temperature along f/H contour respresenting the shelf break

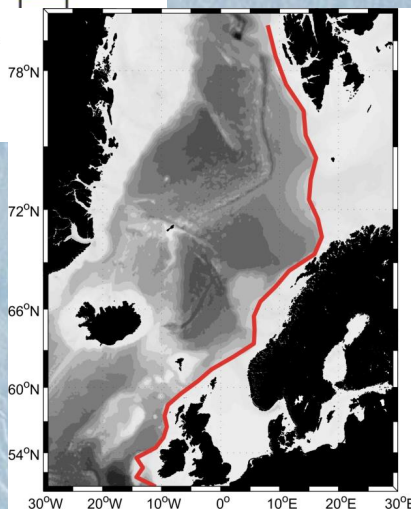






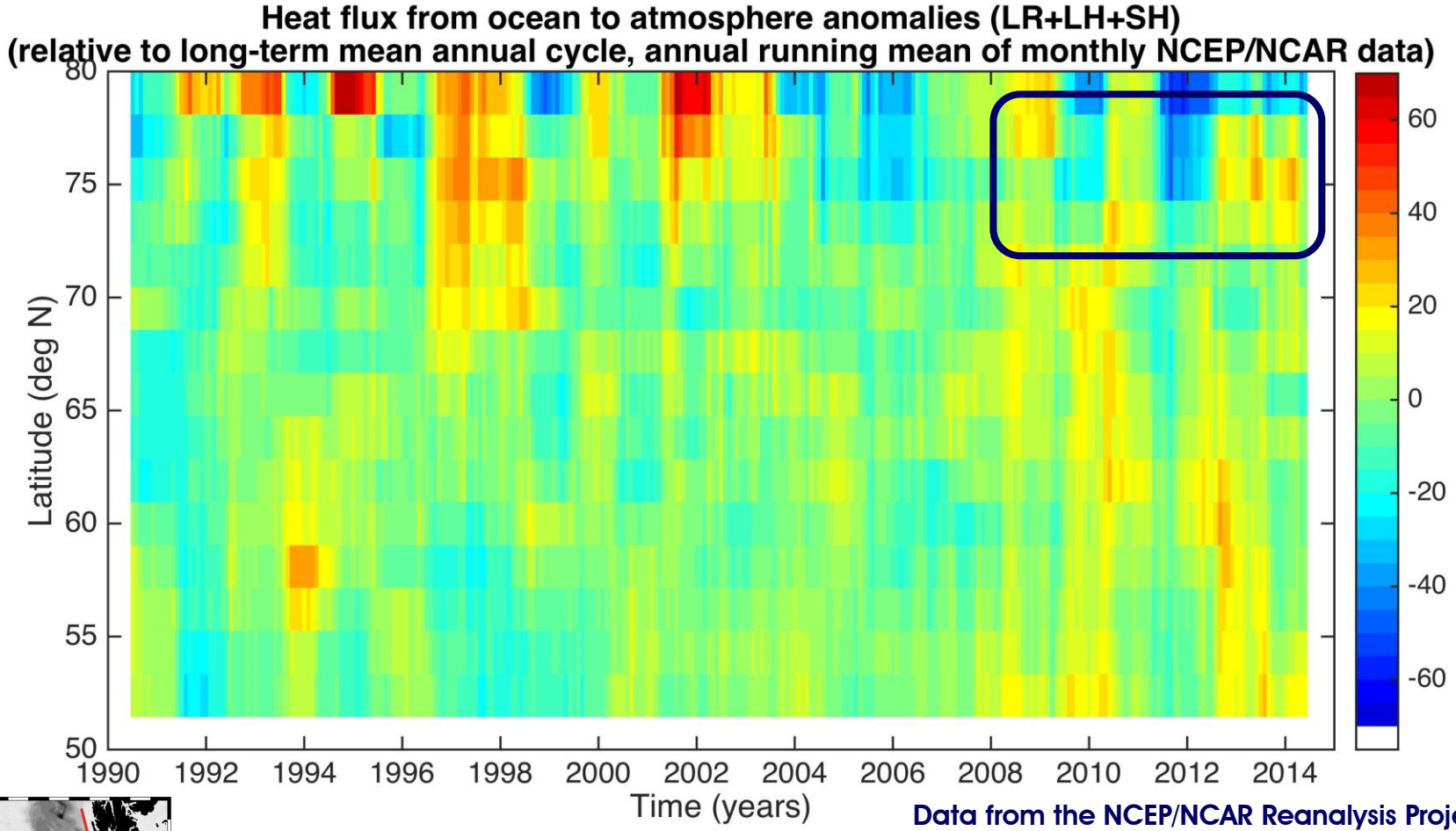
Anomalies of SST on interannual scale along f/H contour respresenting the shelf break



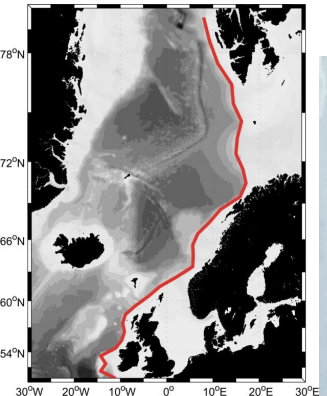


- Warm anomalies can be traced in SST around the eastern rim of the North Atlantic and farther into Fram Strait
- In annually smoothed data anomalies are damped but propagation and time shifts between different latitudes are better visible

Real heat flux (atmosphere warming SH+LH+LR) anomalies along f/H contour respresenting the shelf break

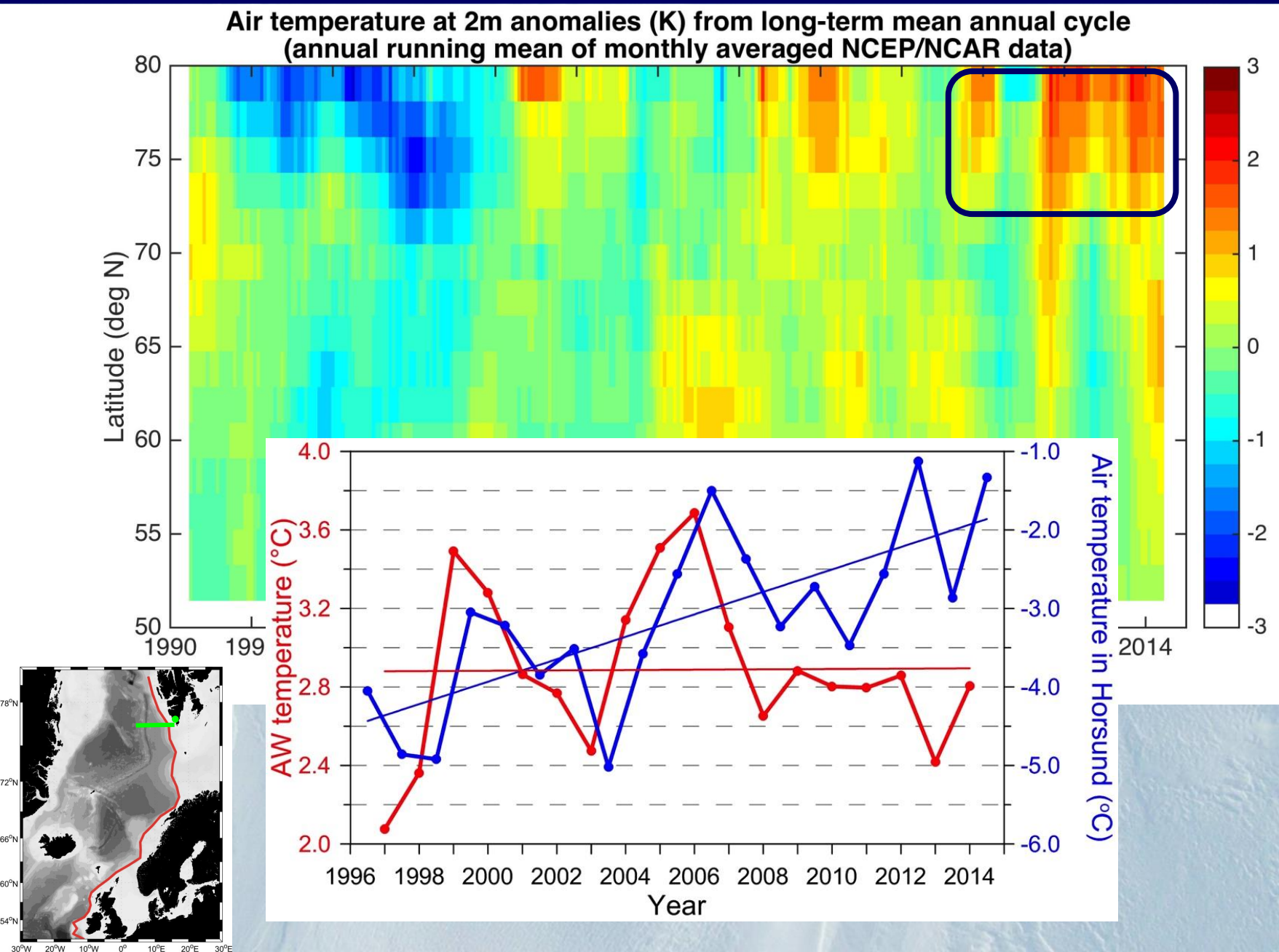


Data from the NCEP/NCAR Reanalysis Project, PSD

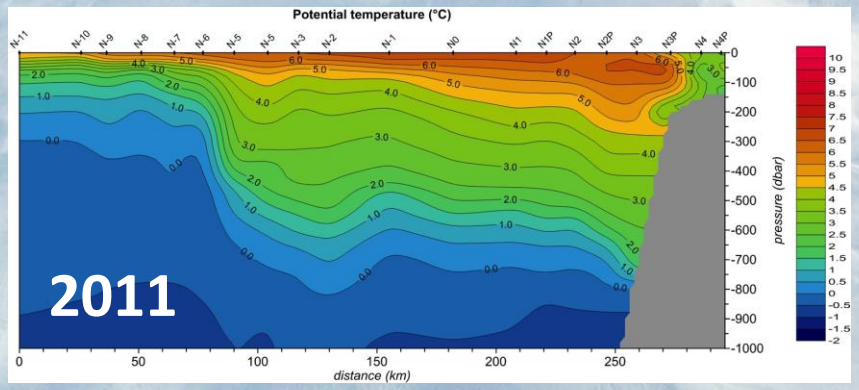


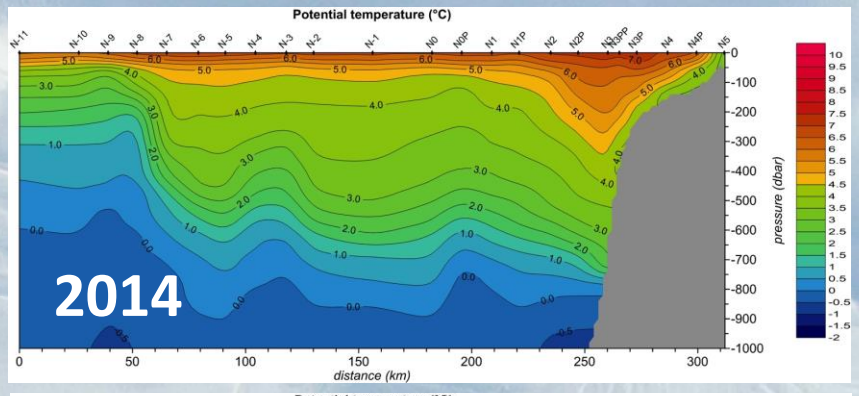
- Most of the time stronger anomalies of heat flux in Fram Strait than in upstream areas south of 72° N
- Positive anomalies in Fram Strait for ‘cold AW periods’, negative for ‘warm AW years’ (but not so clearly)

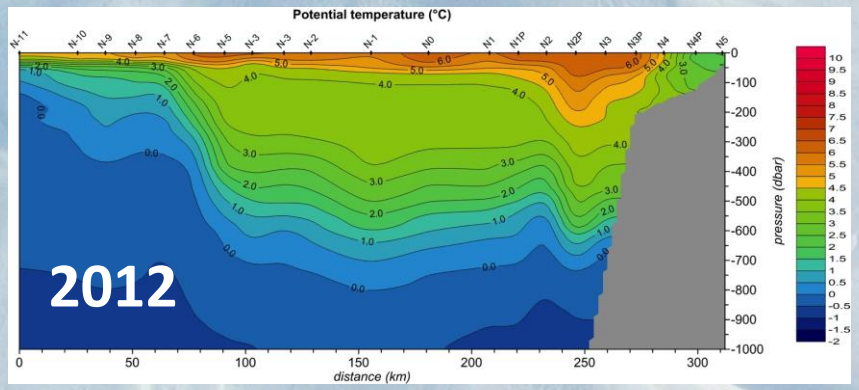
Air temperature anomalies along the shelf break (reanalysis) and air temperaure measured in Hornsund (southern Svalbard)

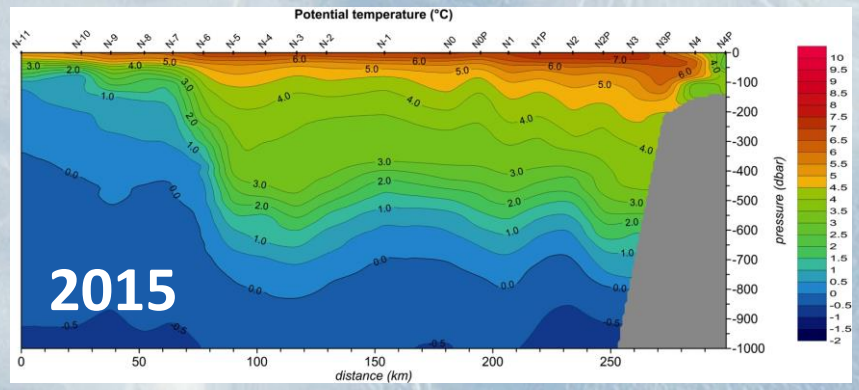


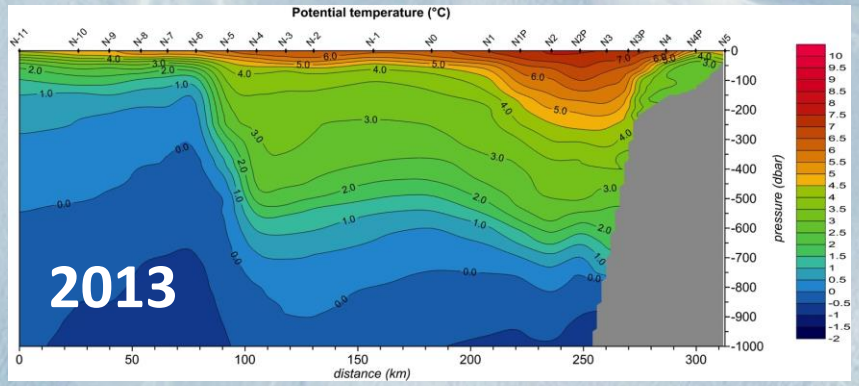
Temperature
Section N

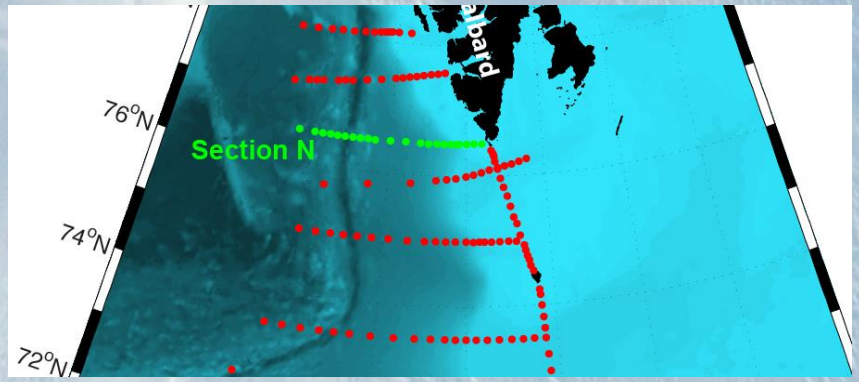




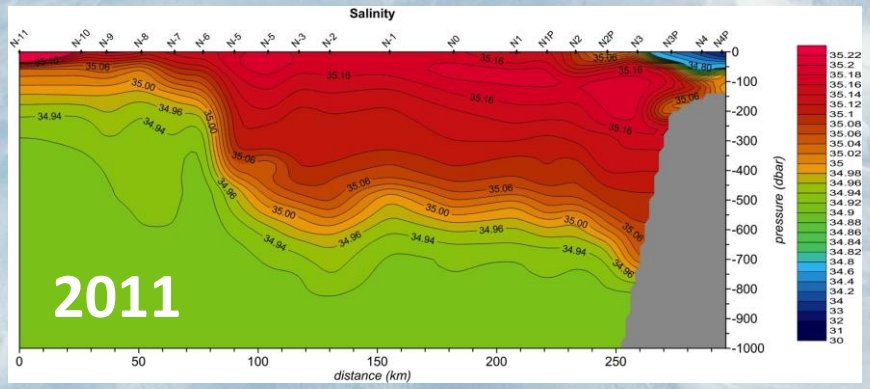


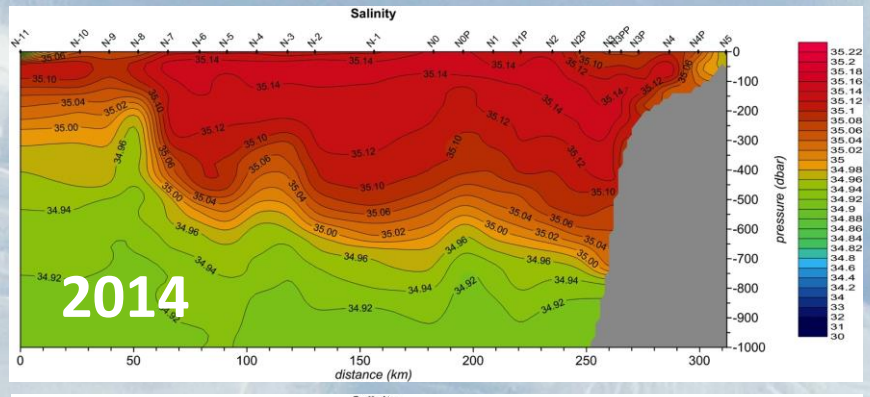


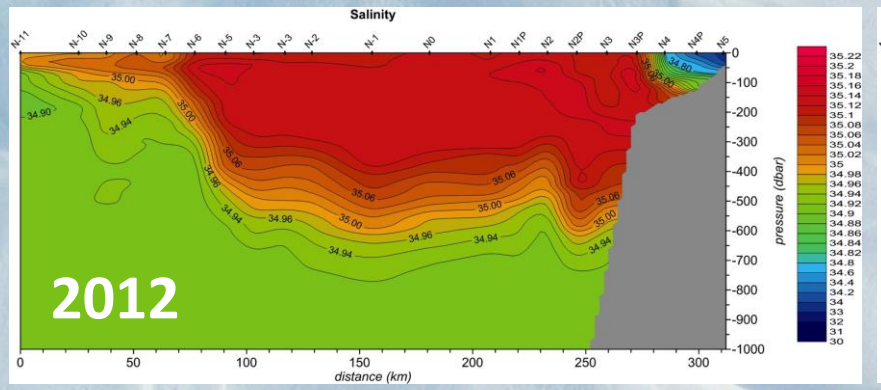


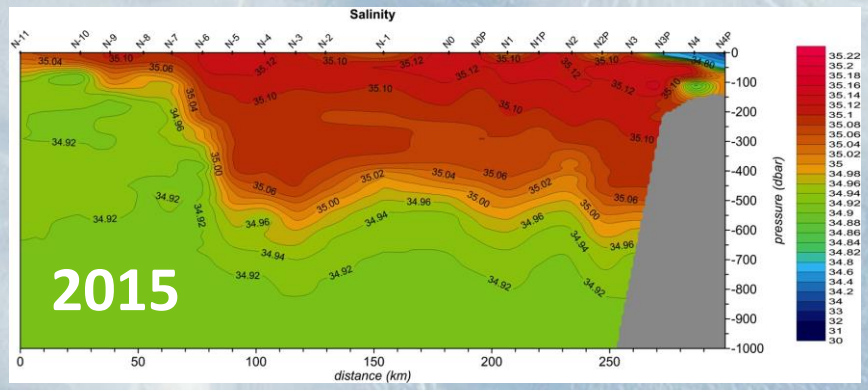


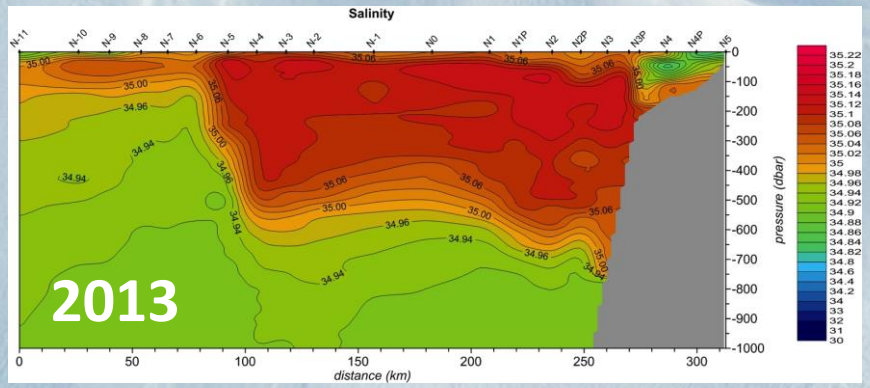
Salinity
Section N

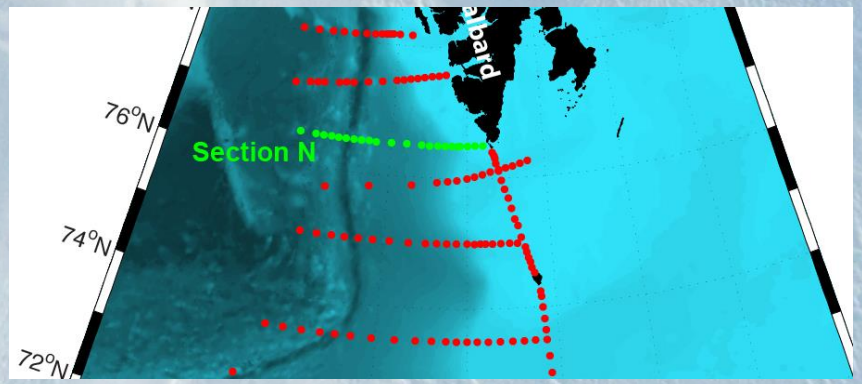




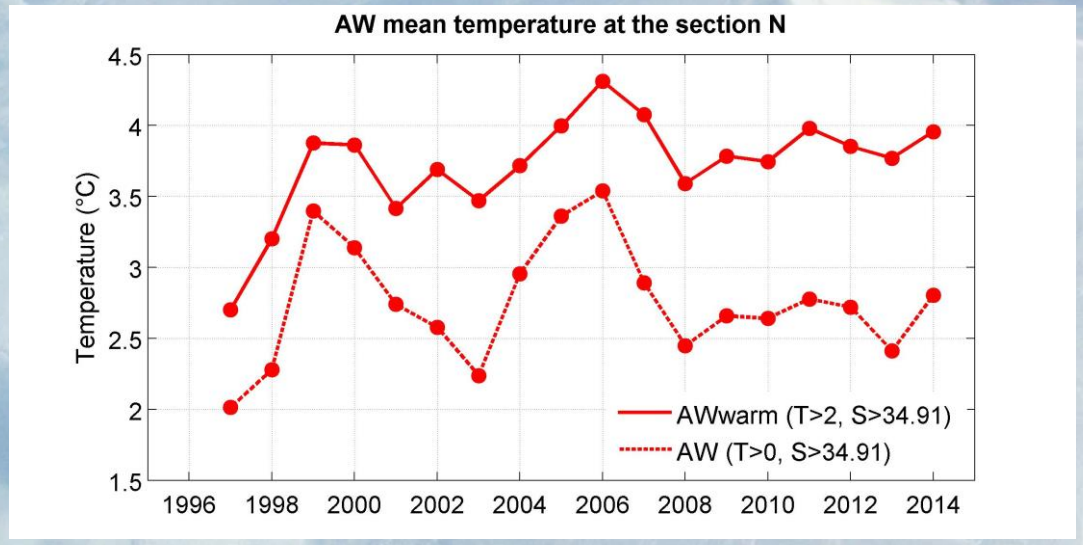


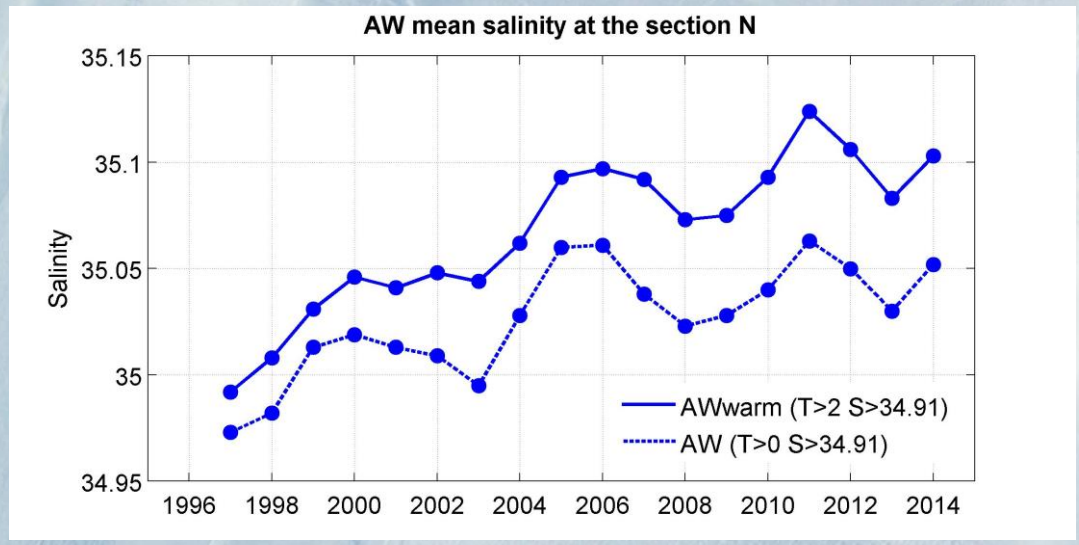






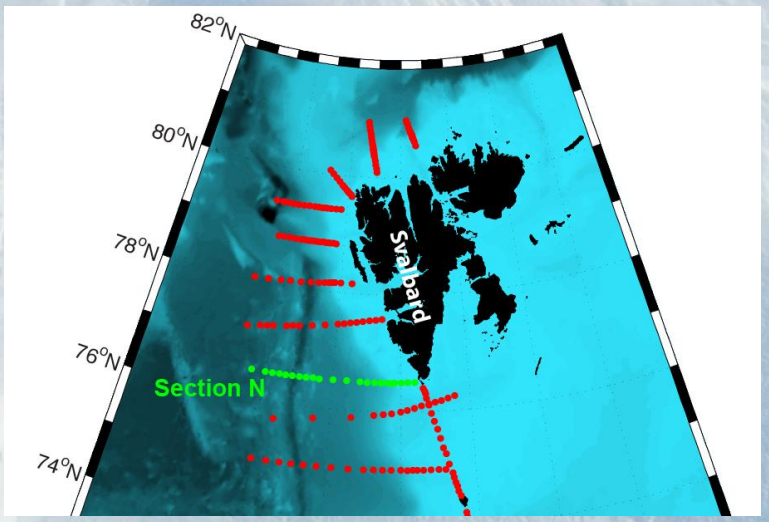
AWAKE-2 2nd Annual Meeting
December 3-4, 2015, Sopot





AW mean temperature

Section N

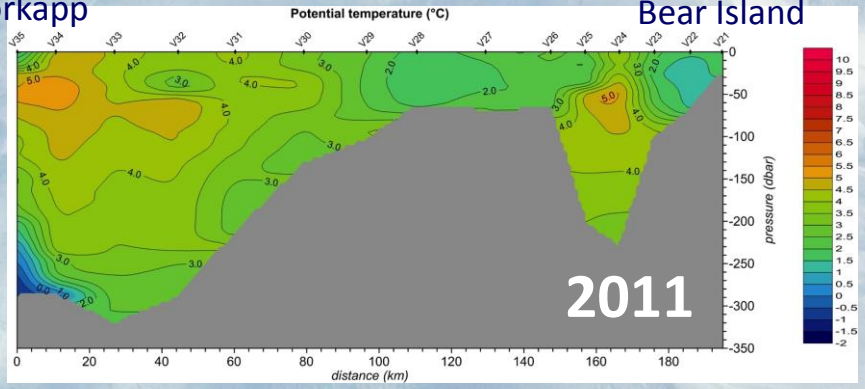


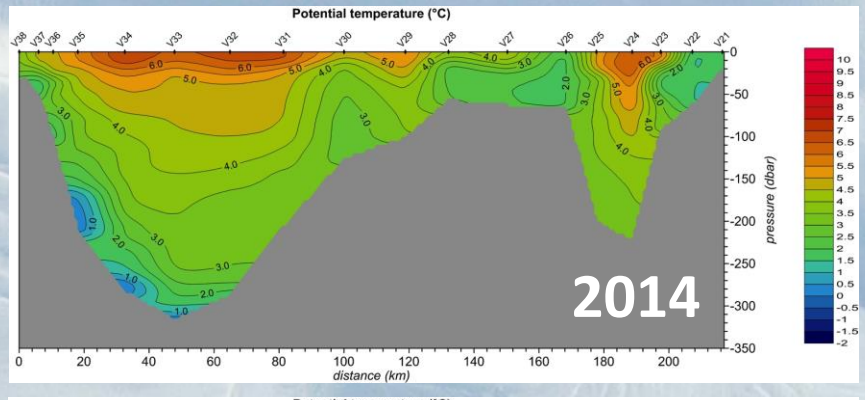
AW mean salinity

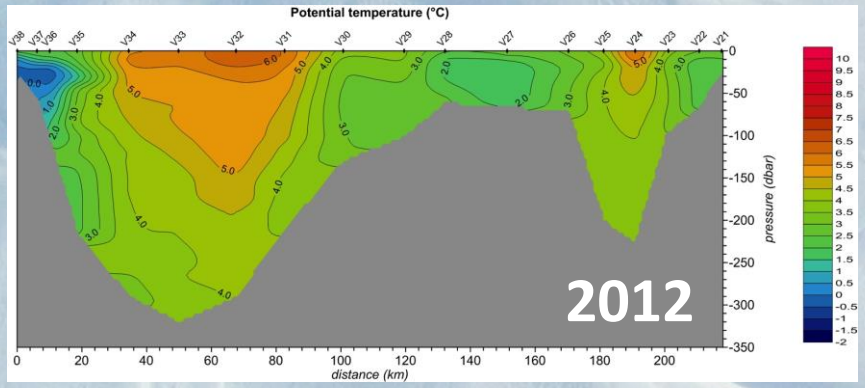
Temperature Section V2

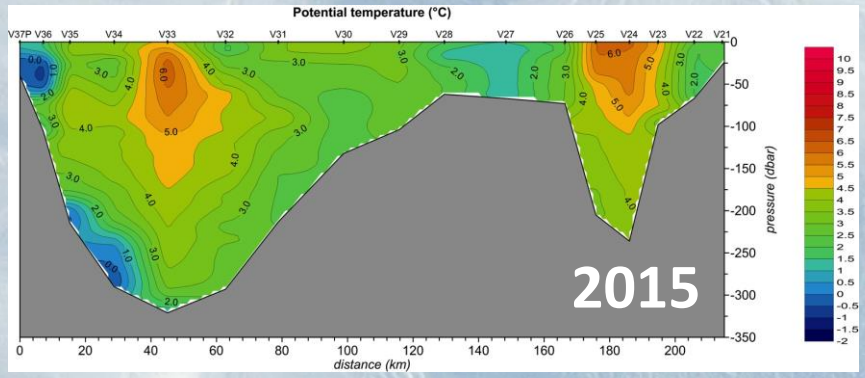
Sørkapp

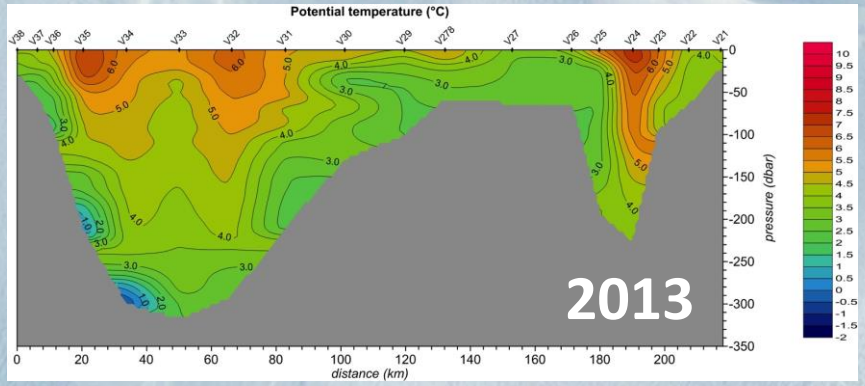
Bear Island

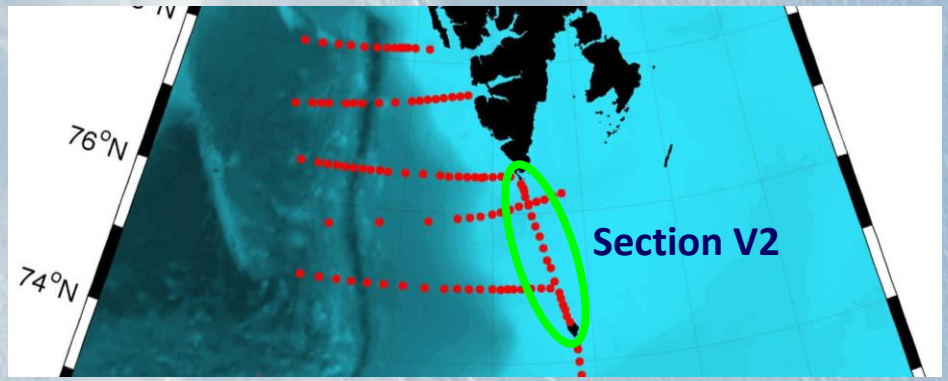








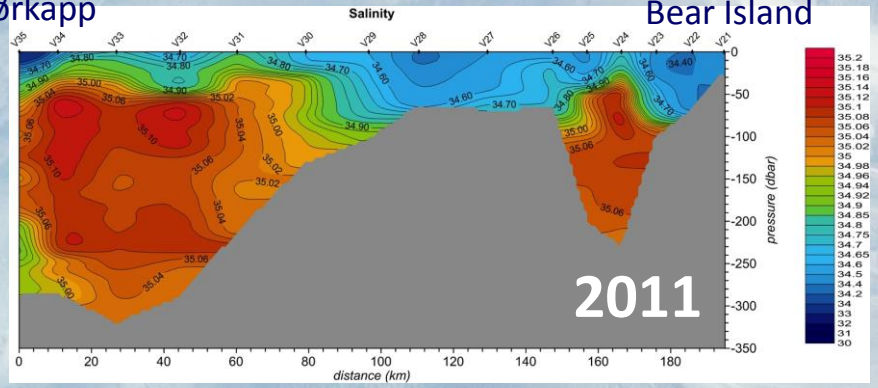


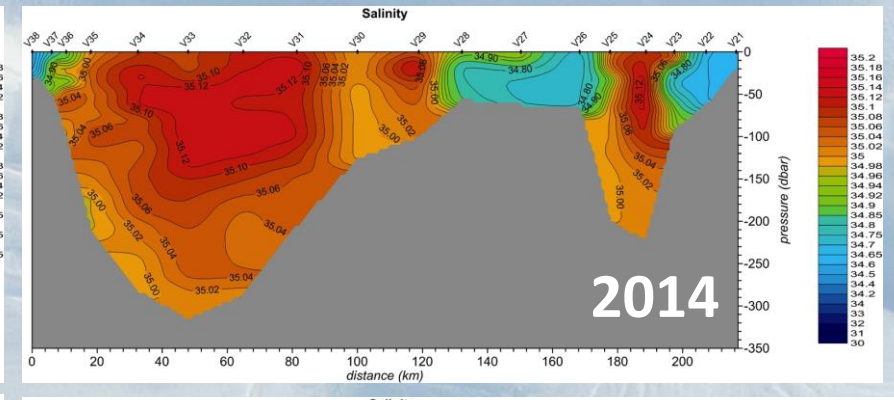


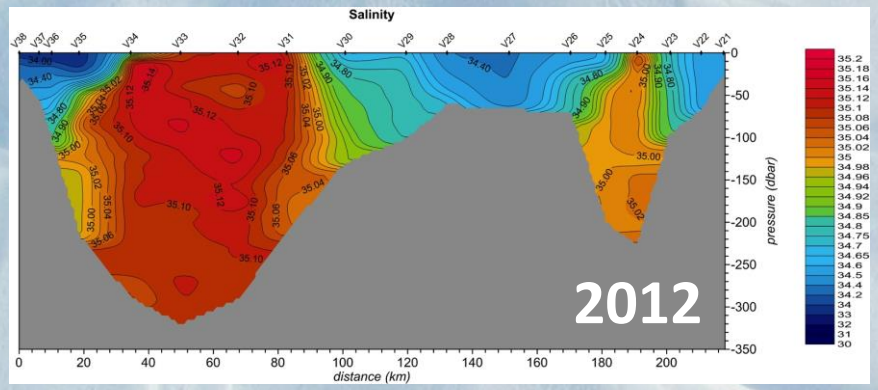
Salinity
Section V2

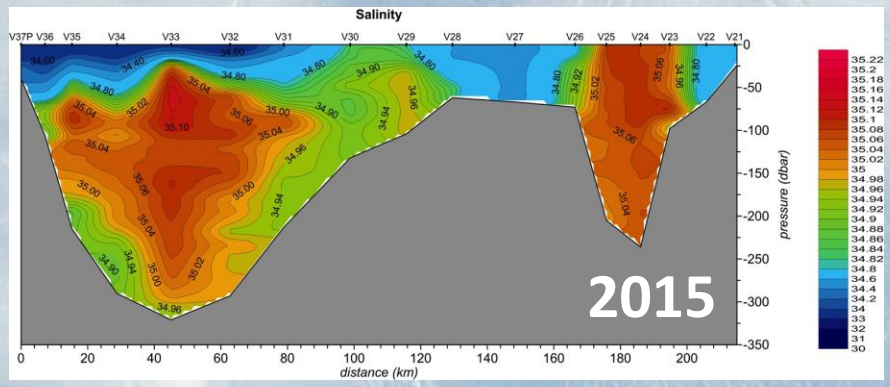
Sørkapp

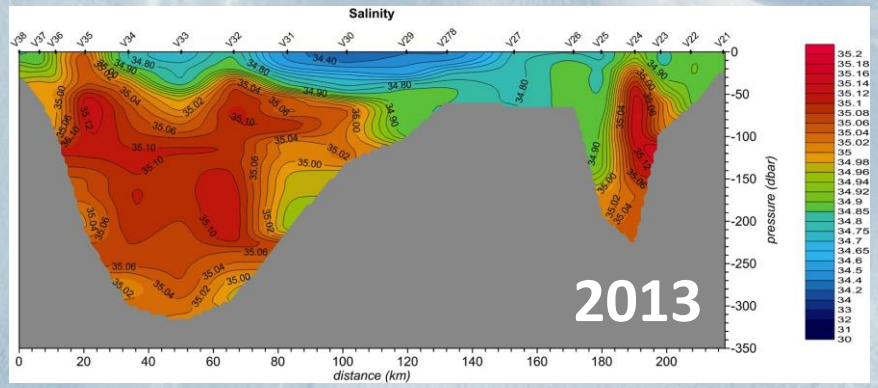
Bear Island

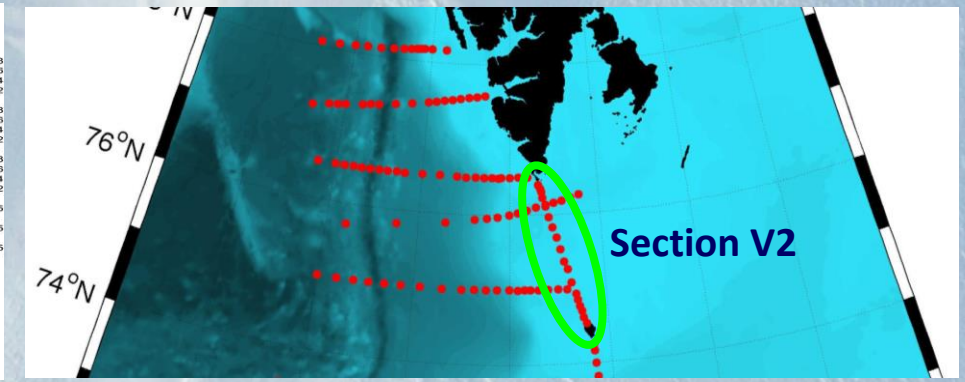




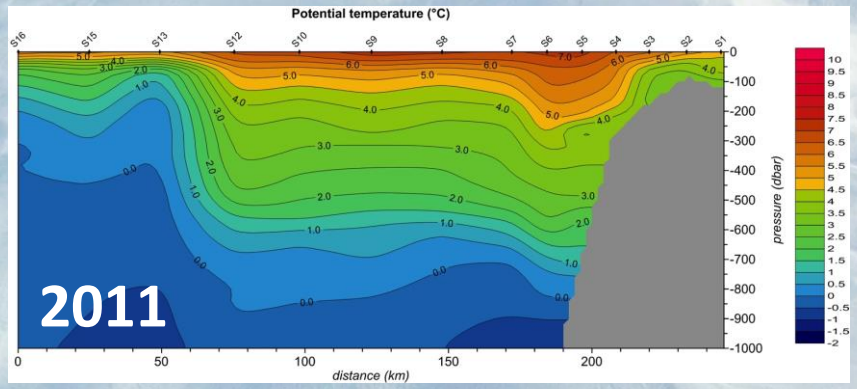


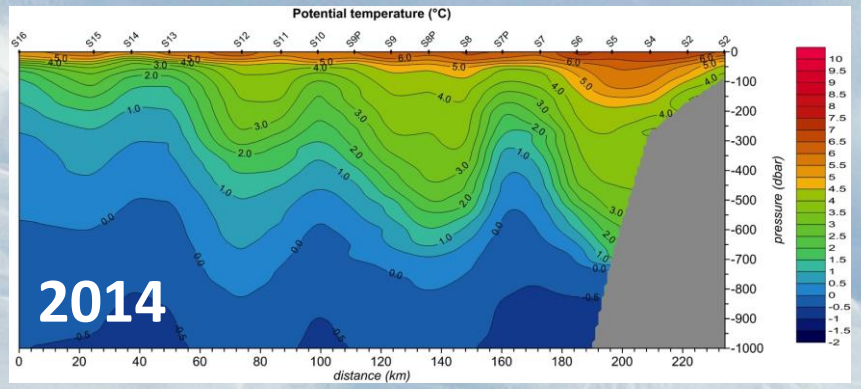


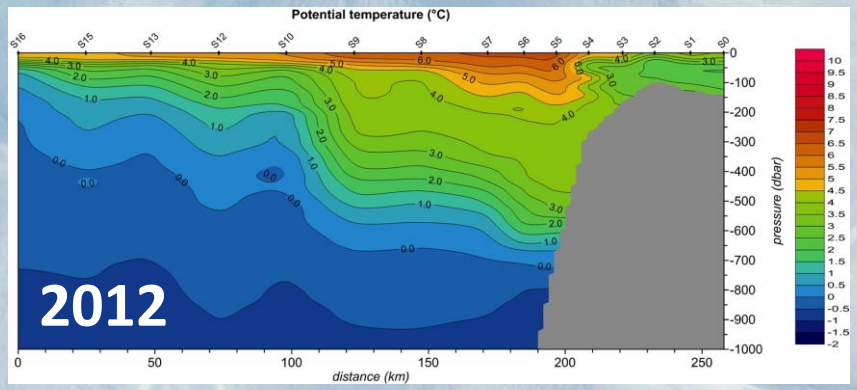


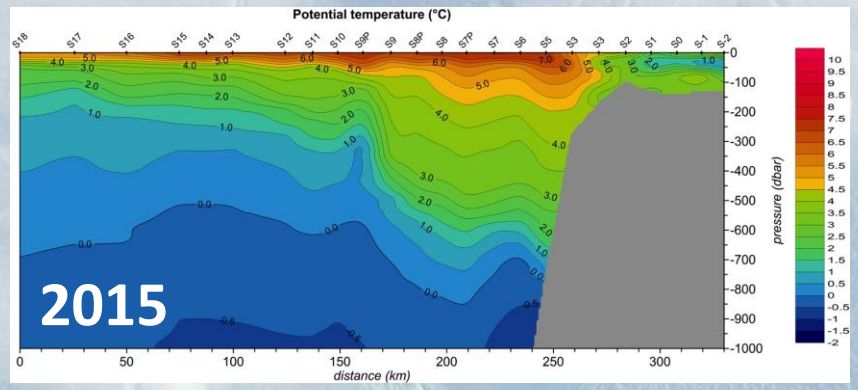


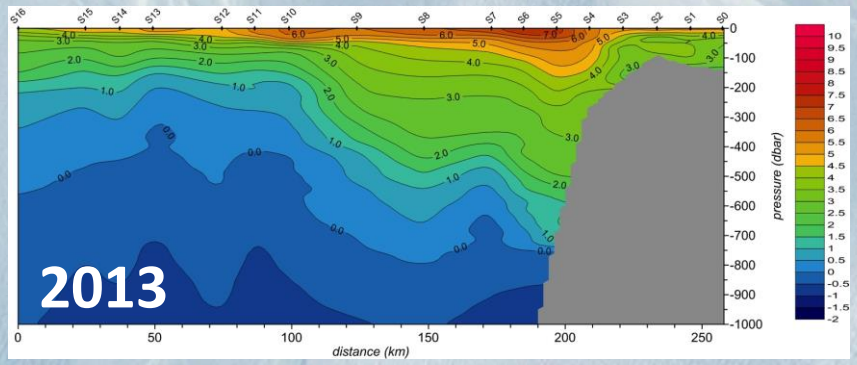
Temperature Section S

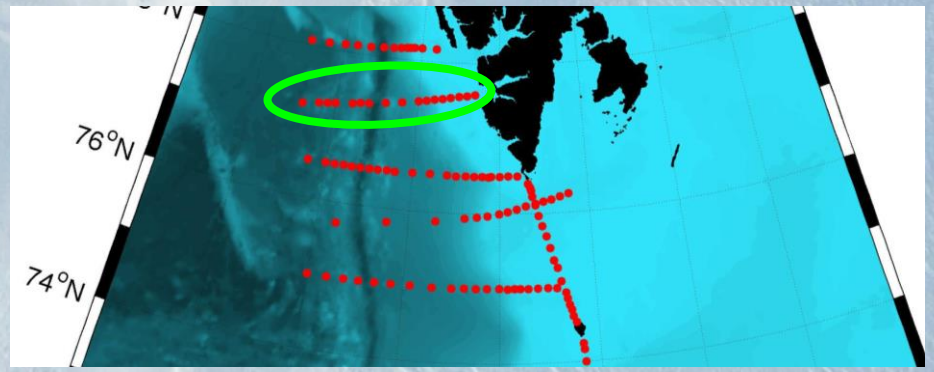




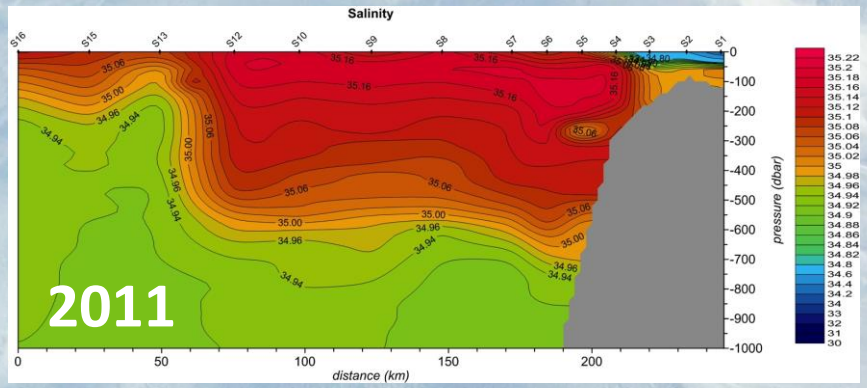


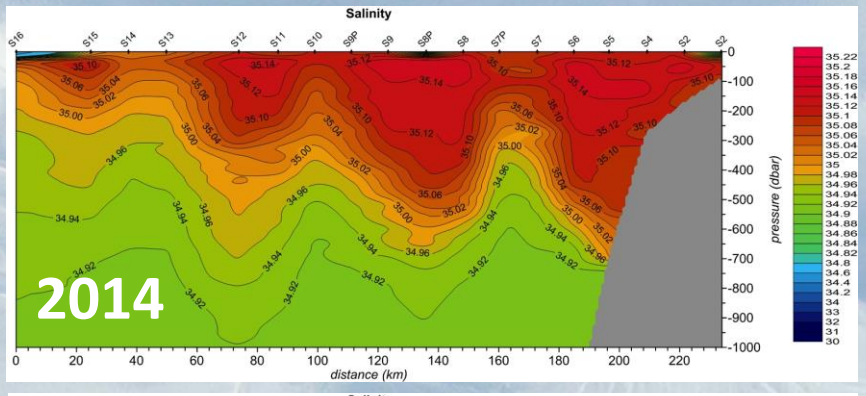


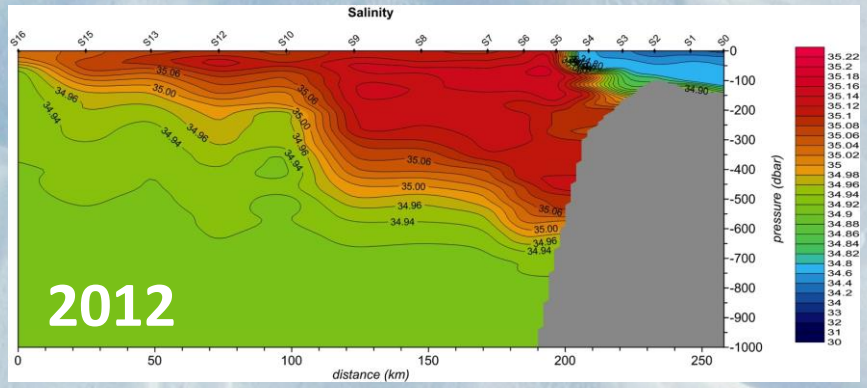


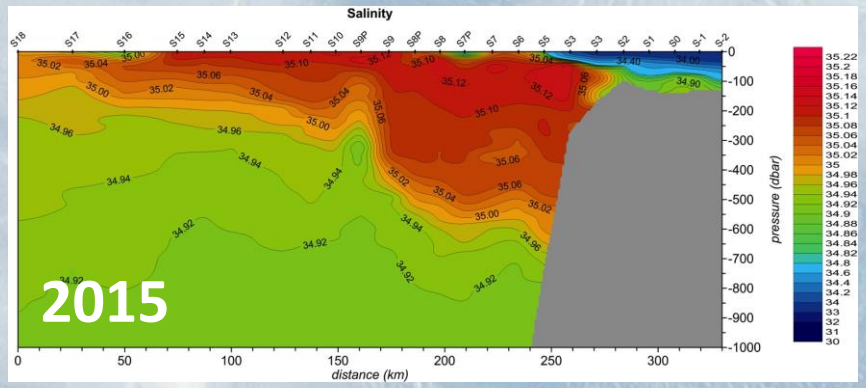


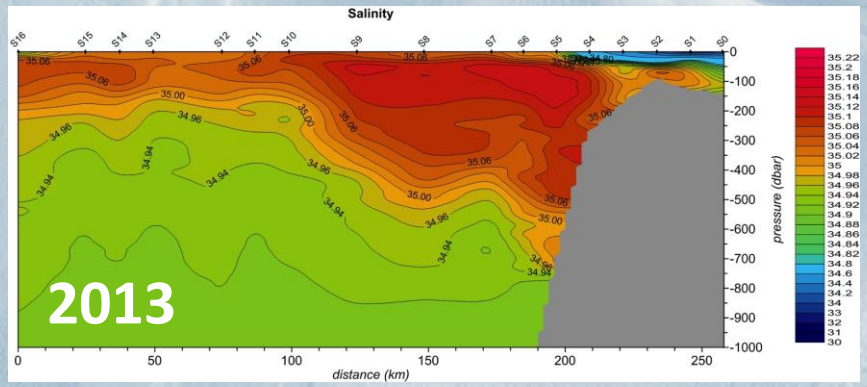
Salinity
Section S

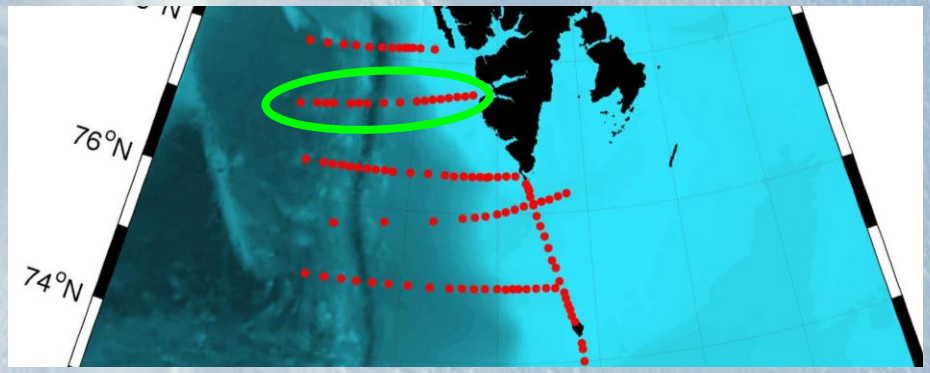












DELIVERABLES IN WP2

D2.1.1 The report on the variability of AW properties and transport in the WSC, based on the available historical data (IOPAS, month 12)

D2.1.2 The cruise reports and collections of new data sets obtained during the first field season (IOPAS with UNIS contr., month 18)

D2.1.3 The cruise reports and collections of new data sets obtained during the second field season (IOPAS with UNIS contr., month 30)

D2.2.1. The scientific paper in the peer reviewed journal focused on forcing mechanisms of the AW variability in the WSC (IOPAS, month 36)

D2.3.1 The prognostic model for determination of dominating water masses on the shelf (UNIS, month 32)

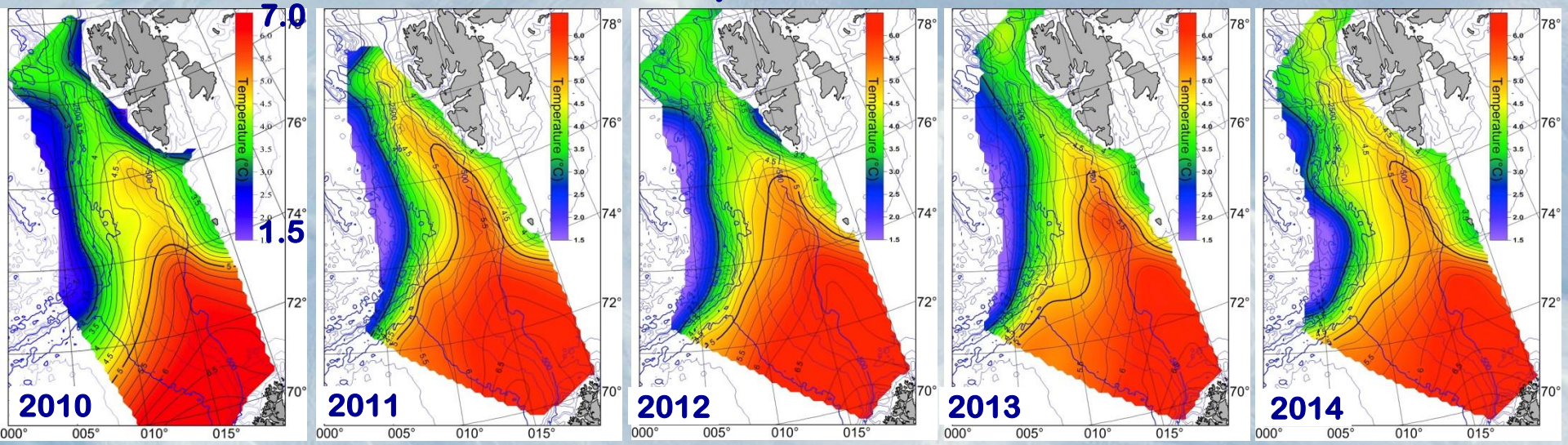
D2.3.2. The scientific paper in the peer reviewed journal describing the mechanisms of water masses domination on the shelf (UNIS, month 36)

AWAKE !

Thank you for your attention !

Temperature and salinity at 100 dbar in 2010-2015

Temperature



Salinity