GAME

Growing of the Arctic Marine Ecosystem

WP1.1. Analyses of the fjords physical environment variability based on the archival hydrographic data

Agnieszka Promińska

Institute of Oceanology PAS, Centre for Polar Studies

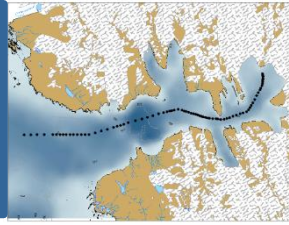
25 April 2016, Sopot

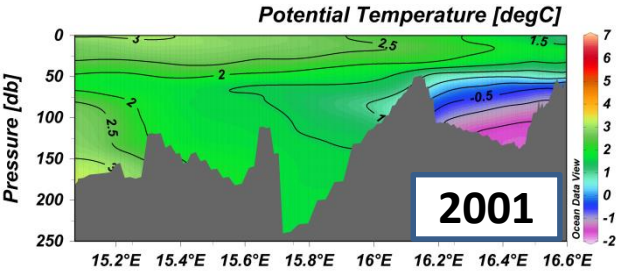
Publications

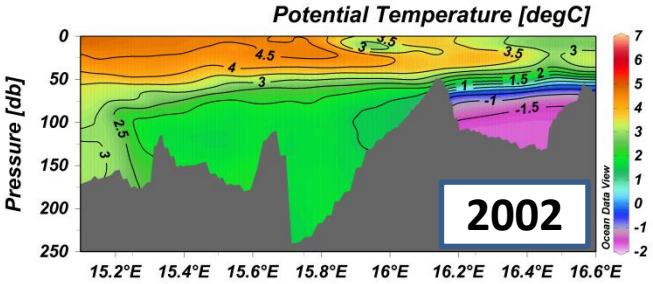
- Promińska et al. *Interannual variability in hydrography and water mass distribution in Hornsund, an Arctic fjord on Svalbard*. Polar Research, in review.

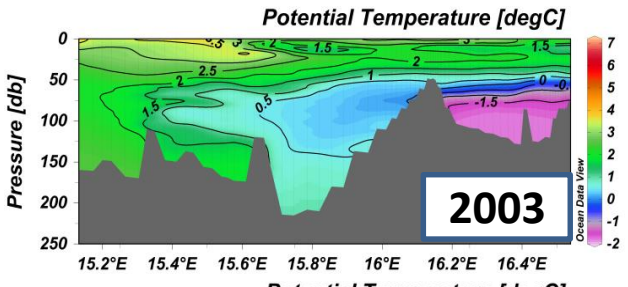
- Kongsfjorden and Hornsund hydrography – a multiyear survey on fjords under different drivers, in prep.

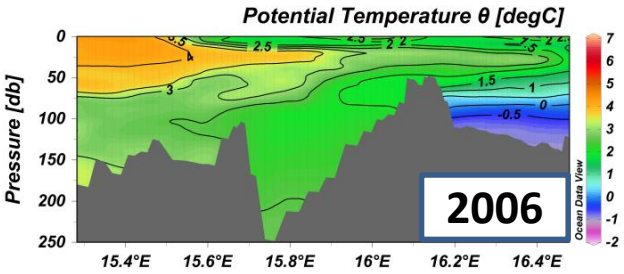
Distribution of temperature along Hornsund between summers 2001-2014

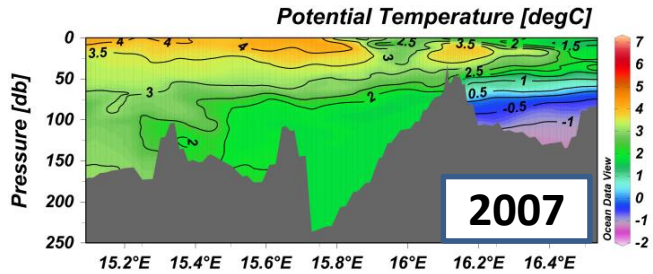


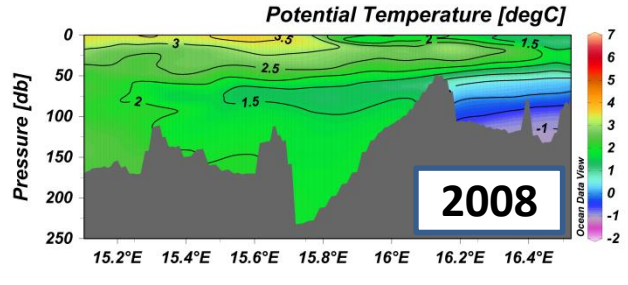


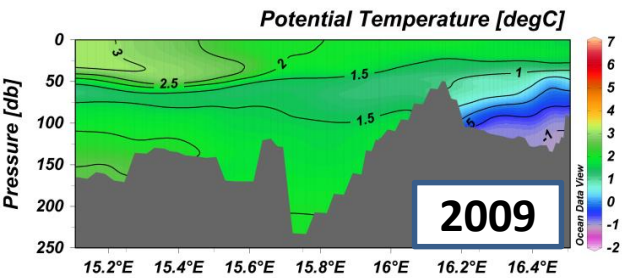


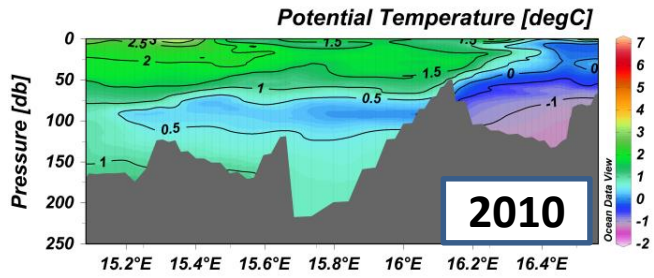


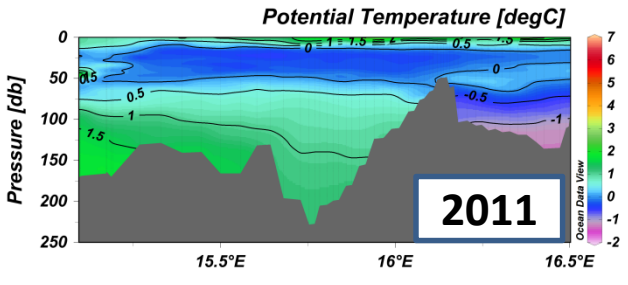


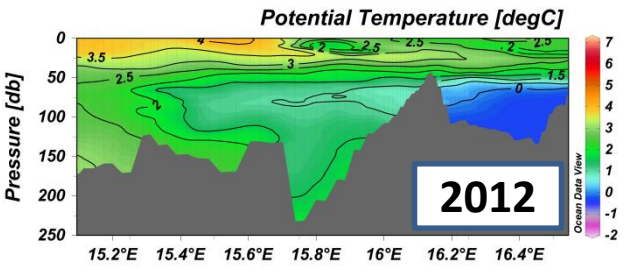


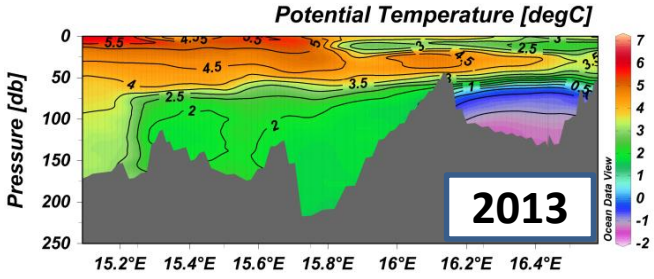


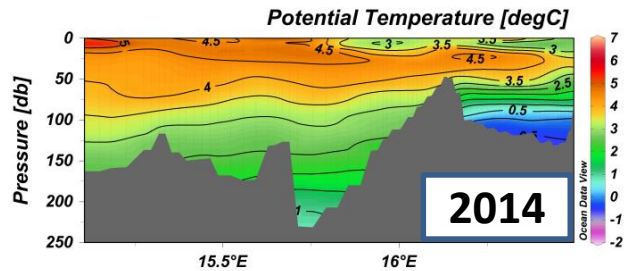




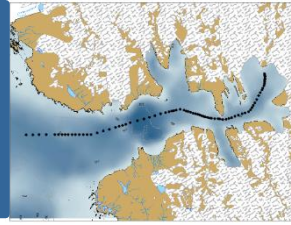


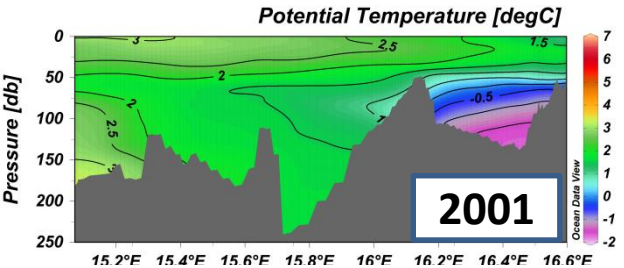


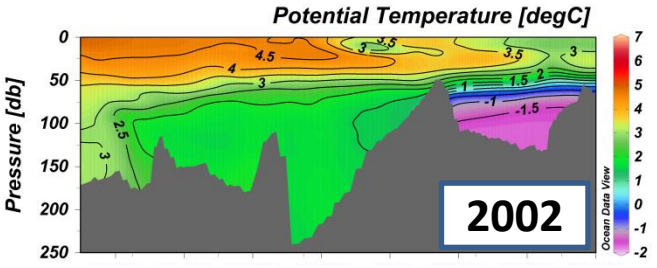


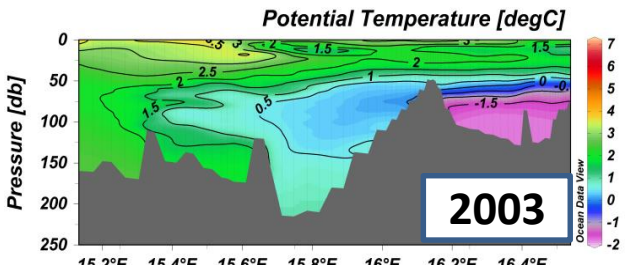


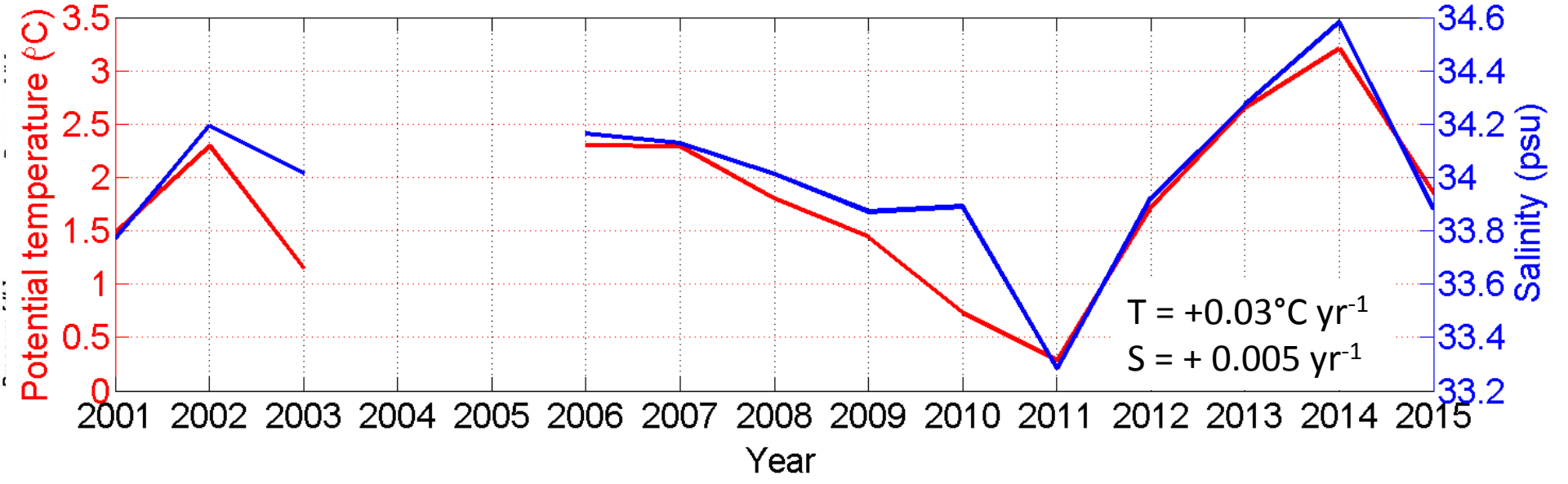
Distribution of temperature along Hornsund between summers 2001-2014

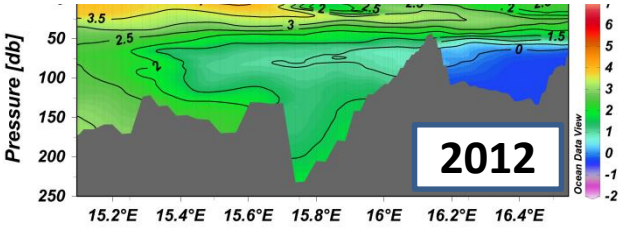


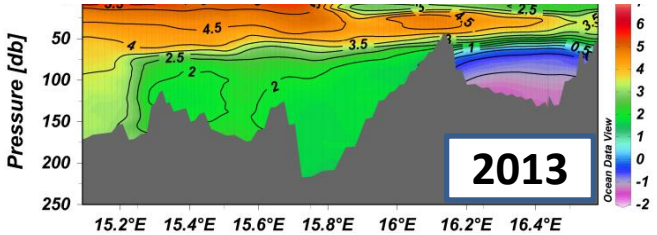


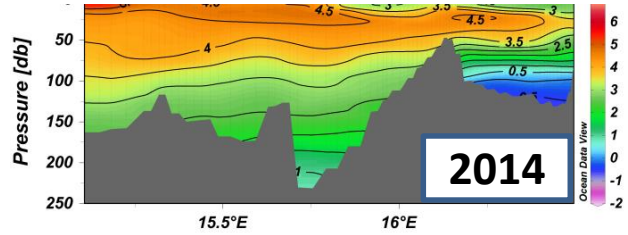




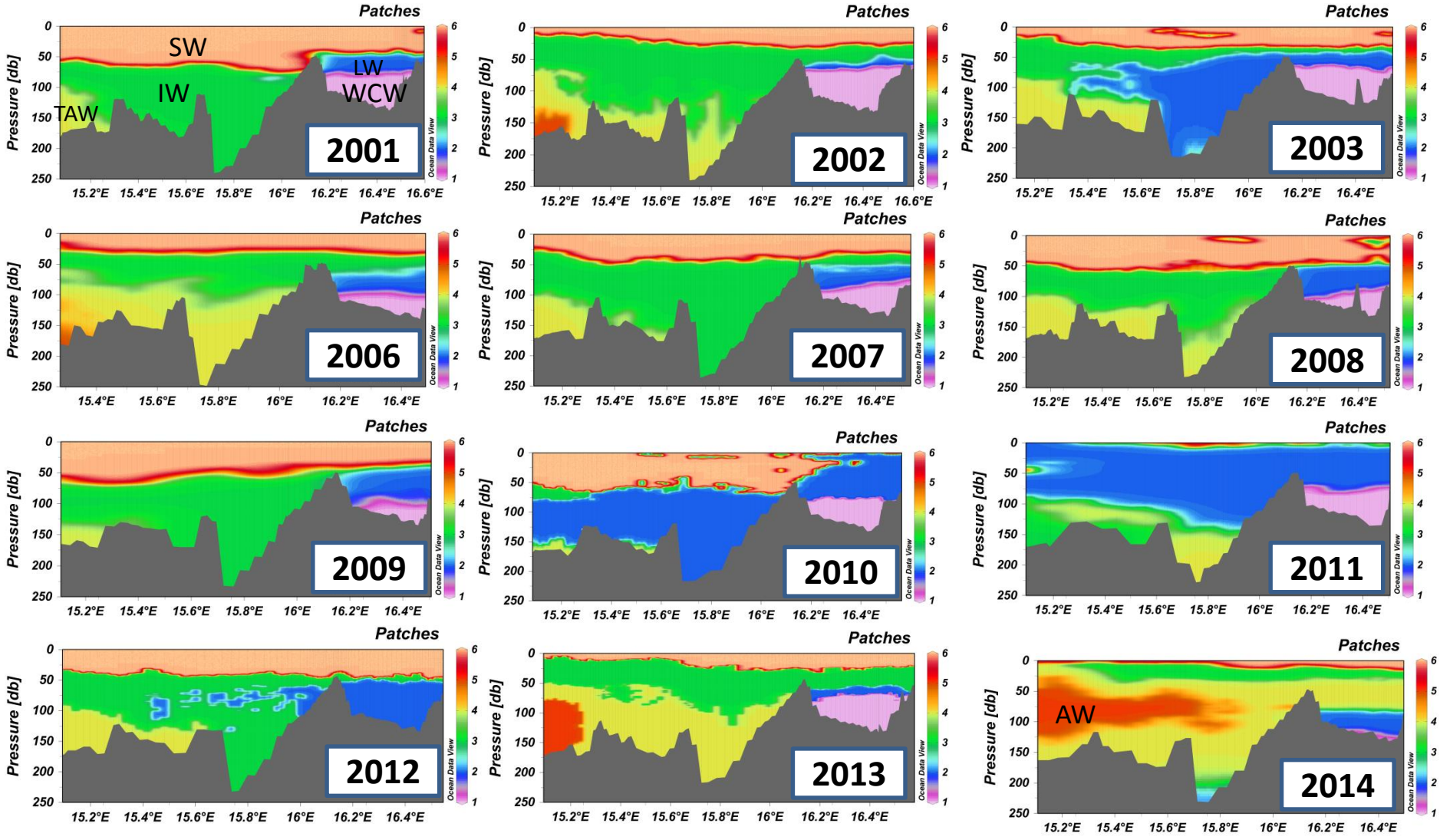






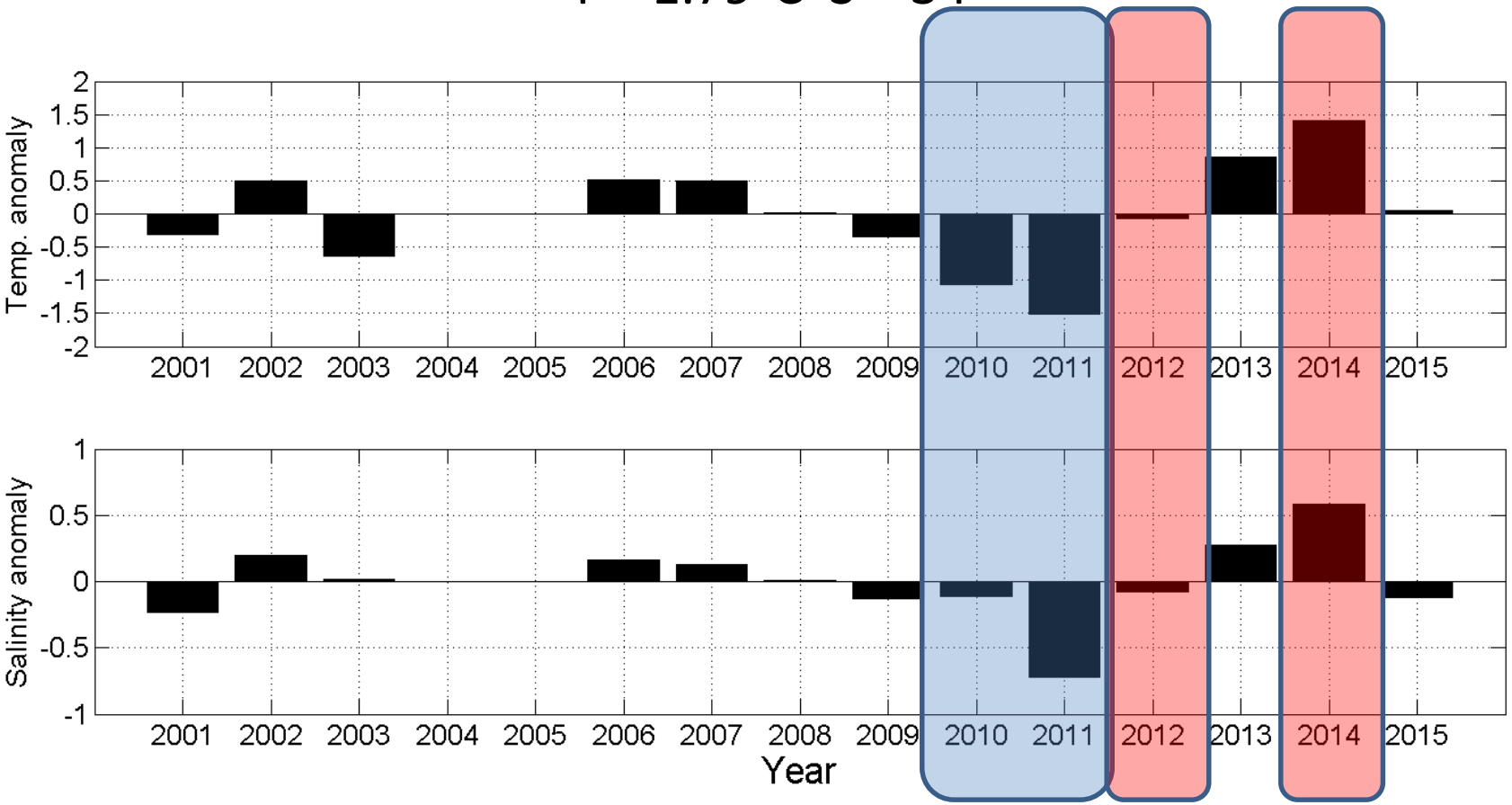


Distribution of water masses along Hornsund in summer 2001-2014

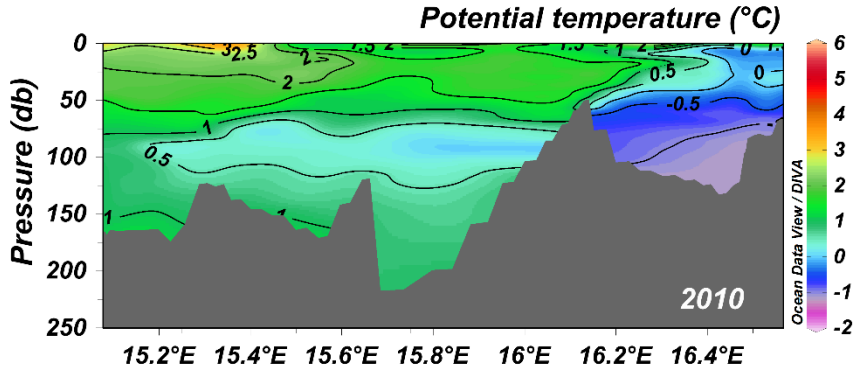


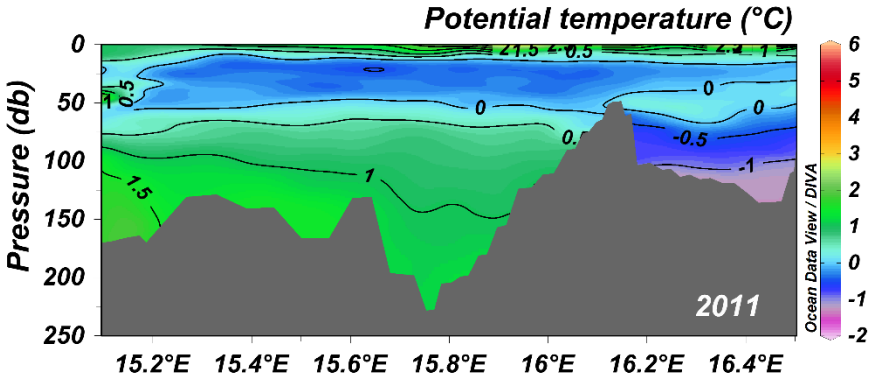
Changes in water temperature and salinity in summers 2001-2015

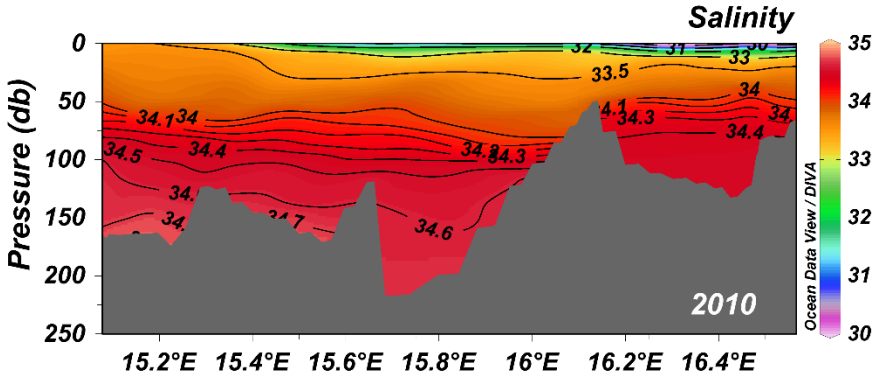
Long-term mean
T = 1.79°C S = 34

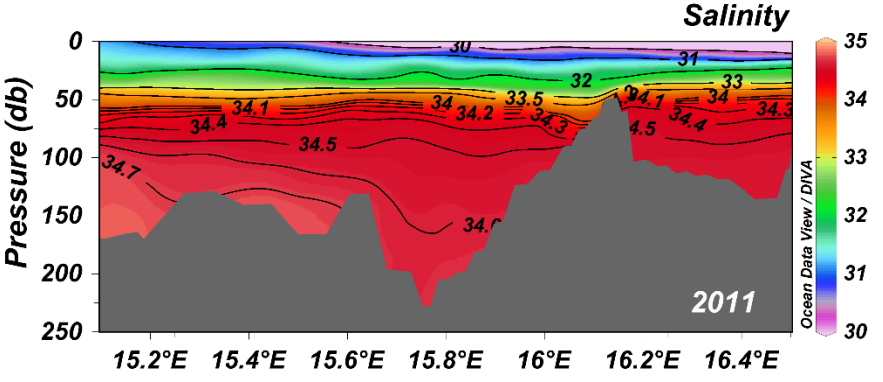


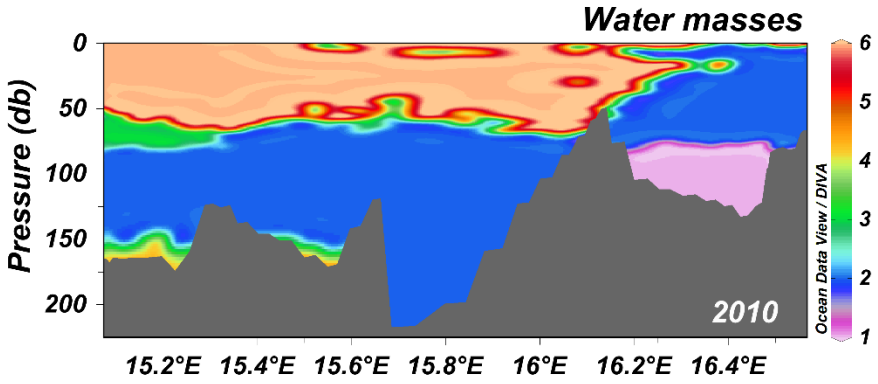
Cold events in summers 2010 and 2011

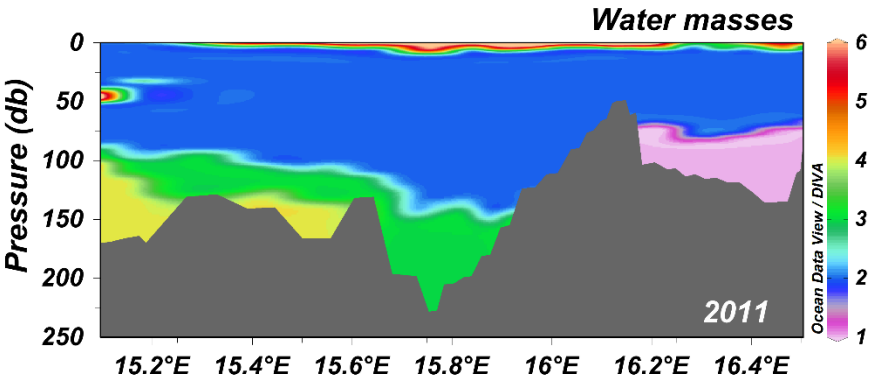




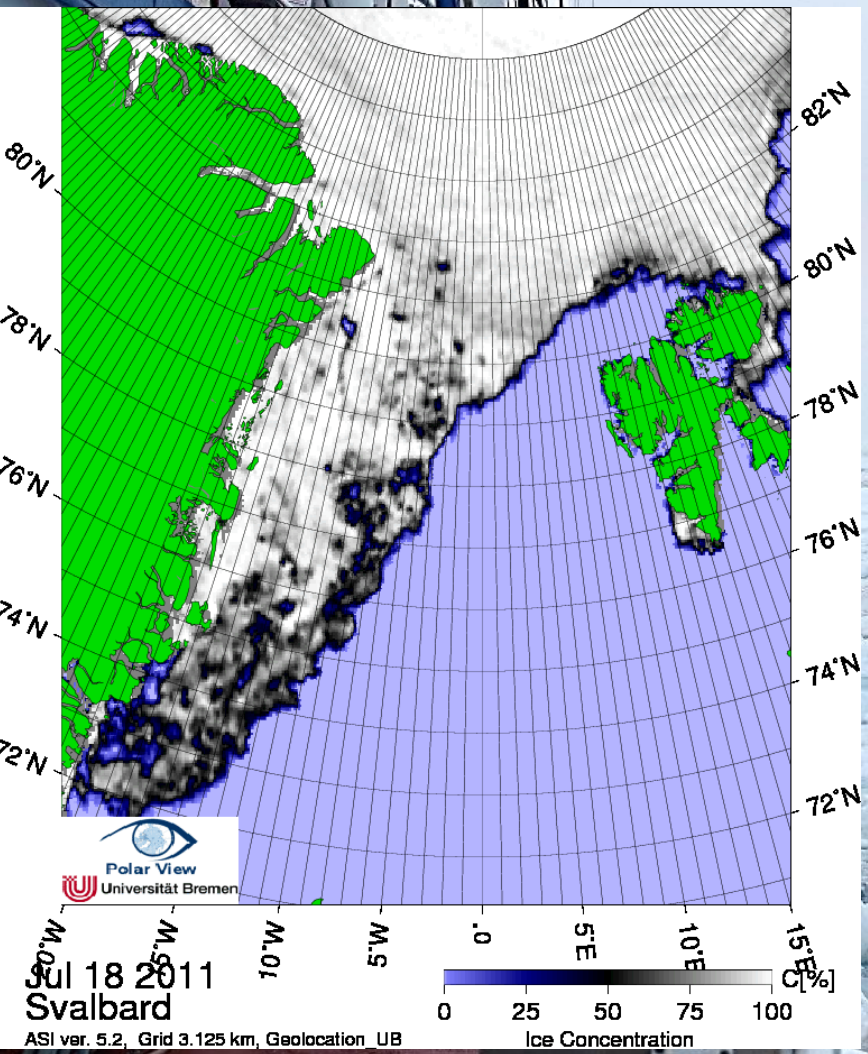








Impact of sea ice conditions (July 2011)

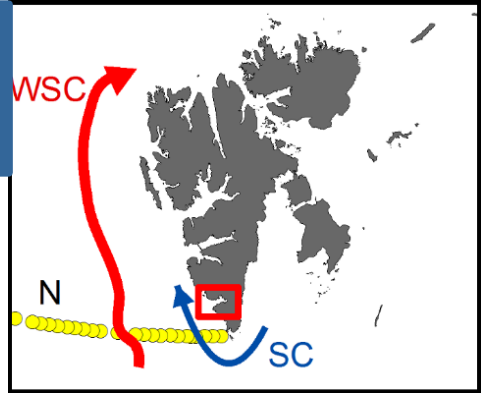


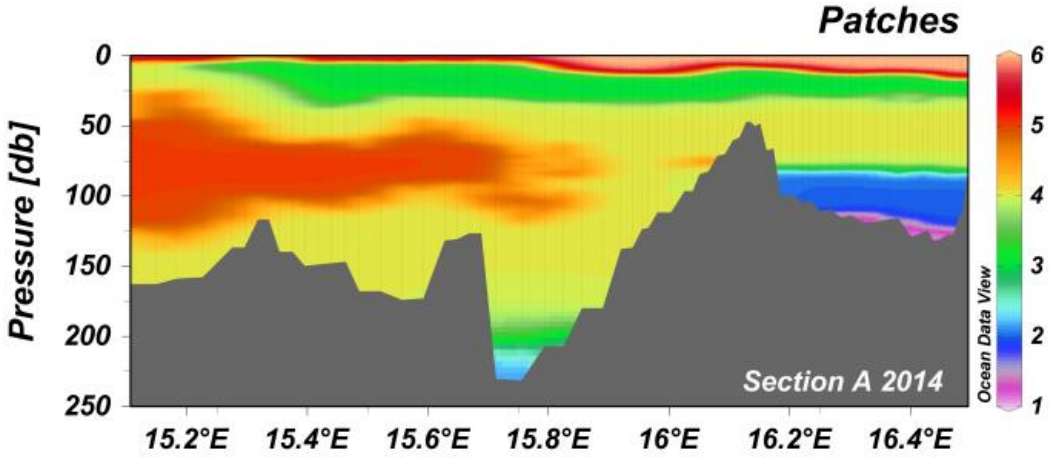
Typical ice conditions

- Fast ice starts to form in late Autumn (November) – mainly in Brepollen and other bays of Hornsund
- Main basin usually covered with pack ice carried by the Sørkapp Current from the Barents Sea
- The ice season in the fjord lasts until May or beginning of June when the drifting ice is blowing out from the fjord

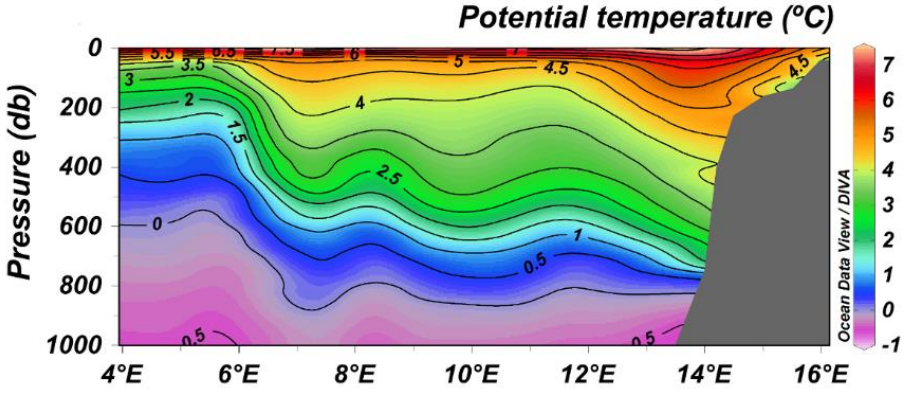
- inflow of sea ice from the Barents Sea observed twice in Hornsund in July 2011 (*Kruszewski 2012*)

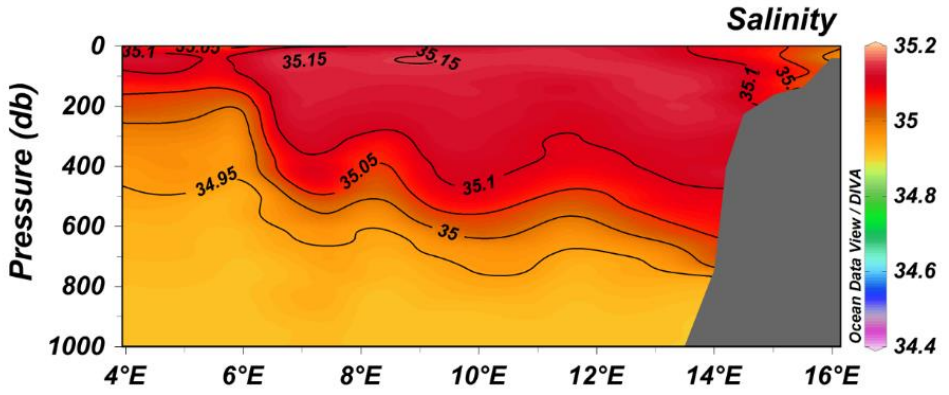
Extremely warm event in summer 2014





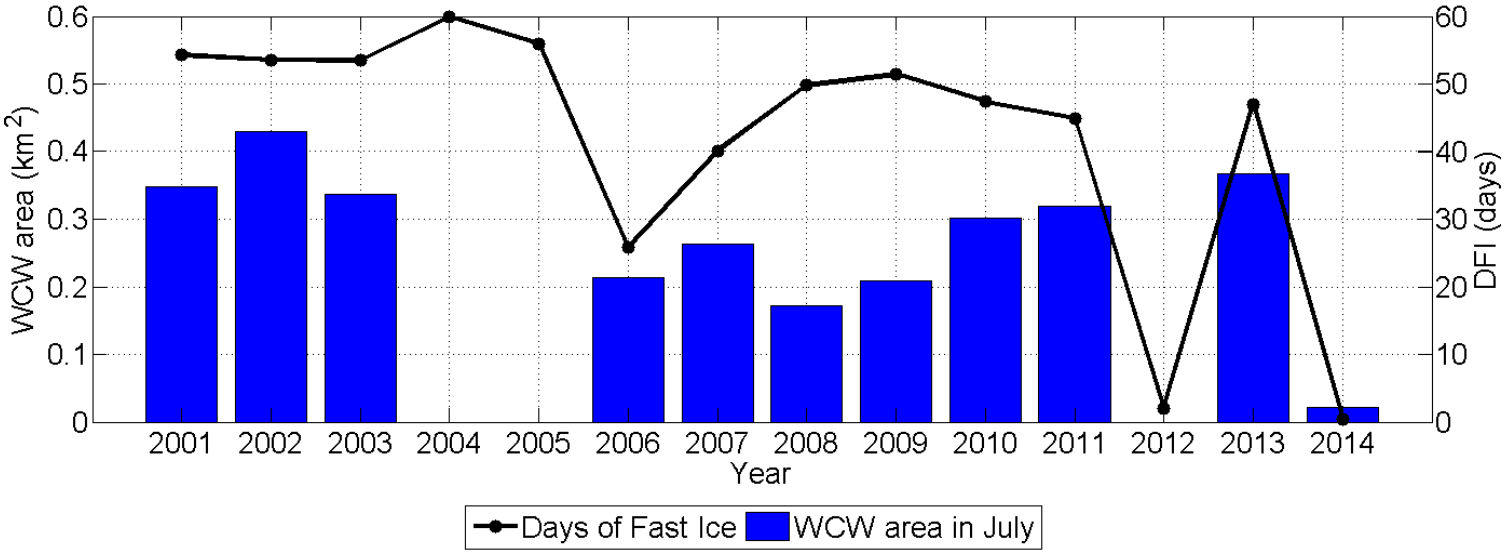
Topographic steering of Atlantic Water into the fjord due to massive flooding of West Spitsbergen Shelf

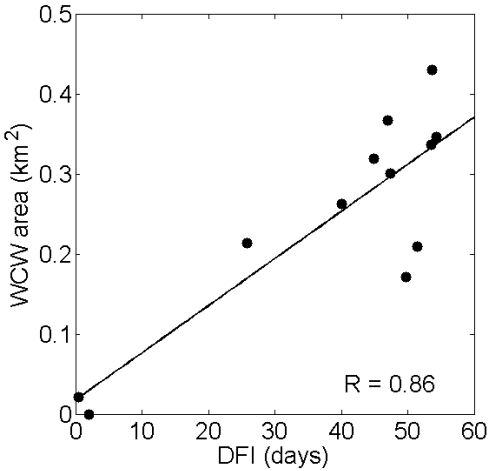




Temperature and salinity distribution along section N

Lack of Winter Cooled Water in summer 2012 and extreme minimum in summer 2014

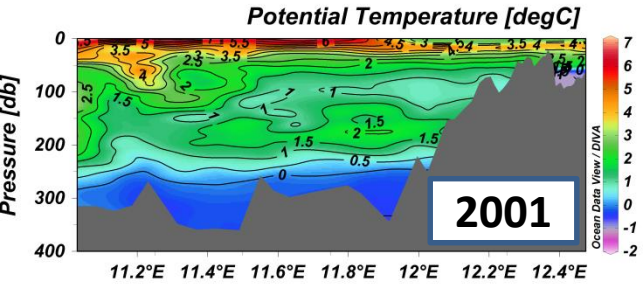


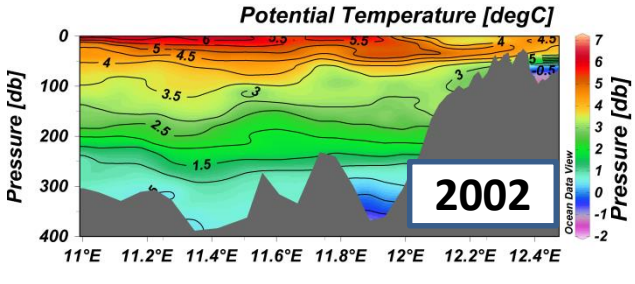


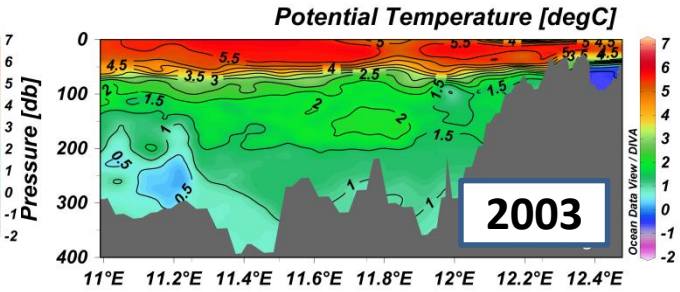
Lack/minimum of WCW in summers 2012 and 2014 connected with weak winter ice conditions due to extremely warm winters 2011/2012 and 2013/2014

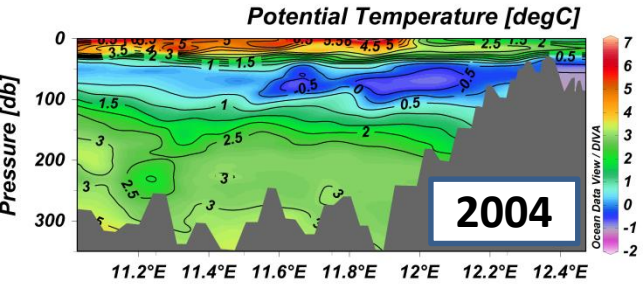
Data of DFI are taken from Muckenhuber et al. 2016

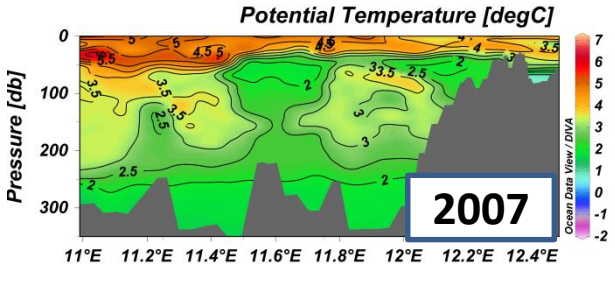
Temperature distribution along Kongsfjorden in summers 2001-2014

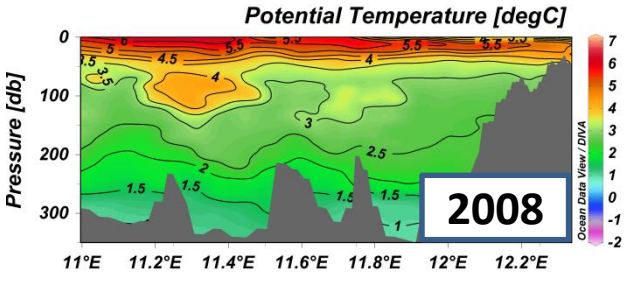


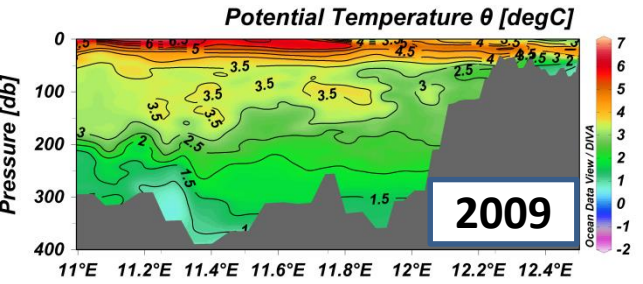


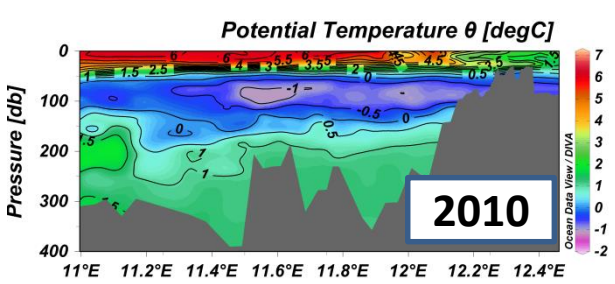


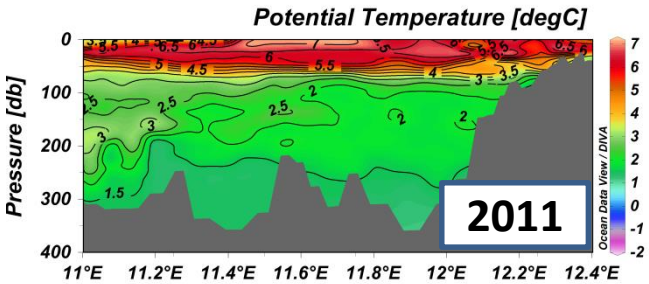


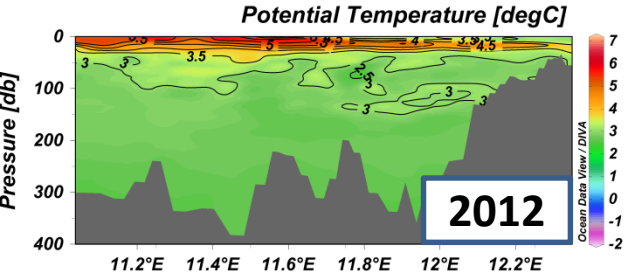


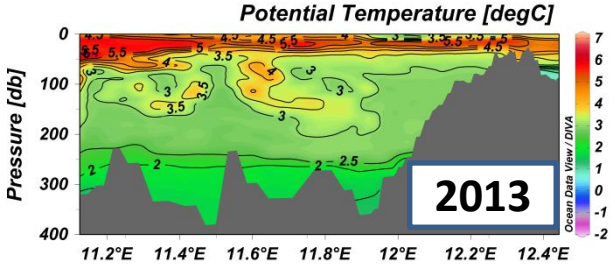


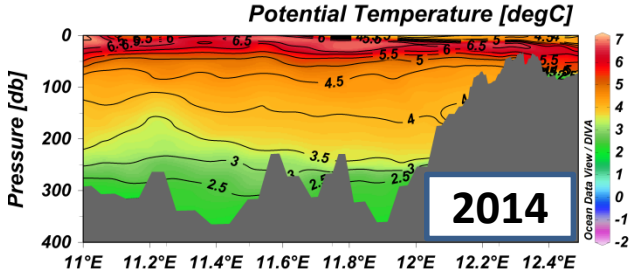




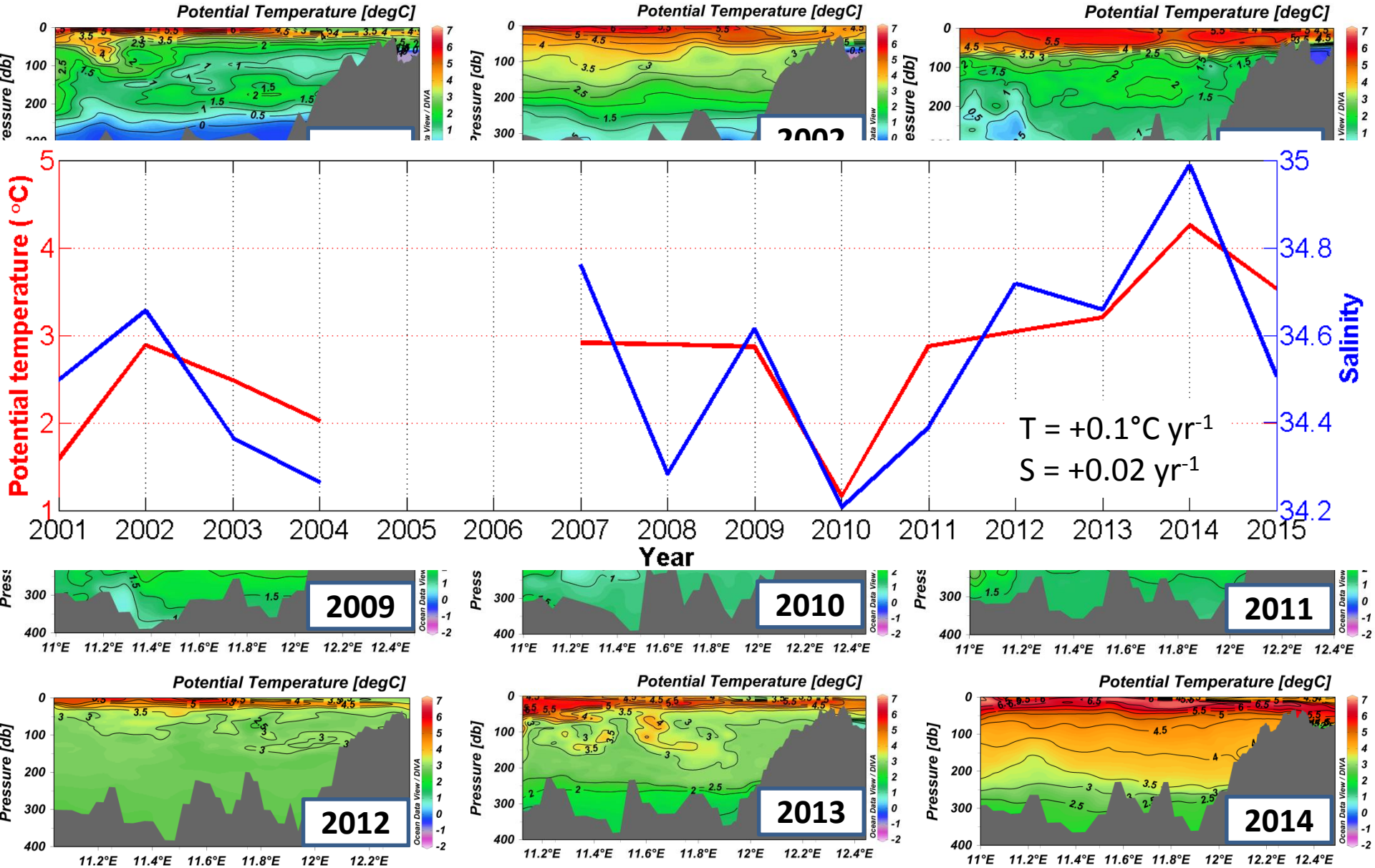




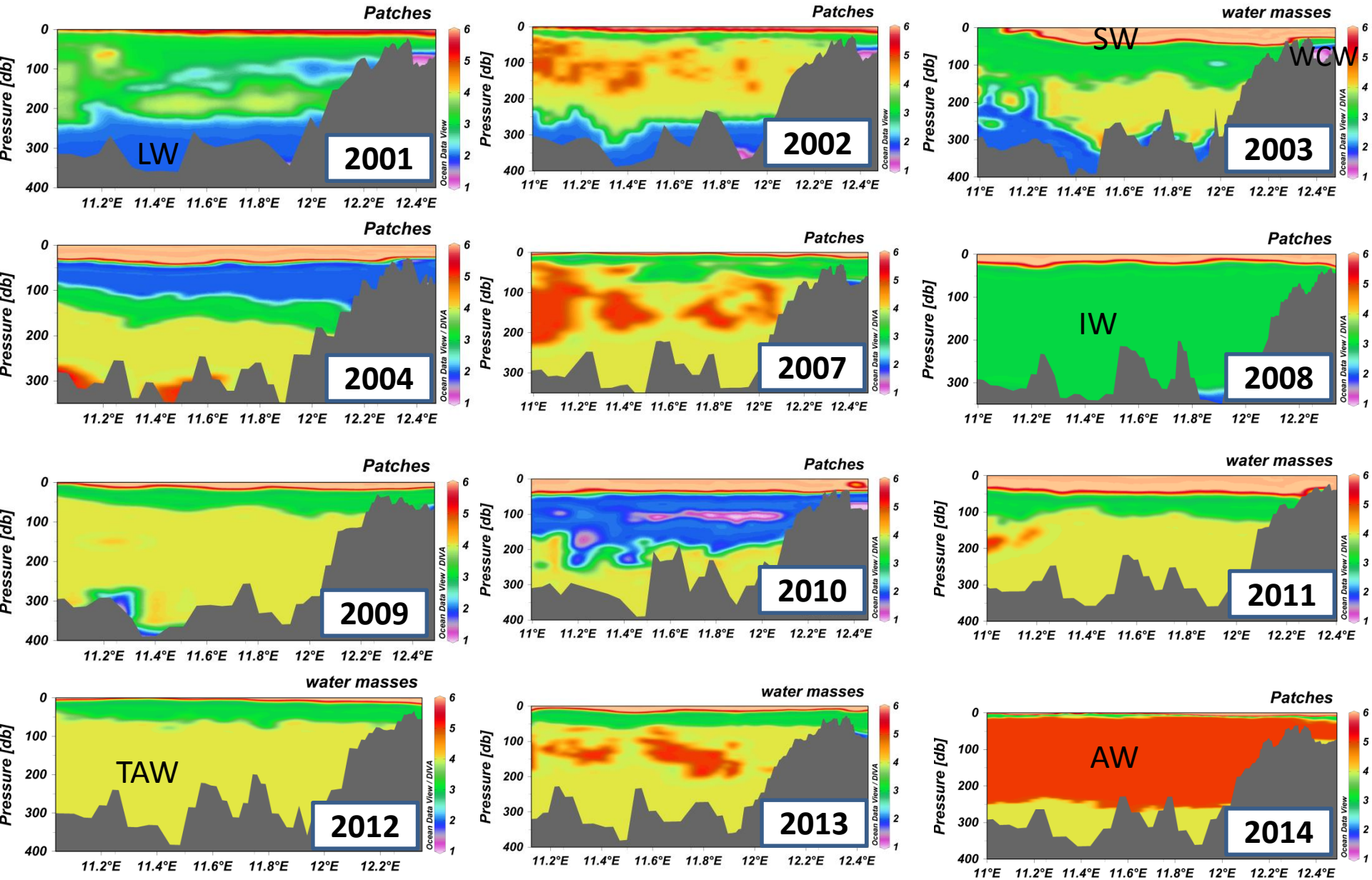




Temperature distribution along Kongsfjorden in summers 2001-2014



Distribution of water masses along Kongsfjorden in summers 2001-2014



Hornsund vs Kongsfjorden

$T = +0.03°C\ yr^{-1}$
$S = +0.005\ yr^{-1}$

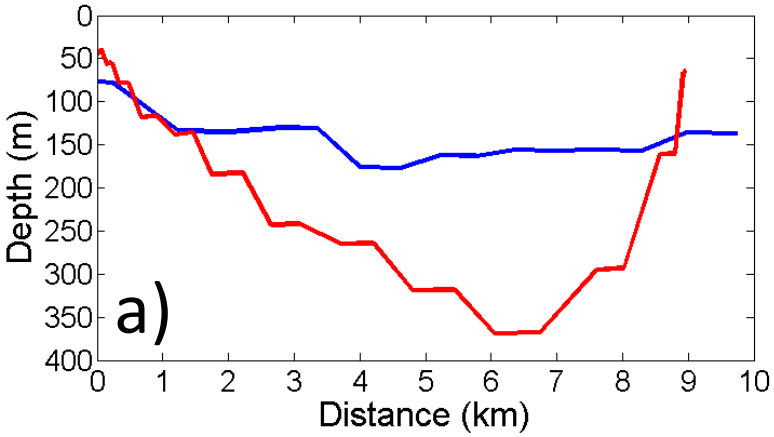
$T = +0.1°C\ yr^{-1}$
$S = +0.02\ yr^{-1}$

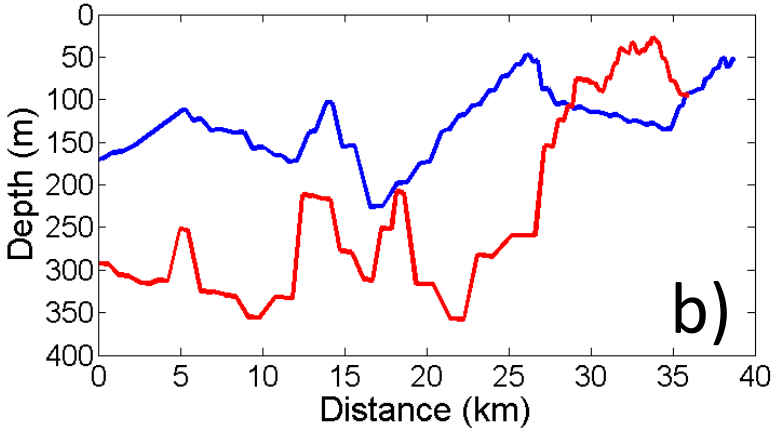
- Long-term mean T:
  1.79°C 2.75°C
- Long-term mean S:
  34.00 34.53

All data
Mean ΔT: 1.07°C
Mean ΔS: 0.57

Main Basin
Mean ΔT: 0.81°C
Mean ΔS: 0.49

Fjords geometry

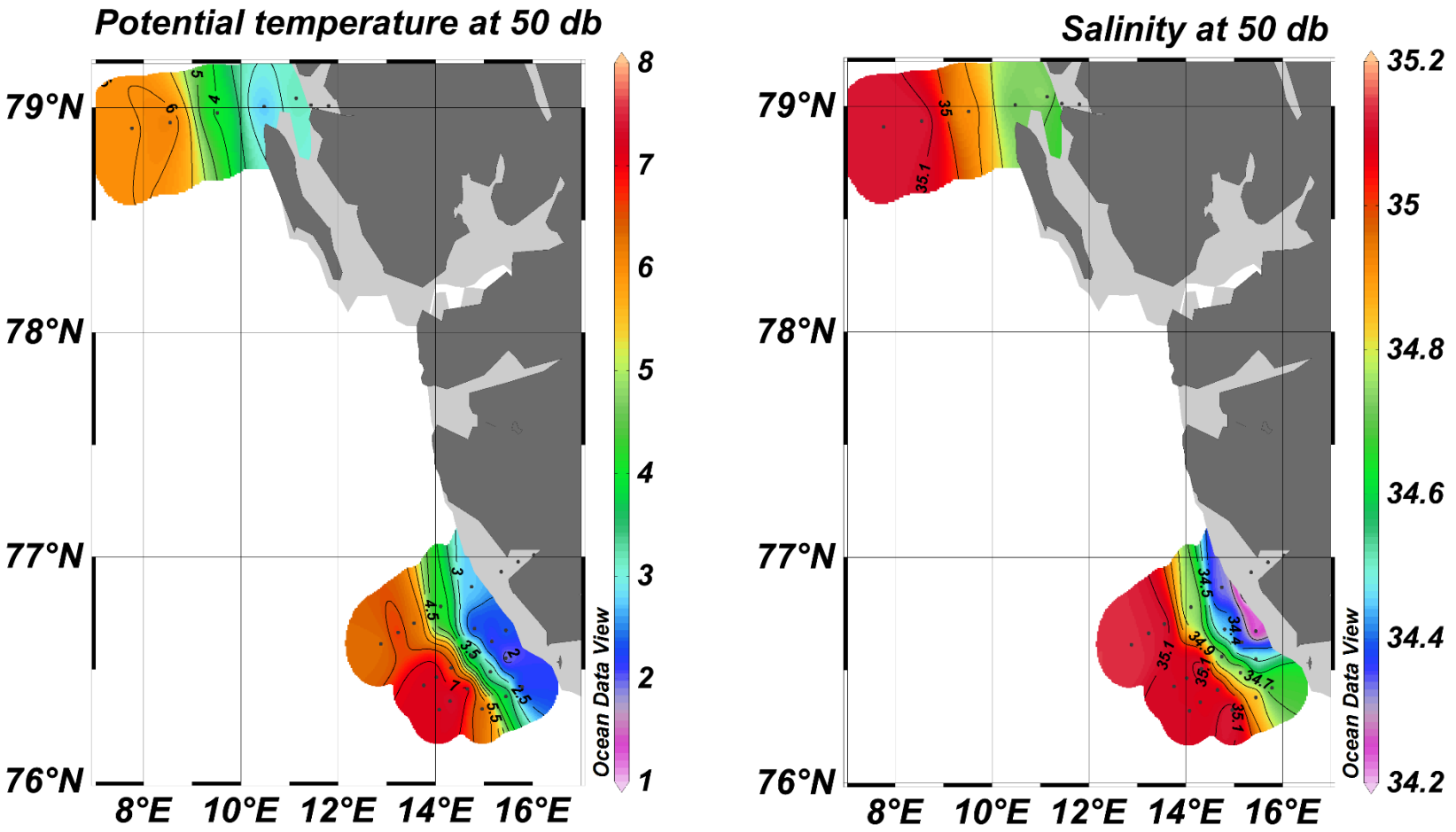




Bathymetry of cross section (a) and along fjord section (b) in Hornsund (blue) and Kongsfjorden (red).

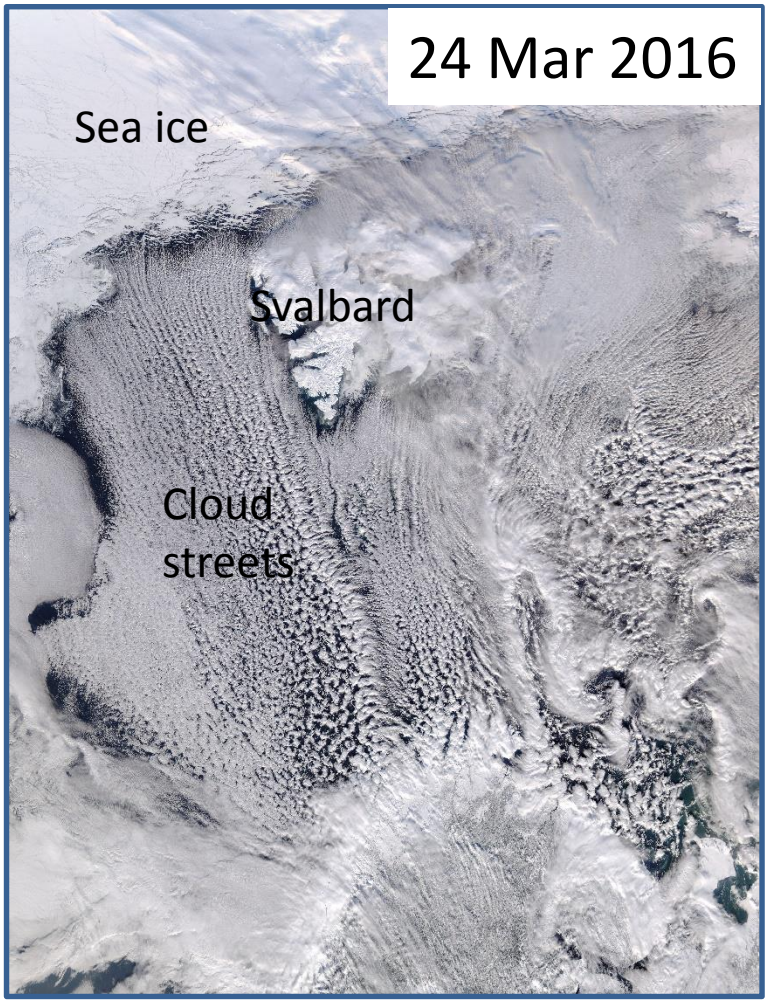
	Hornsund	Kongsfjorden
Length (km)	35	29
Width (km)	2-12	8-10
Area (km^2)	320	237
Volume (km^3)	29	~38

Arctic Front position

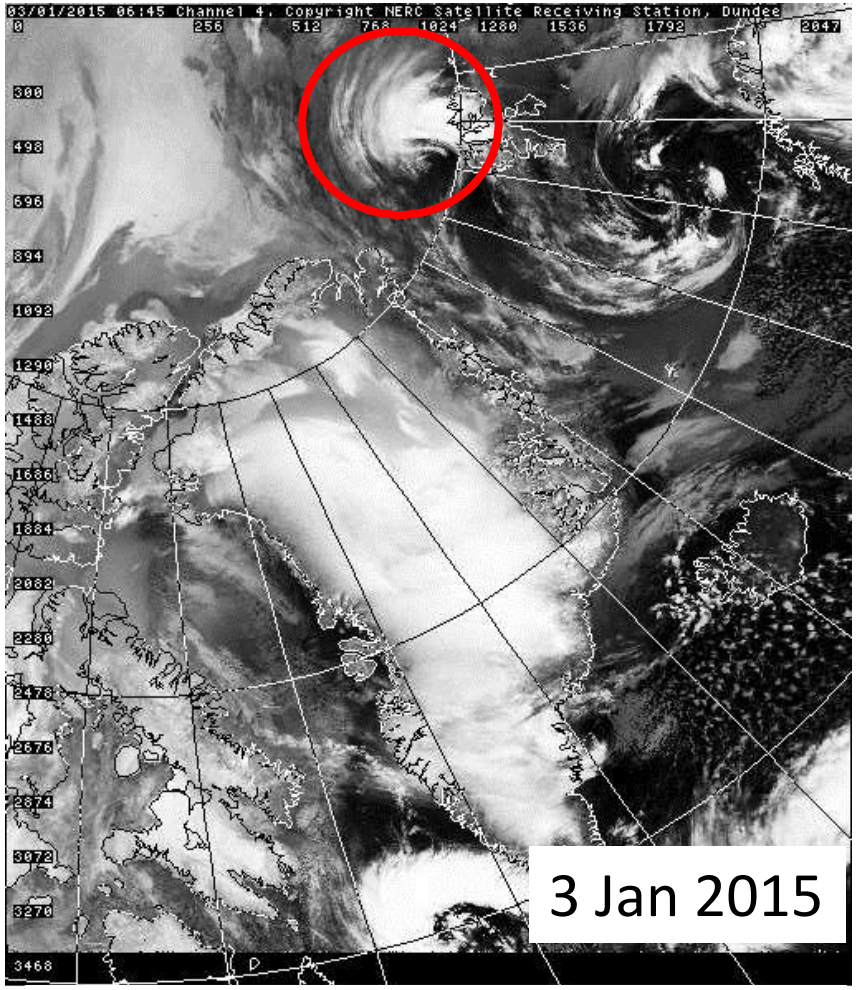


Węsławski et al., in review, Journal of Marine Systems

Changing Arctic



Source: http://www.sat.dundee.ac.uk/



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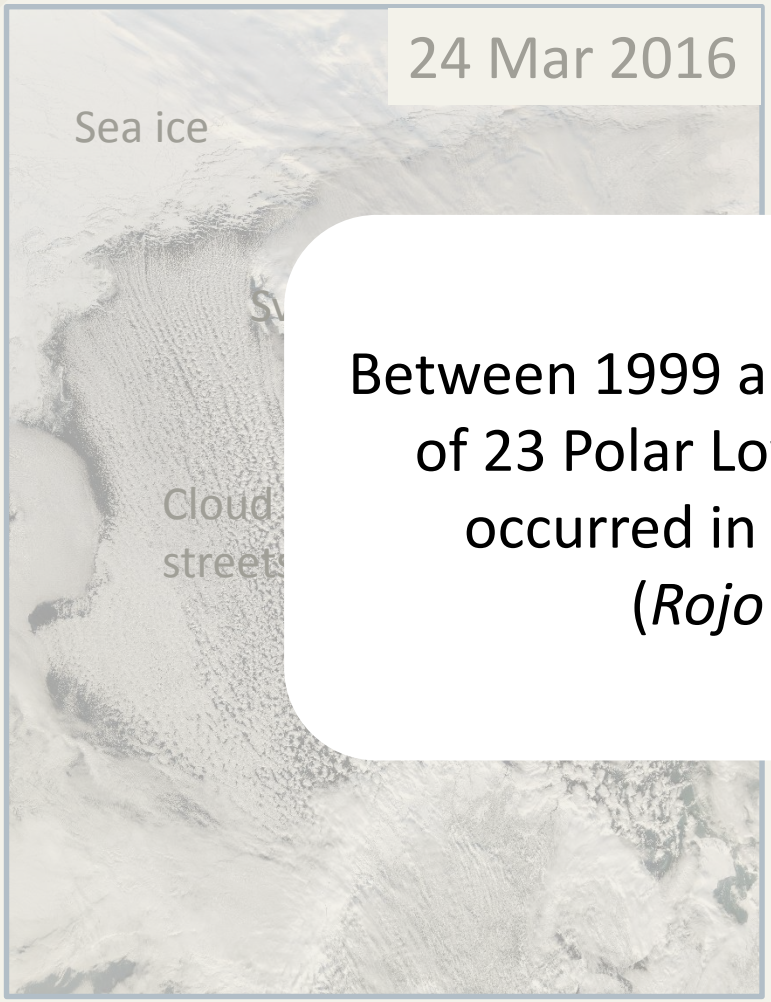
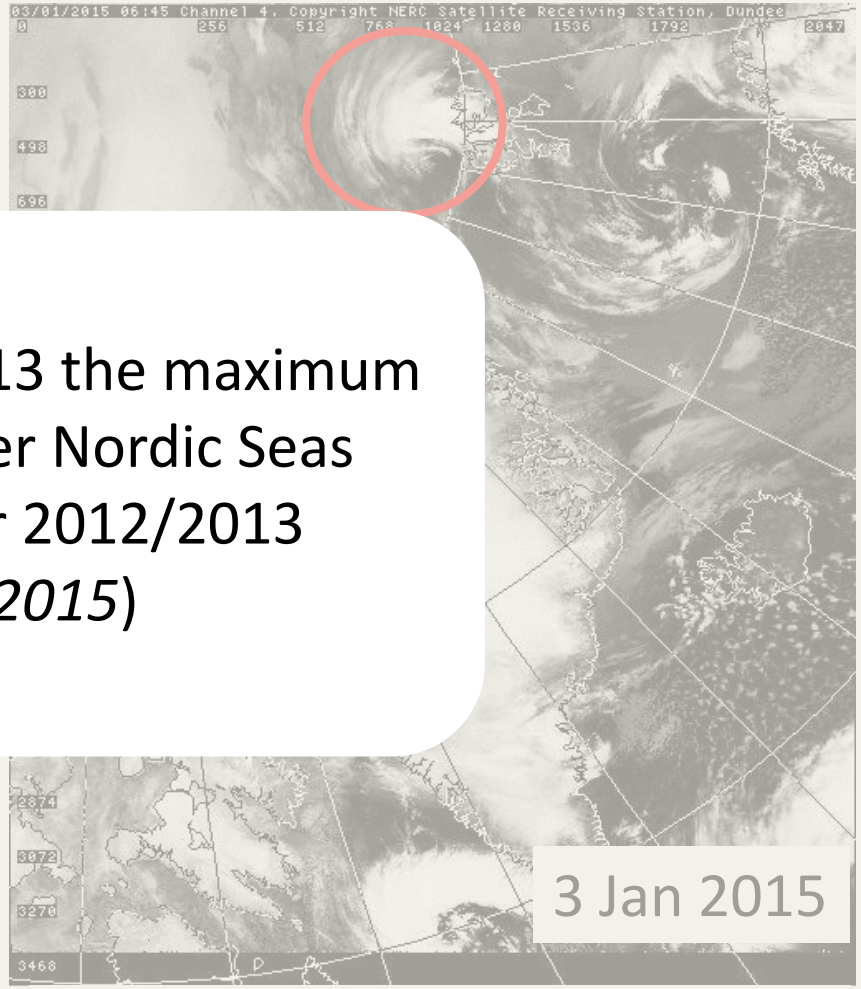


Source: http://www.sat.dundee.ac.uk/

Between 1999 and 2013 the maximum of 23 Polar Lows over Nordic Seas occurred in winter 2012/2013 (*Rojo et al. 2015*)



Source: http://www.sat.dundee.ac.uk/