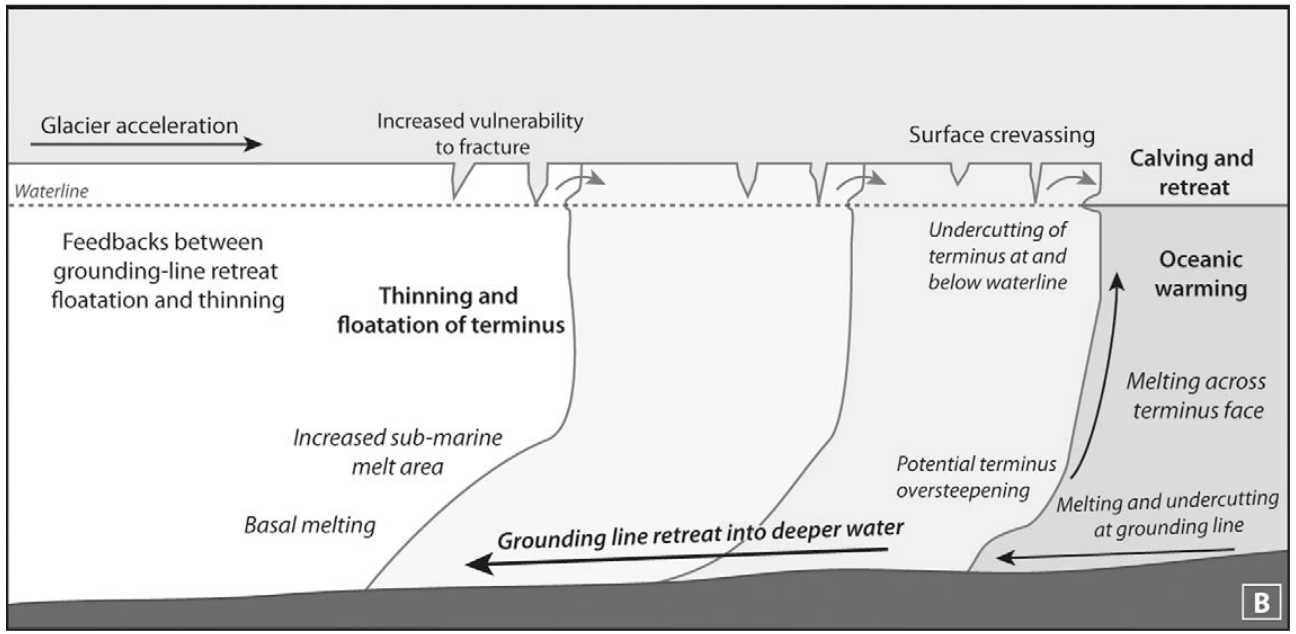
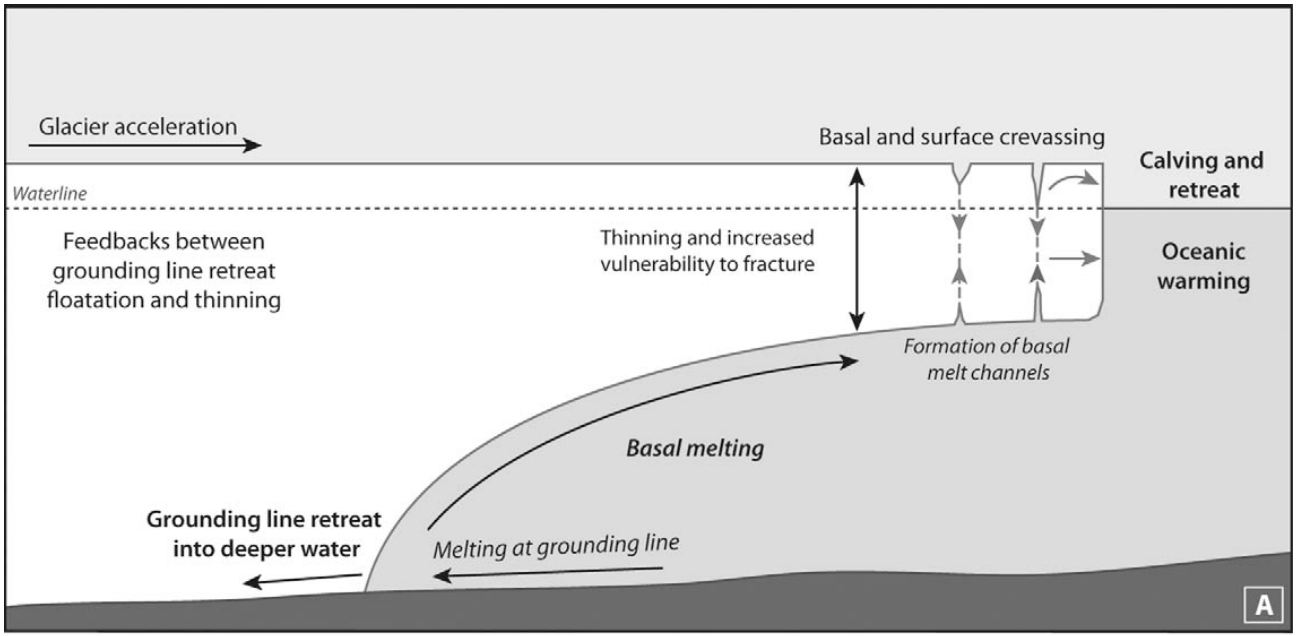


Grounded Terminus:

Helheim Glacier
Jakobshavn Isbrae



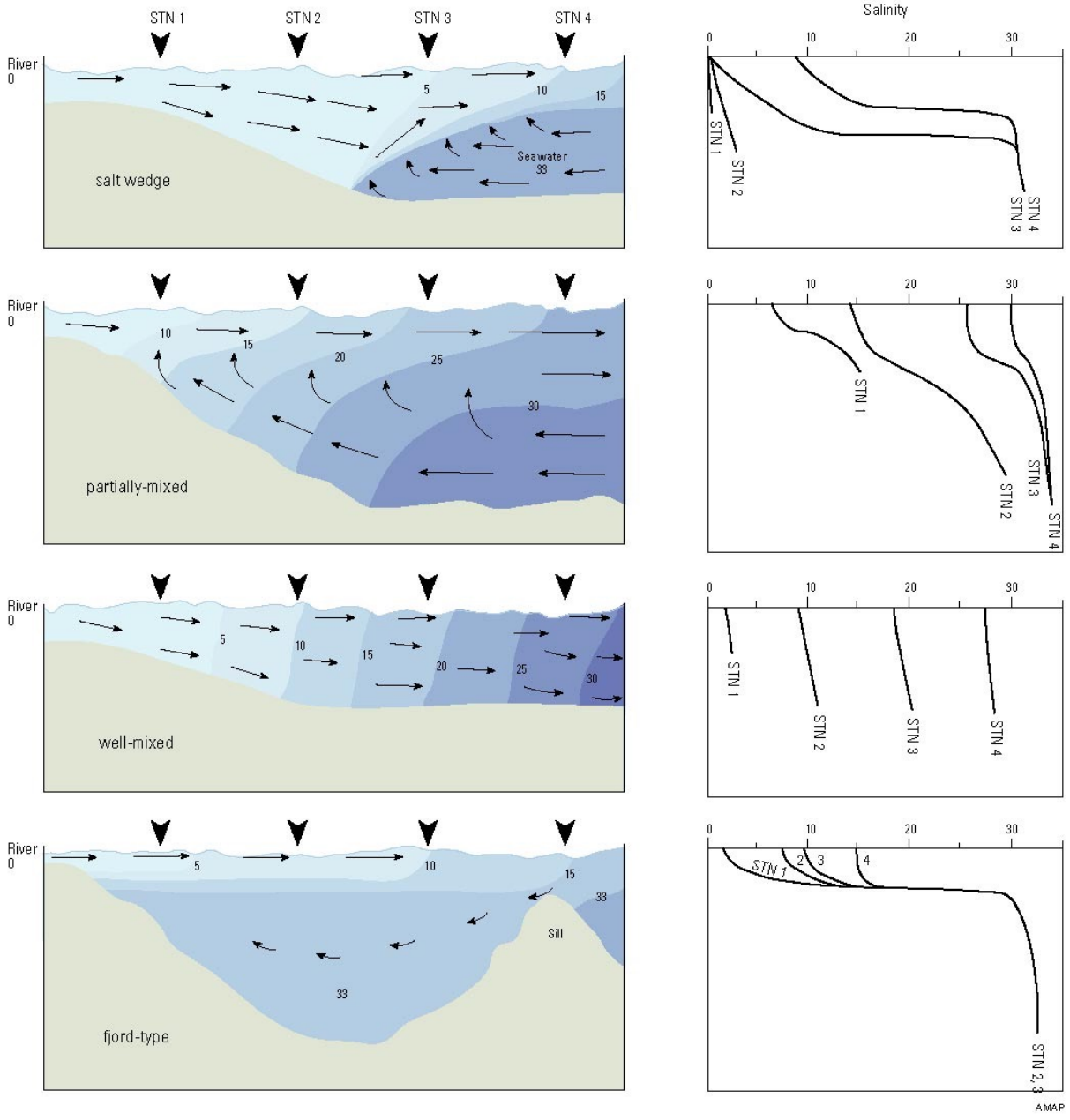
Floating Terminus:

Petermann Gletscher
79N Glacier

Carr (2013)

Estuarine Circulation:

Arctic Monitoring and Assessment Programme
AMAP Assessment Report: Arctic Pollution Issues, Figure 3-18



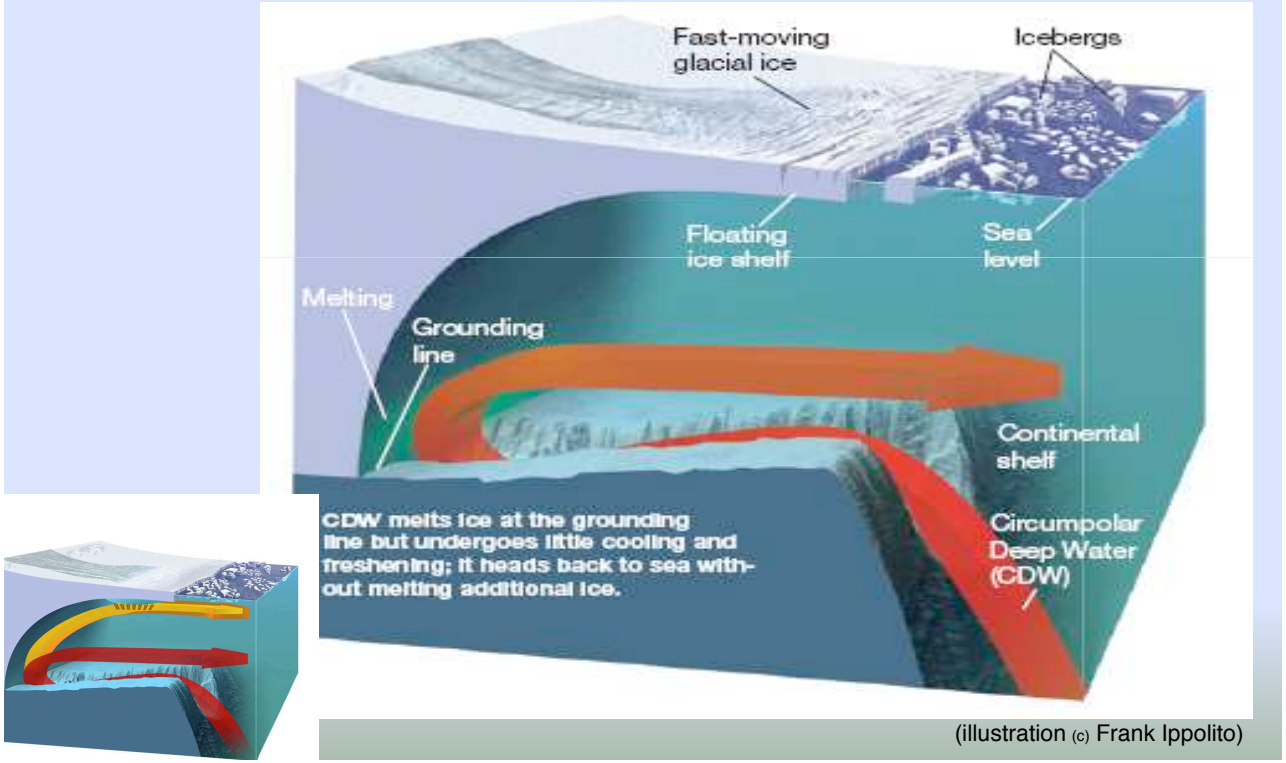
Salt-wedge,
Hudson River

Patially-mixed,
Delaware Estuary
(neap tide)

Well-mixed,
Delaware Estuary
(spring tide)

Fjord-type,
Pudget Sound,
Greenland Glaciers

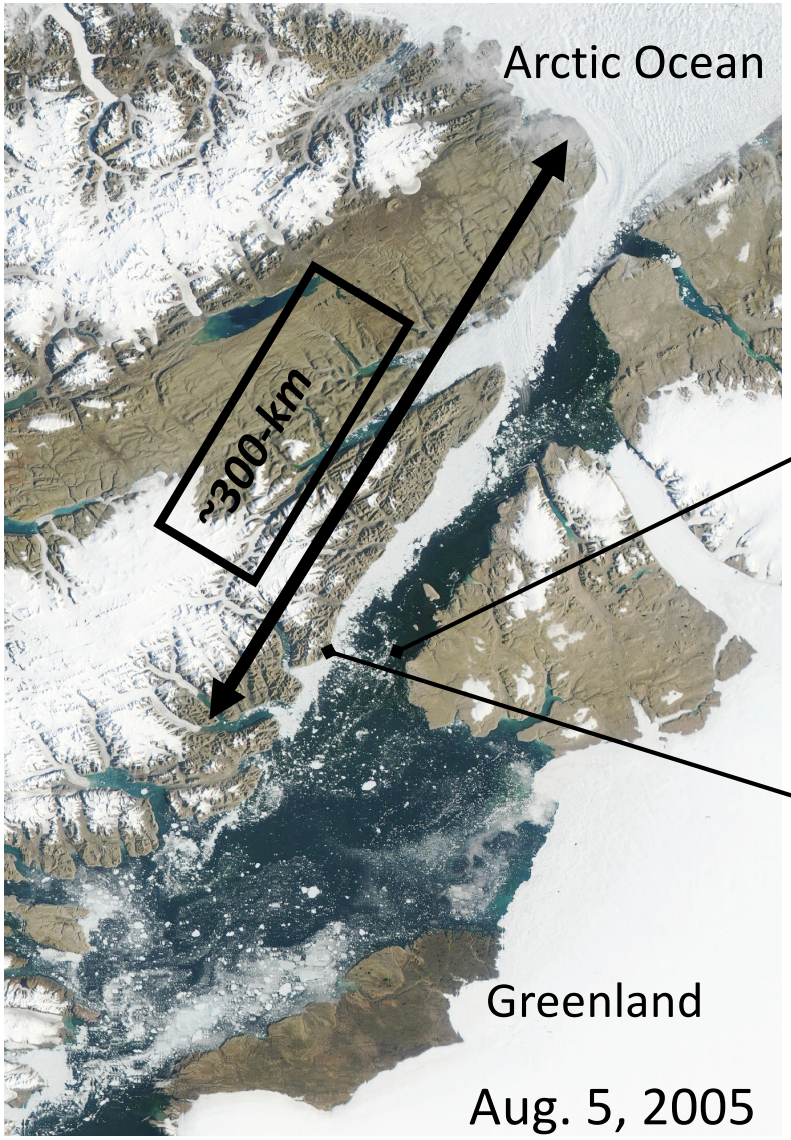
Warm ocean water is attacking the edges of ice sheets



Two-Dimensional View: Works for "***narrow***" fjords, maybe.

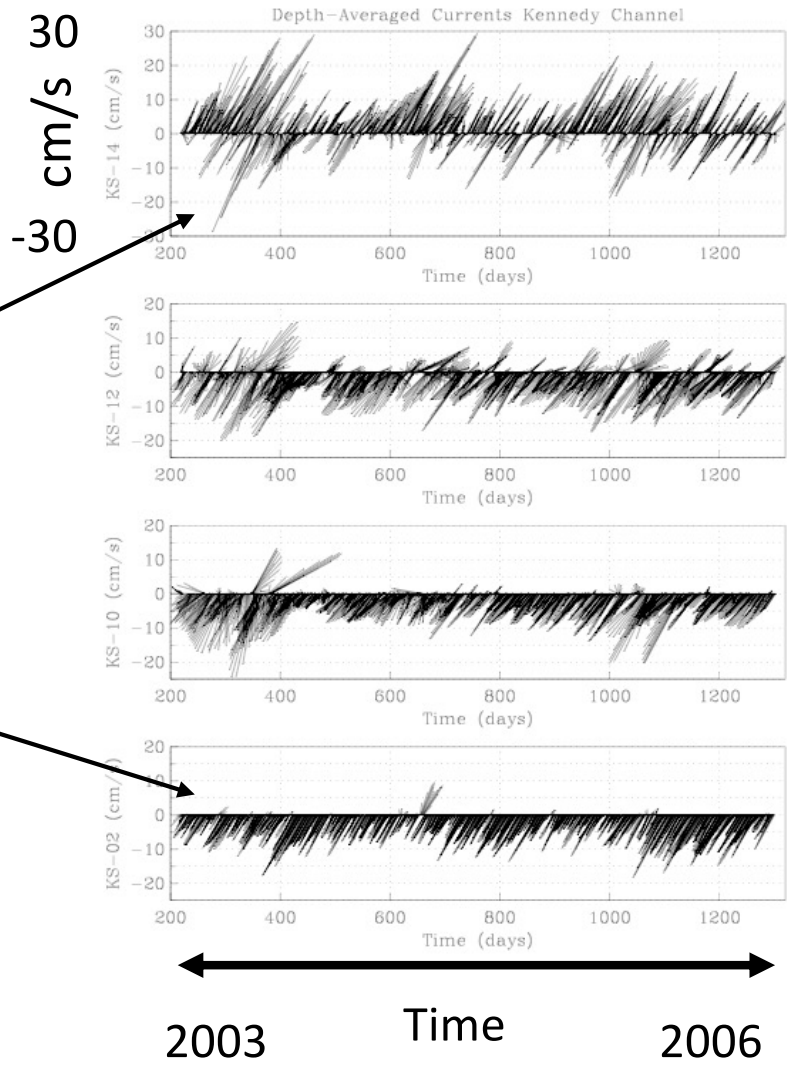
Definition of "***narrow***": Width of Fjord < Internal Deformation Radius
(dynamical scale related to rotation and stratification)

Nares Strait Freshwater Flux Experiment



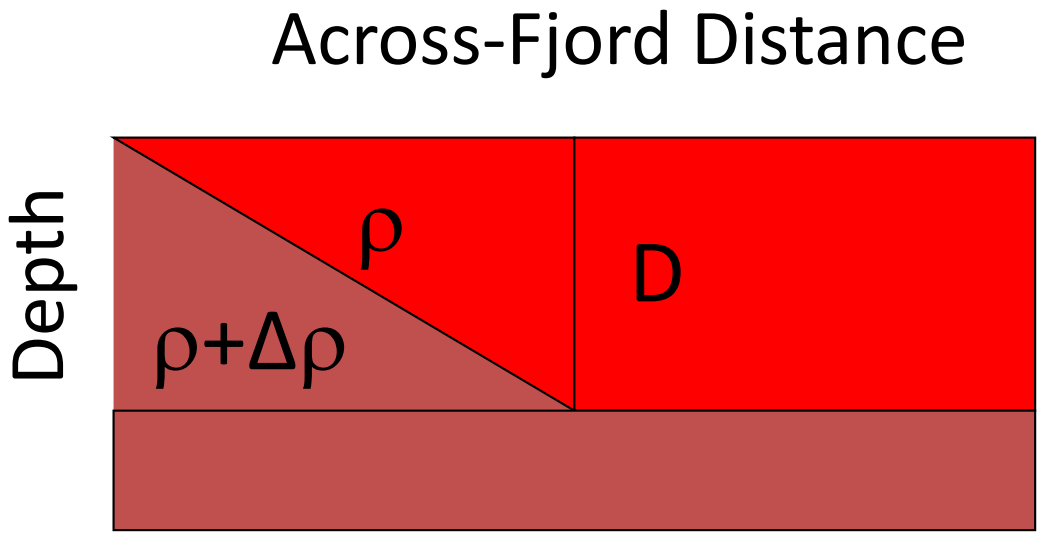
Velocity Time Series (3-years)

Along-Channel Currents, cm/s



Internal Rossby Radius of Deformation L_D

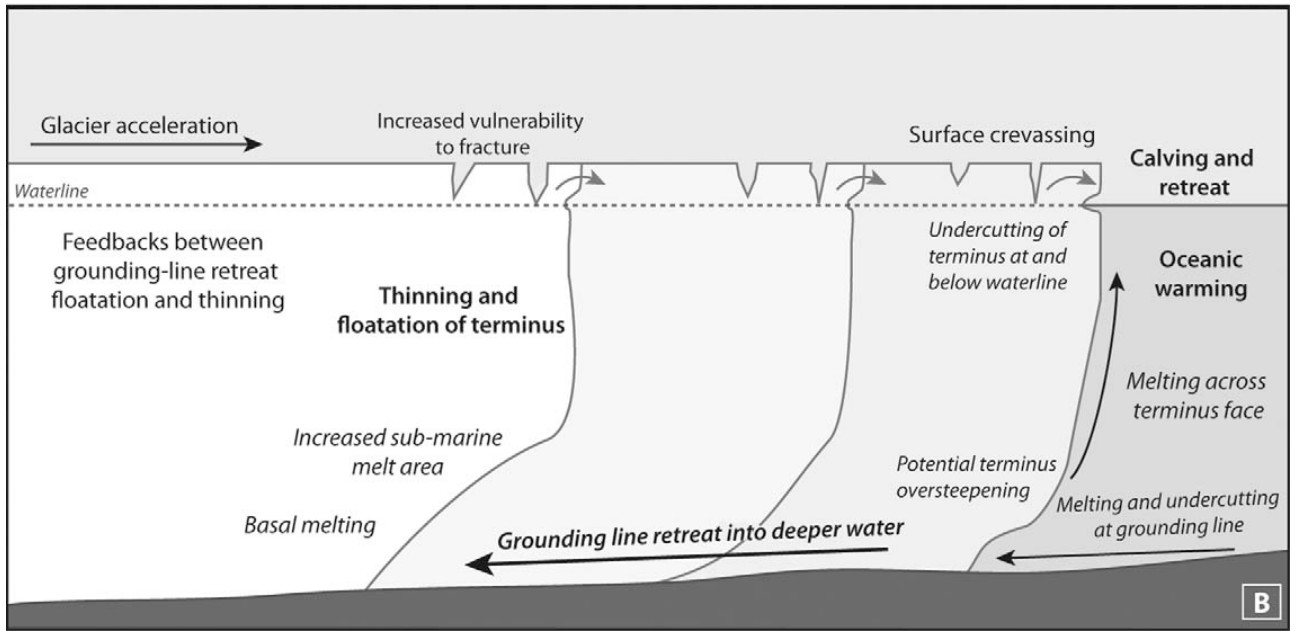
Freshwater driven flows generally scale with the internal Rossby radius of deformation, the "eddy" scale



$$\frac{\sqrt{\Delta\rho/\rho_0}\, g\, D}{f}$$

~ 10 km

f is Coriolis "force"
ρ is density
D is vertical scale of motion



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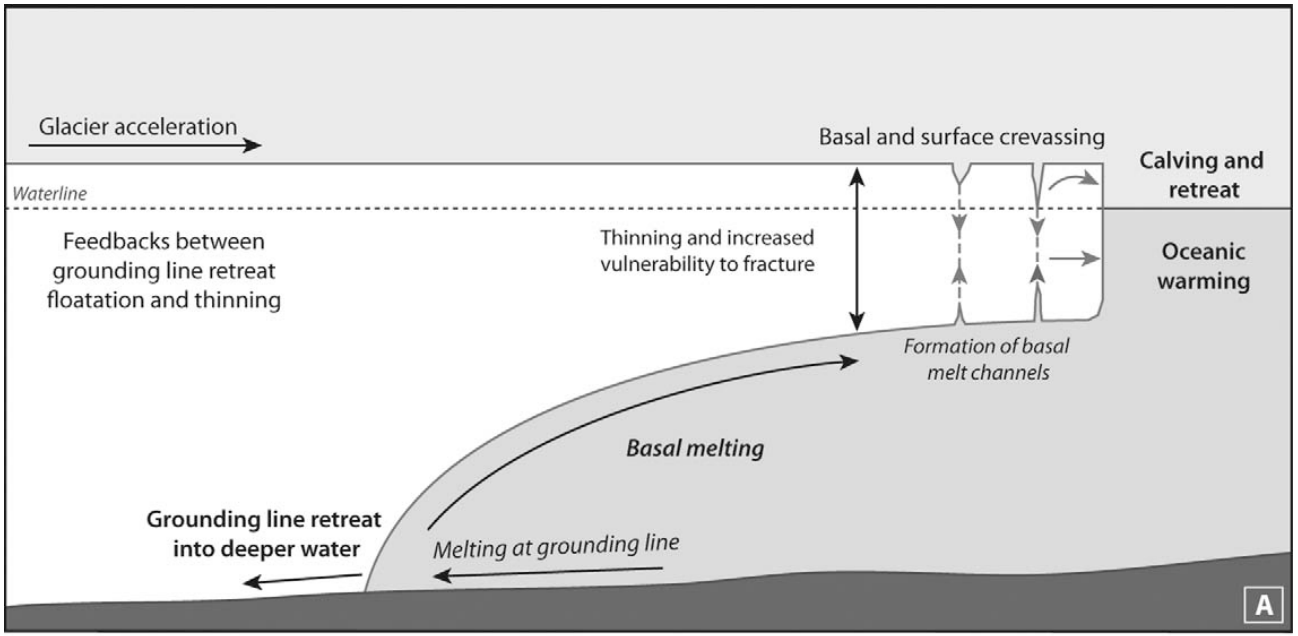
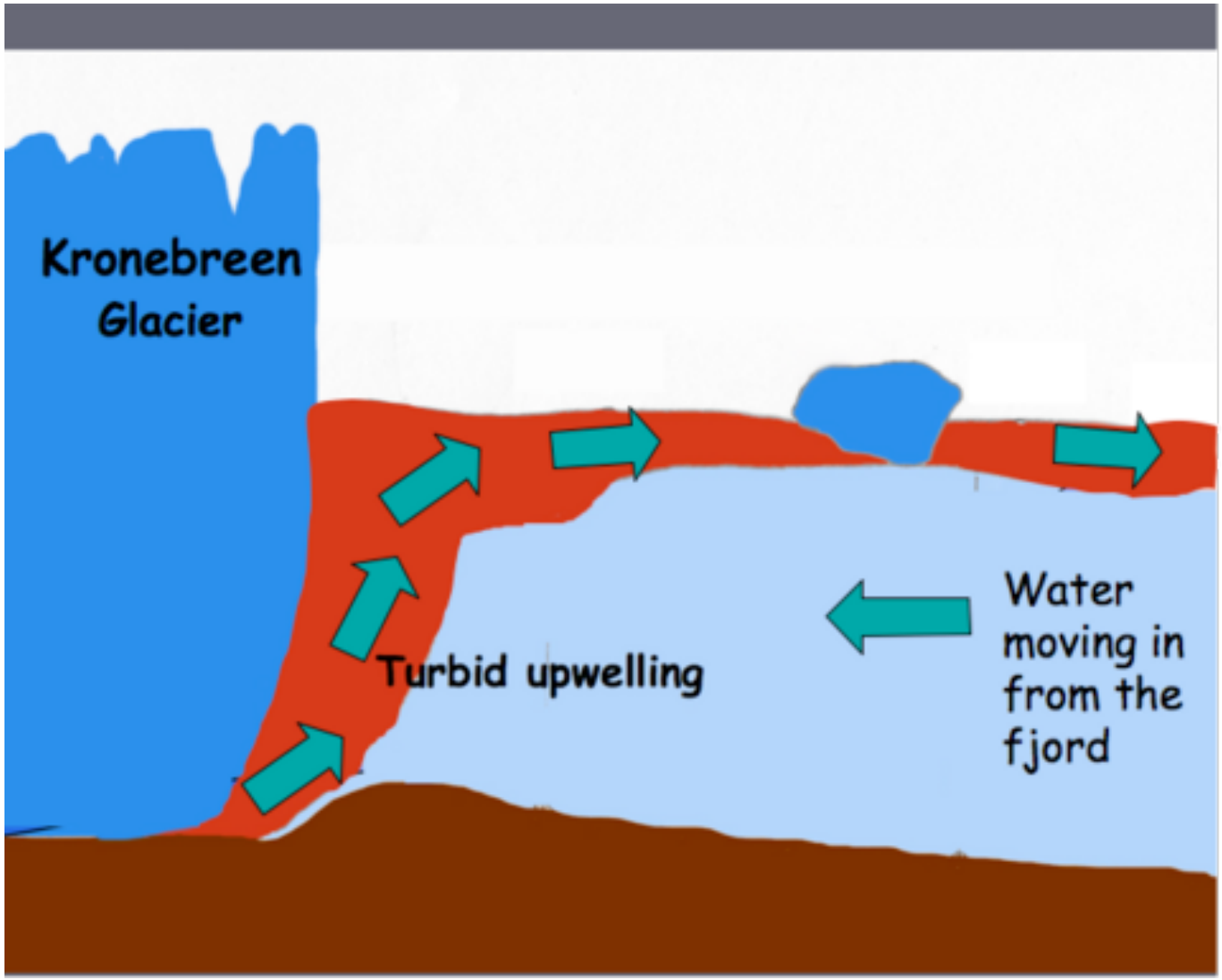


Floating Terminus:

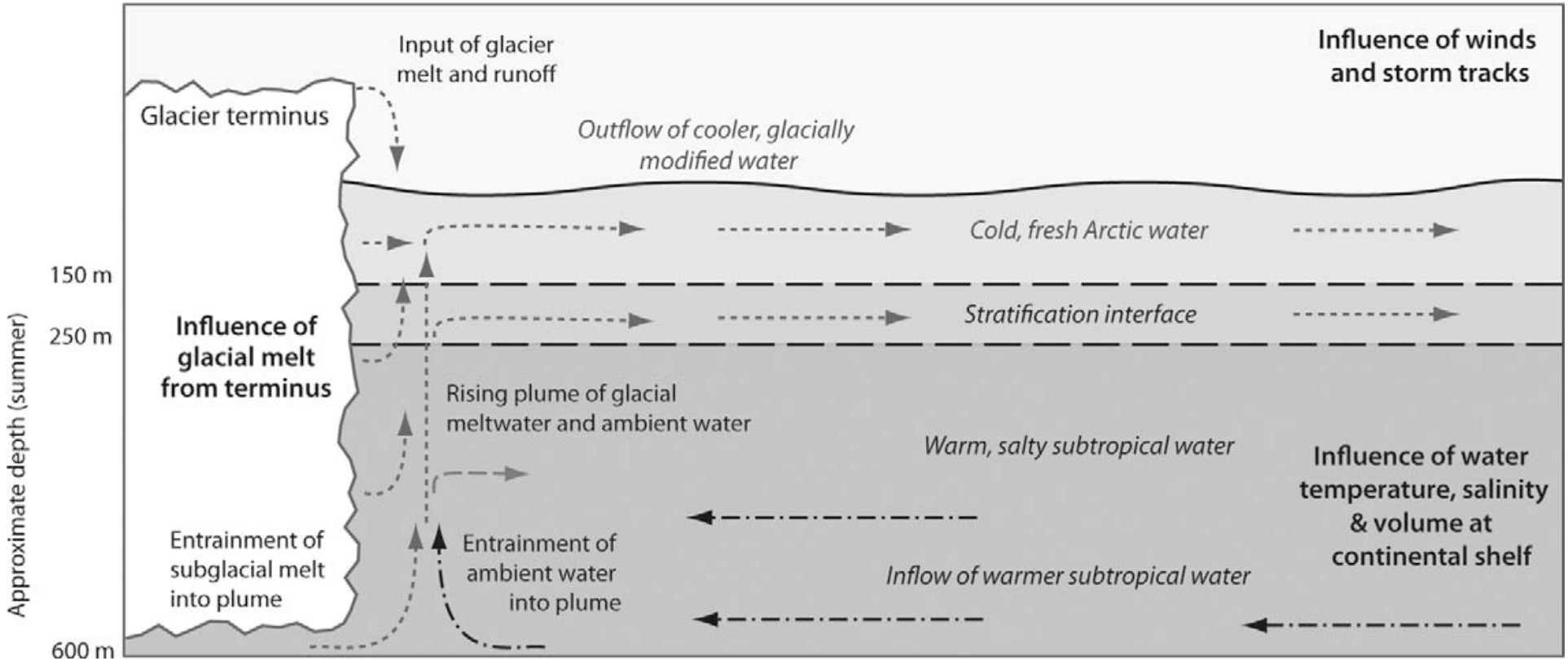
Petermann Gletscher
79N Glacier

Carr (2013)

Old Text Book View:

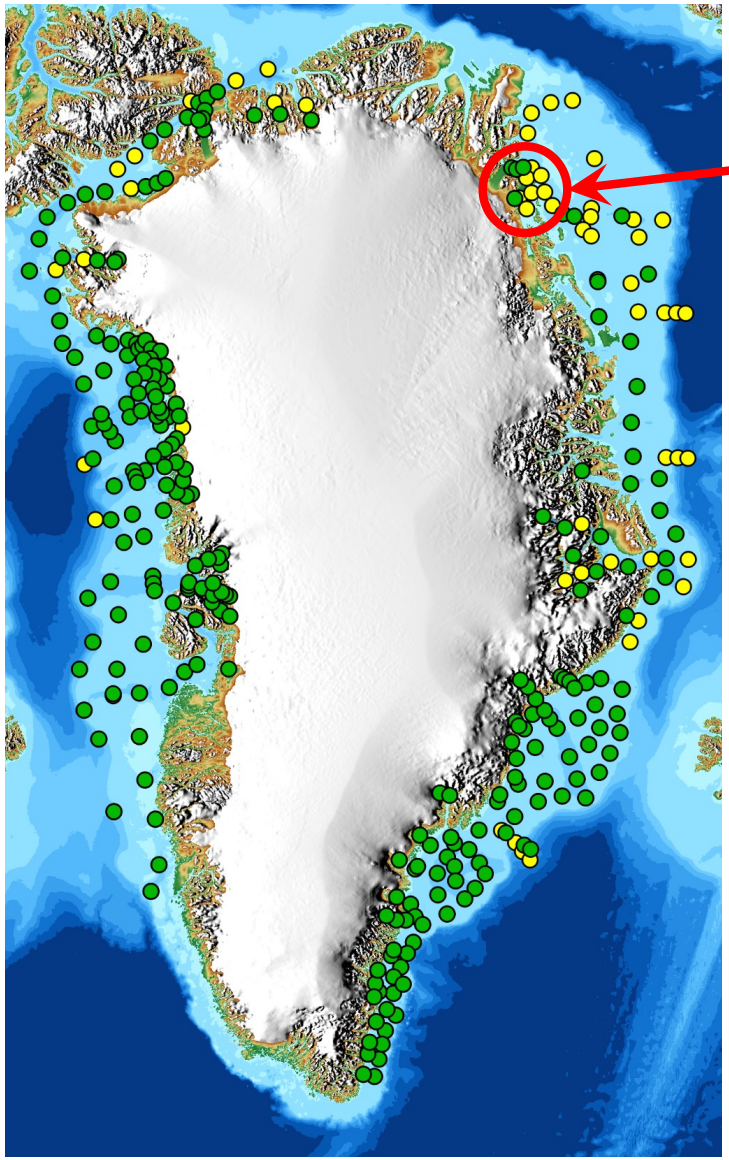


New and More Realistic View (Straneo et al, 2011):

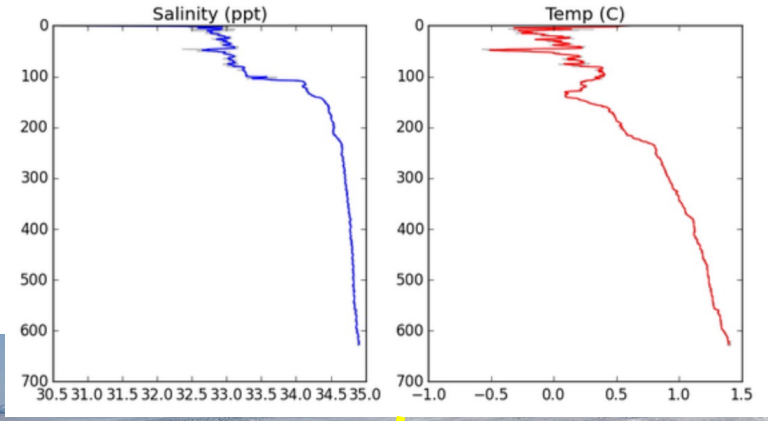


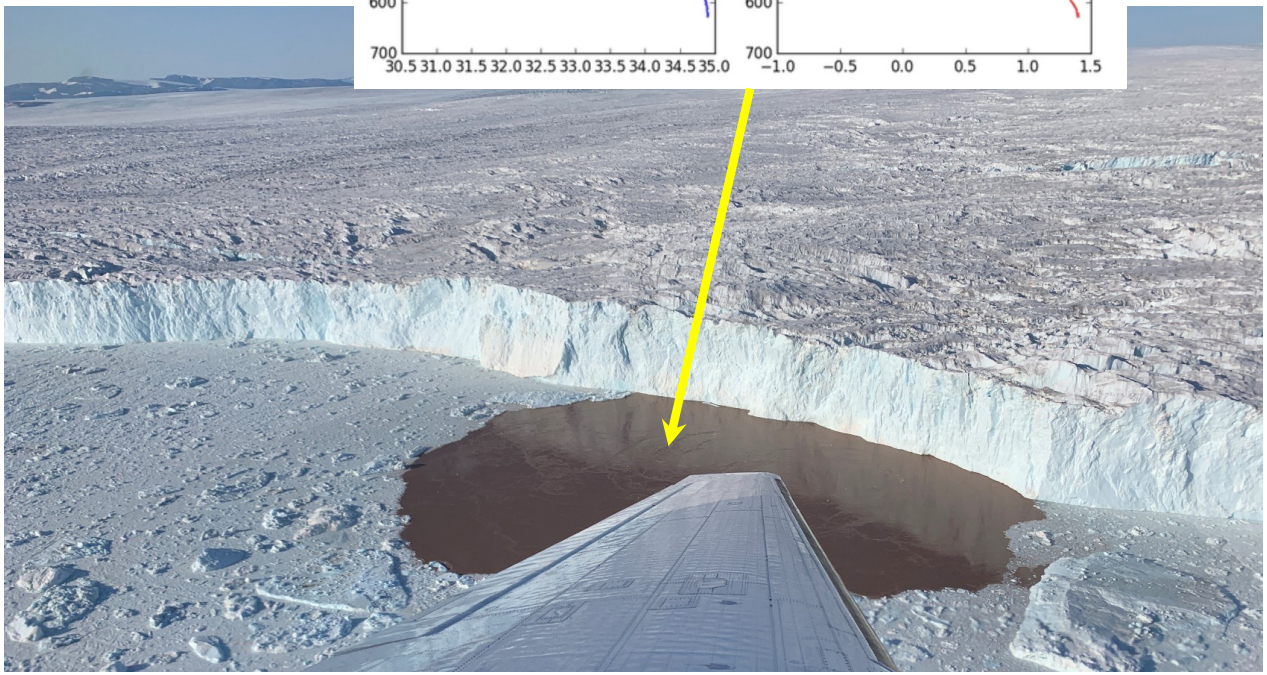
Salinity: 0 psu 34.5 psu

Carr (2013)

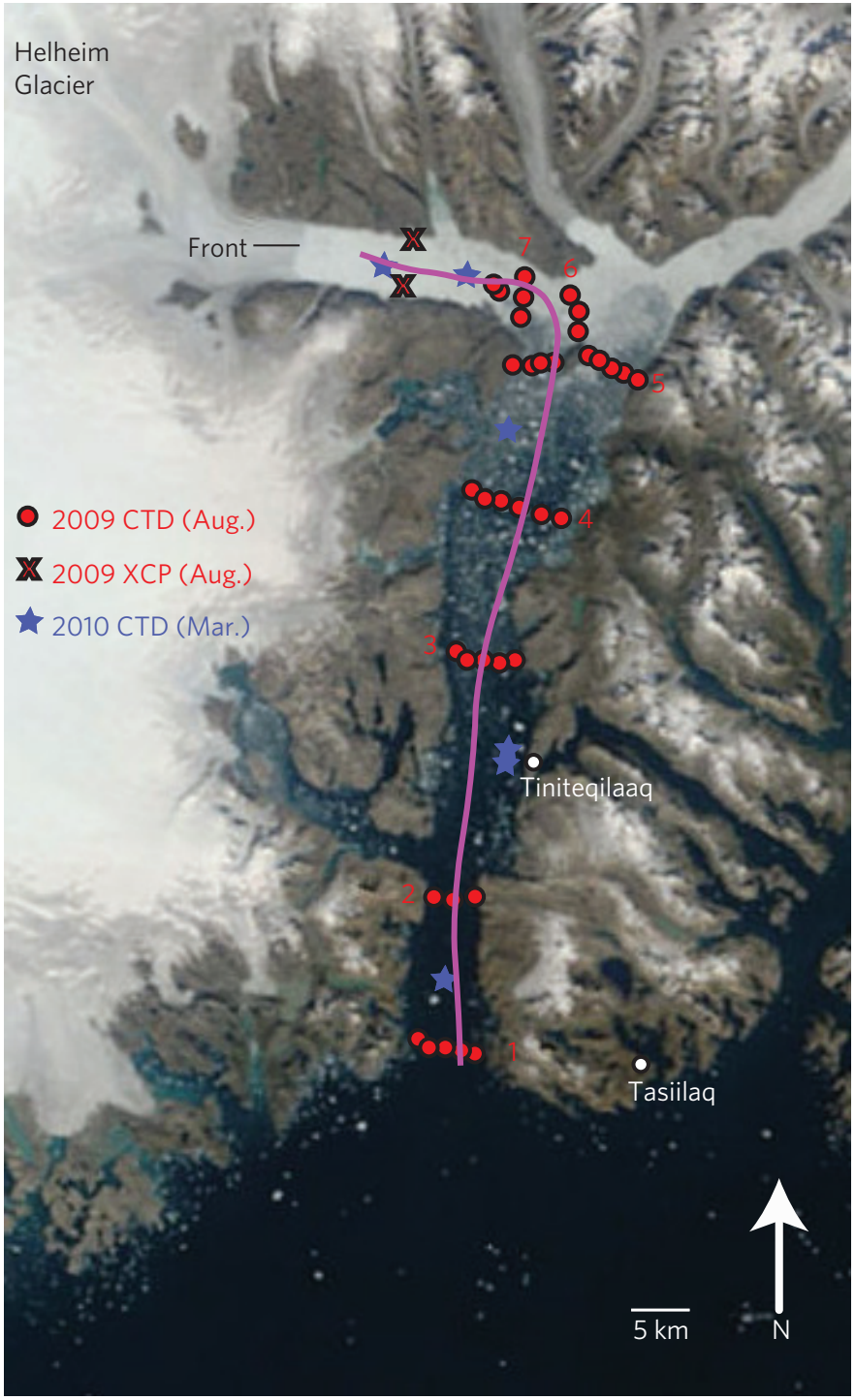


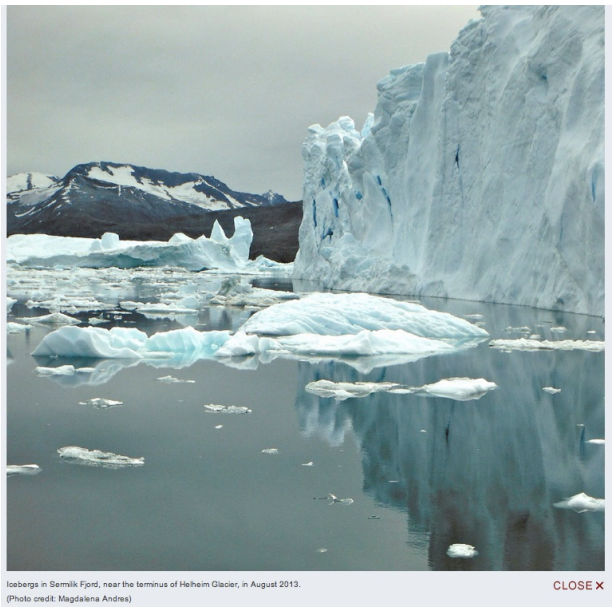
Temperature & Salinity





Helheim Glacier, Greenland

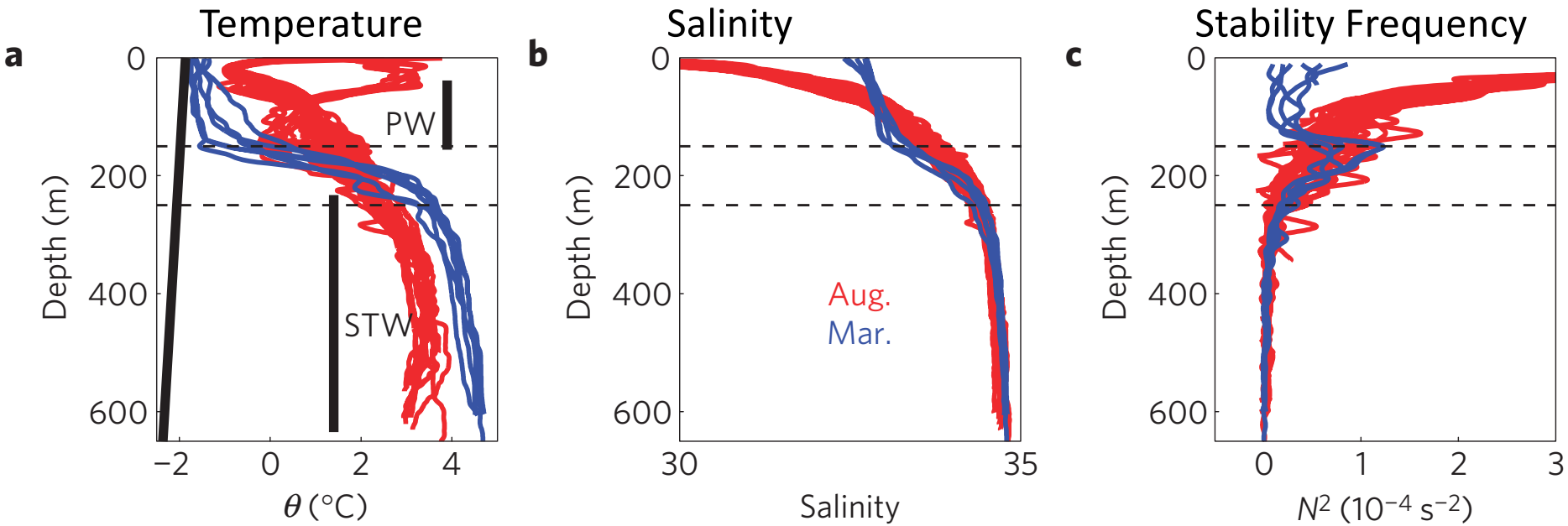




Icebergs in Sermilik Fjord, near the terminus of Helheim Glacier, in August 2013.
(Photo credit: Magdalena Andres)
CLOSE ×

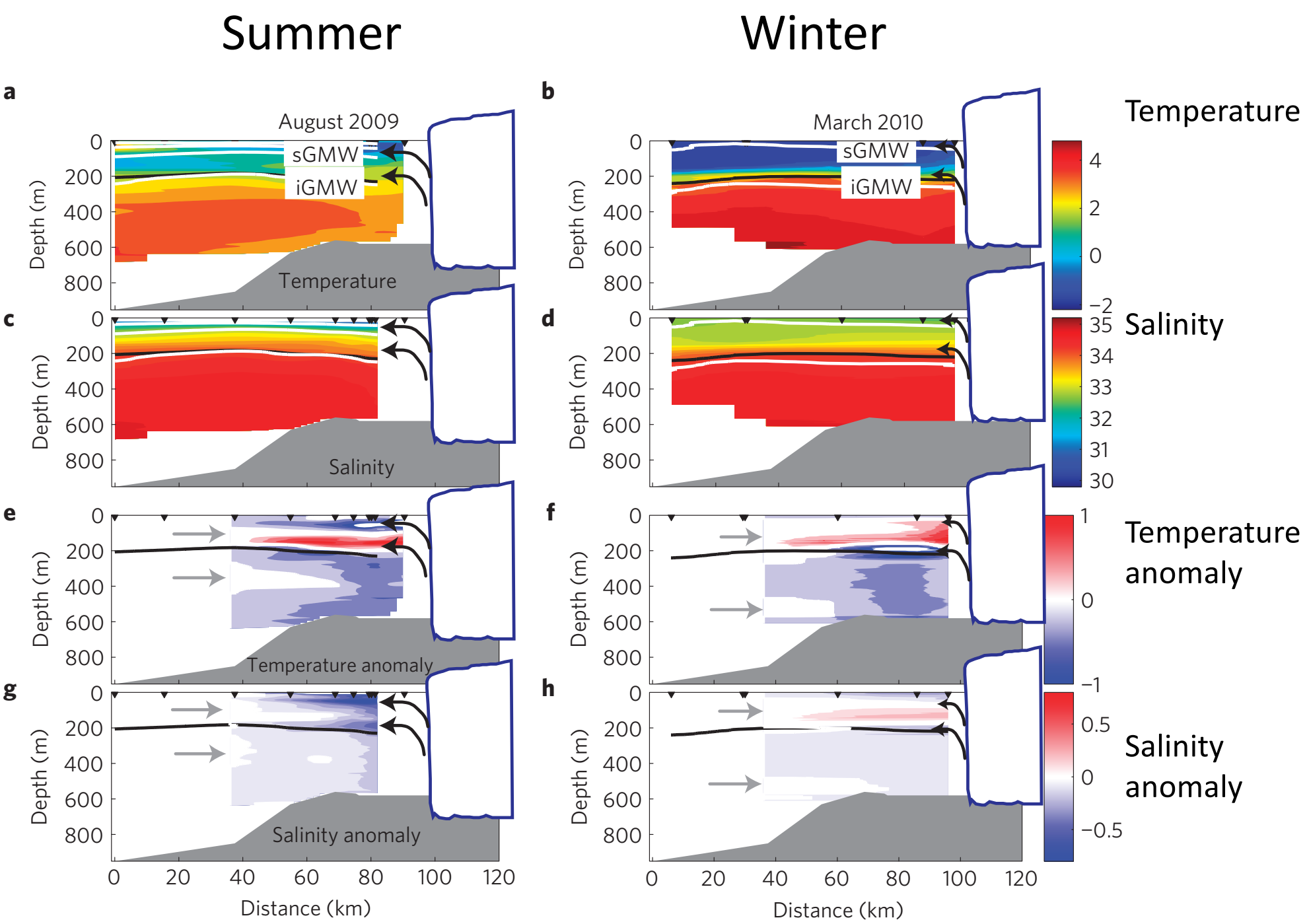
The deployment of a scientific mooring in Sermilik Fjord in August, 2011. The yellow buoyant sphere of the mooring can be seen floating on the surface with authors Rebecca Jackson and David Sutherland in the small boat behind.
(Photo by Fiamma Straneo, Woods Hole Oceanographic Institution)
CLOSE ×

Straneo et al. (2011)



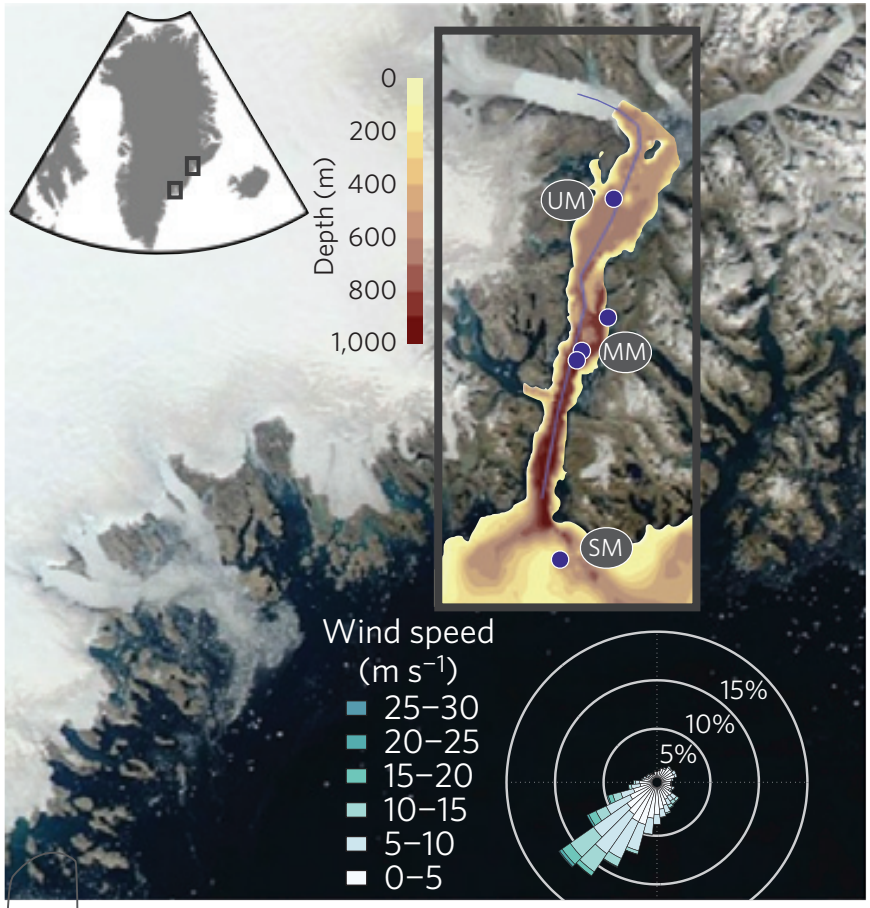
Warmer bottom water
In Winter

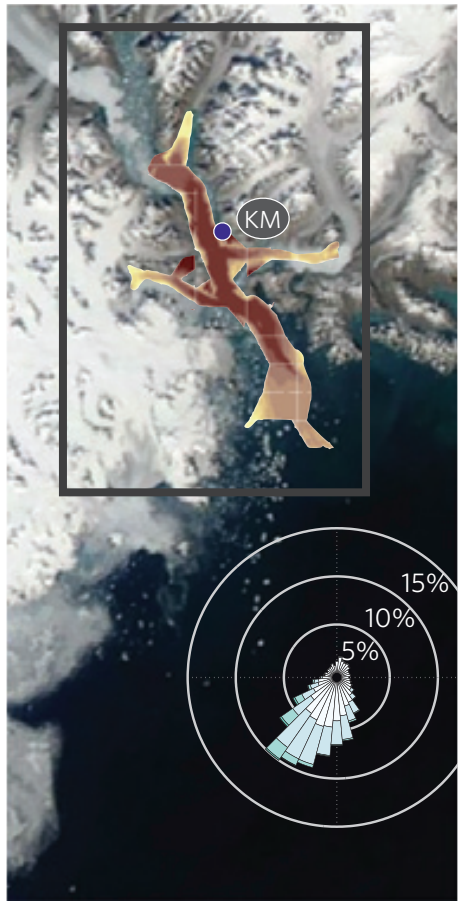
Straneo et al. (2011)

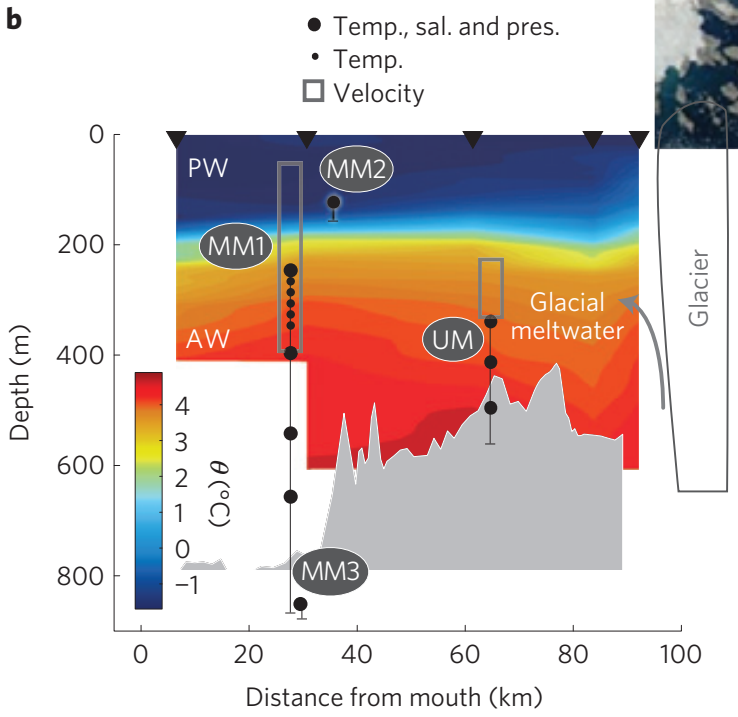


Straneo et al. (2011)

Storm Events

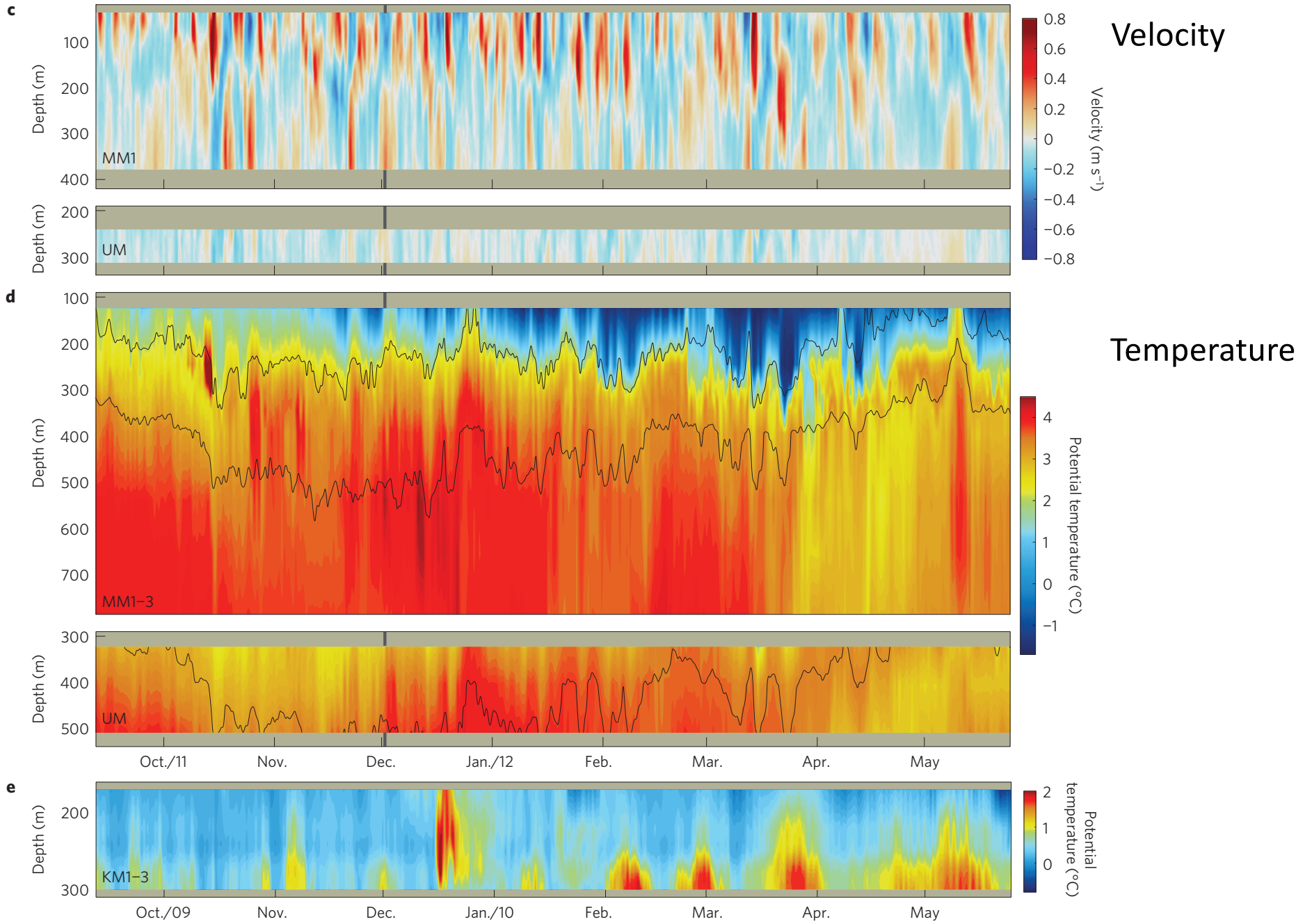






Jackson et al. (2014)

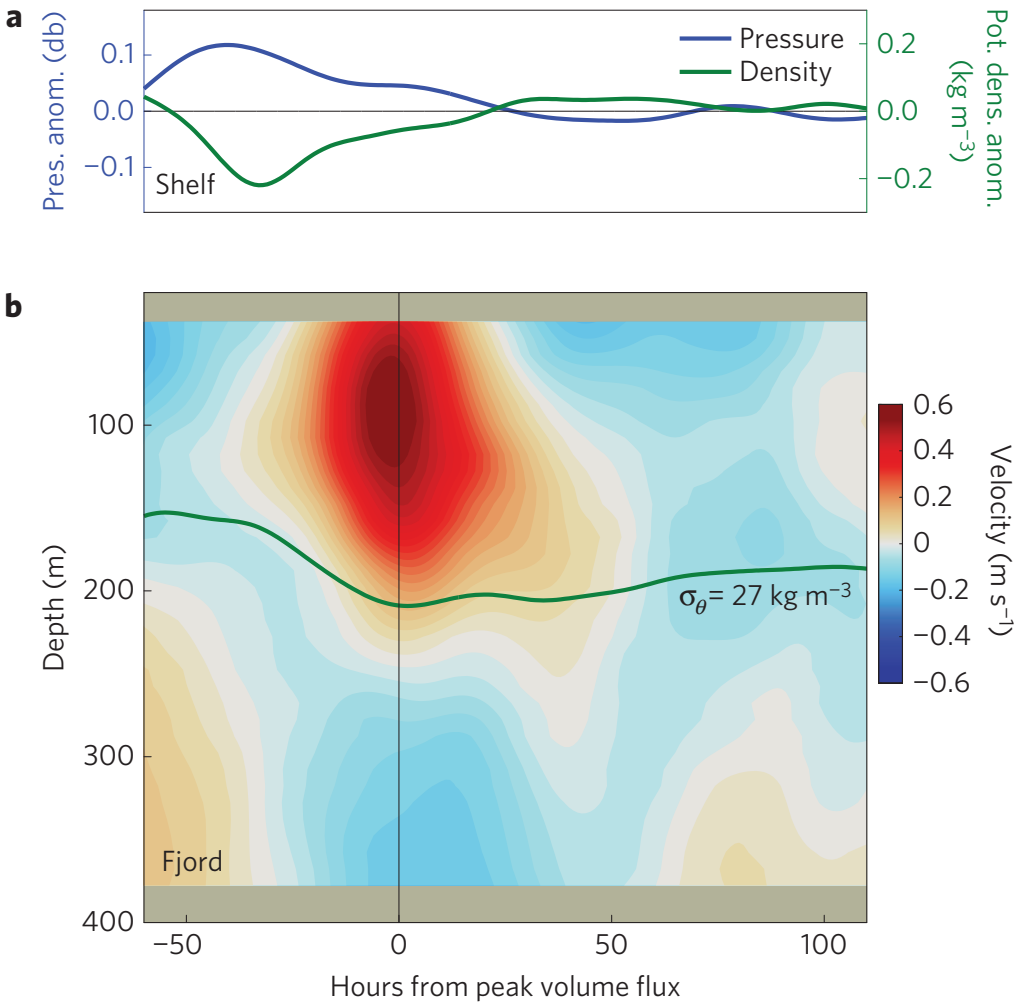
1-year Mooring Observations in Sermilik Fjord

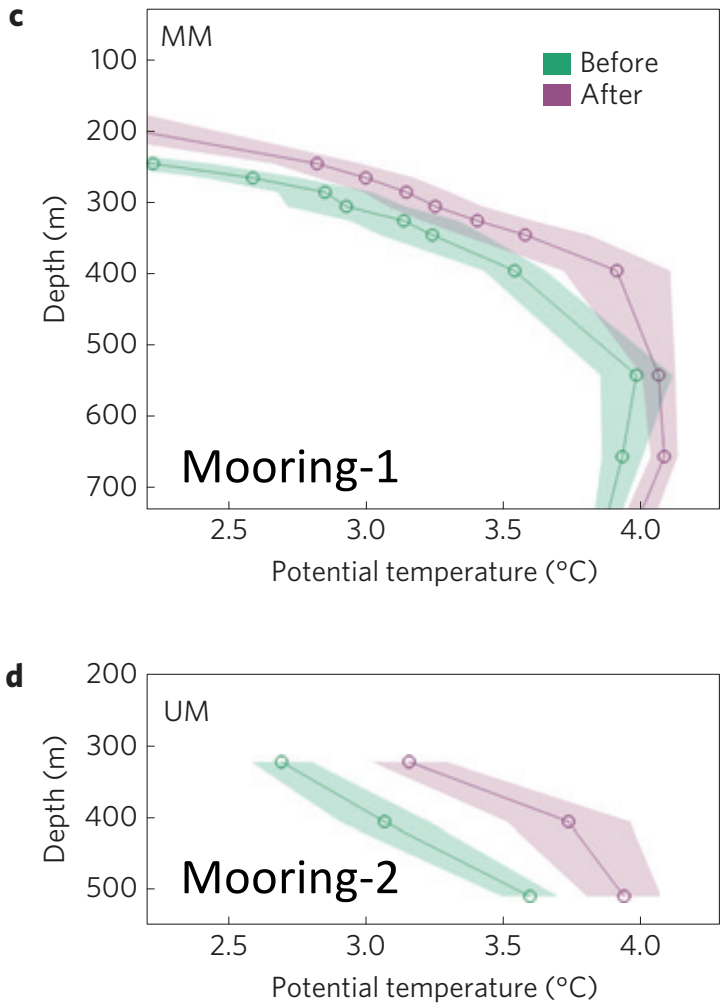


Jackson et al. (2014)

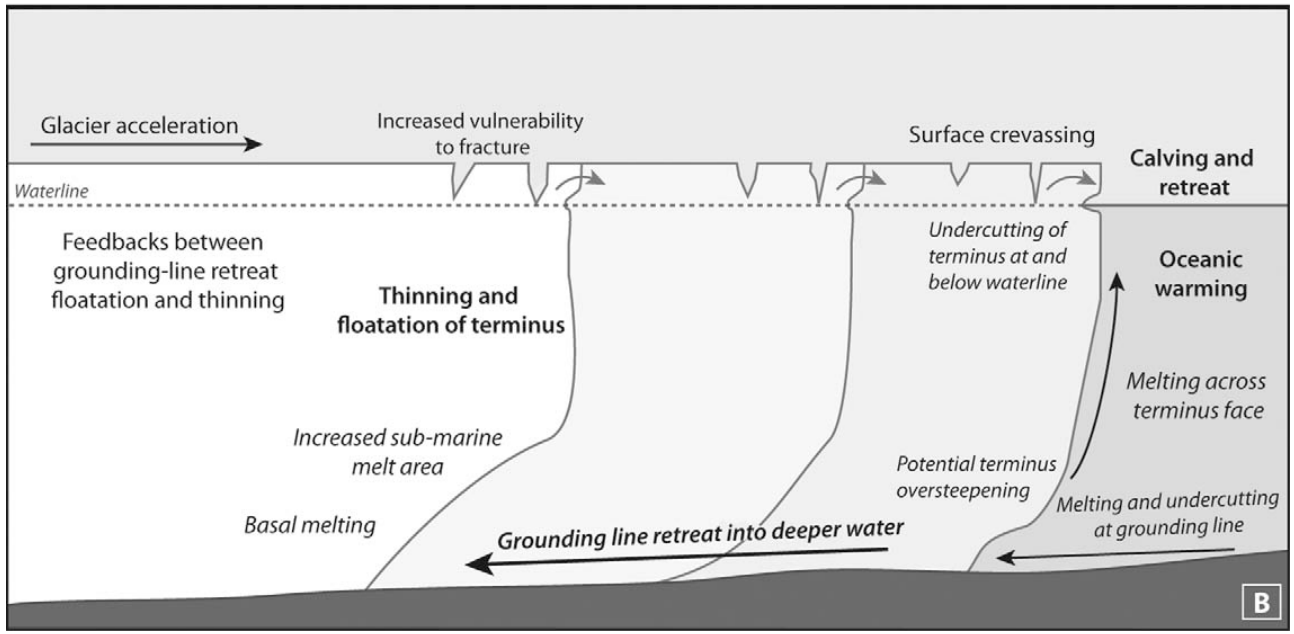
Event/Ensemble Averaging: Storms

T(z) relative to storm events





Jackson et al. (2014)



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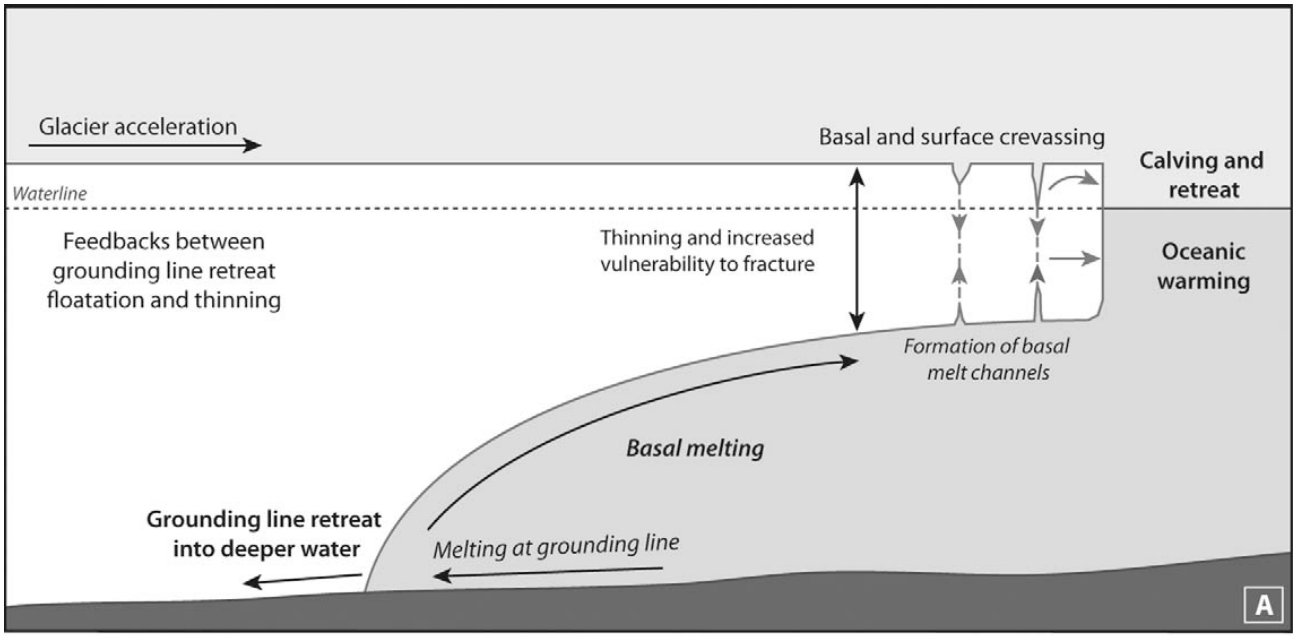

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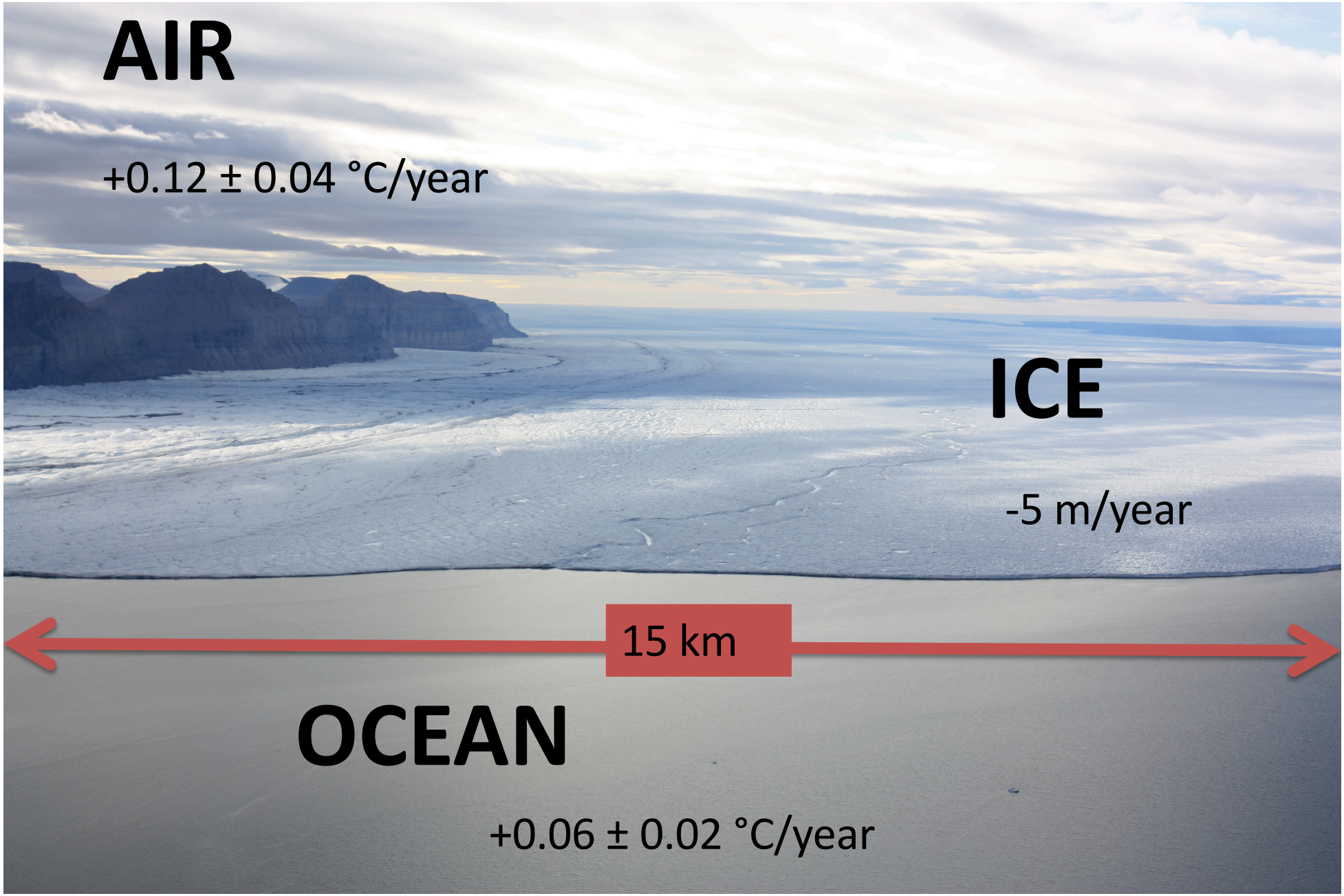
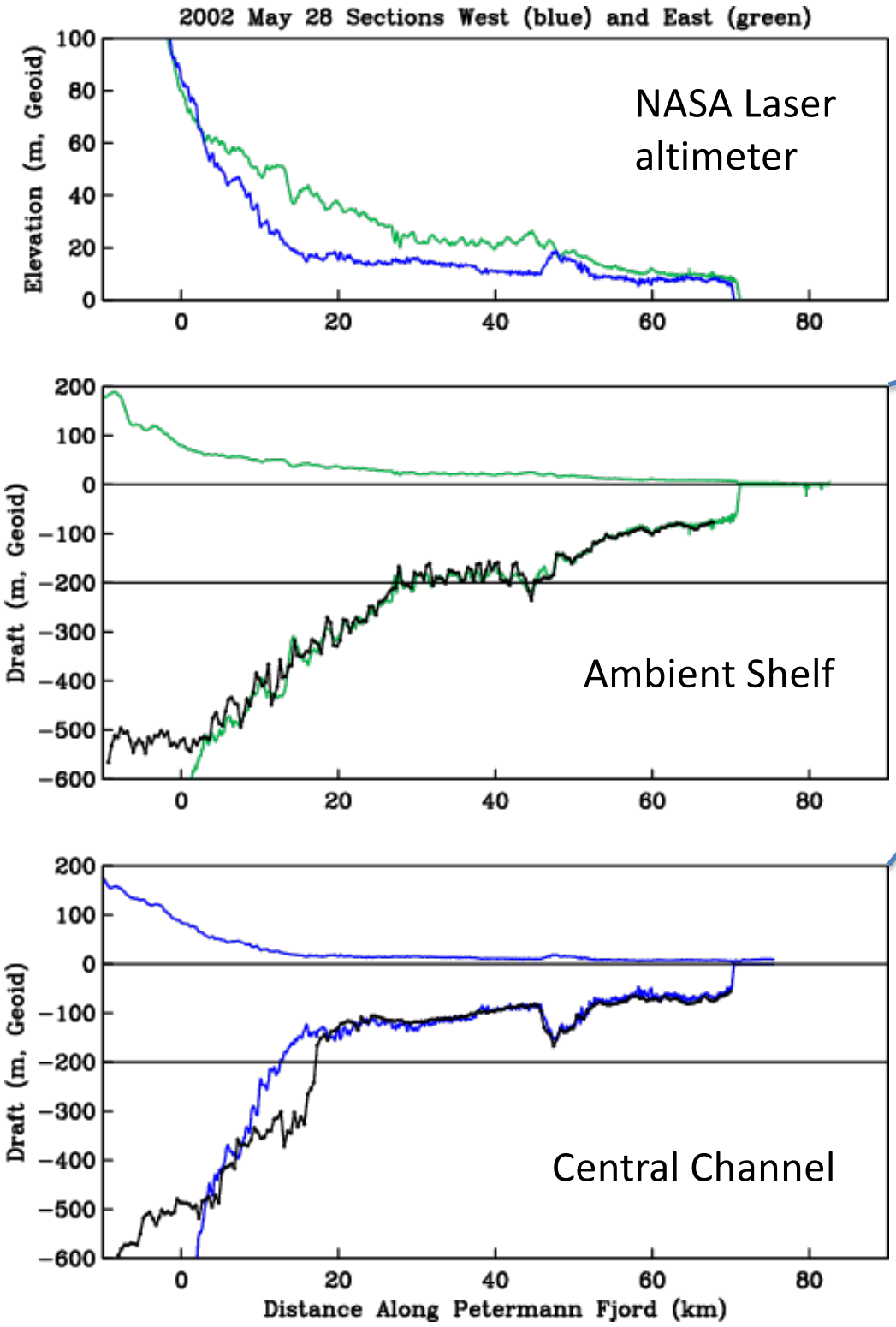
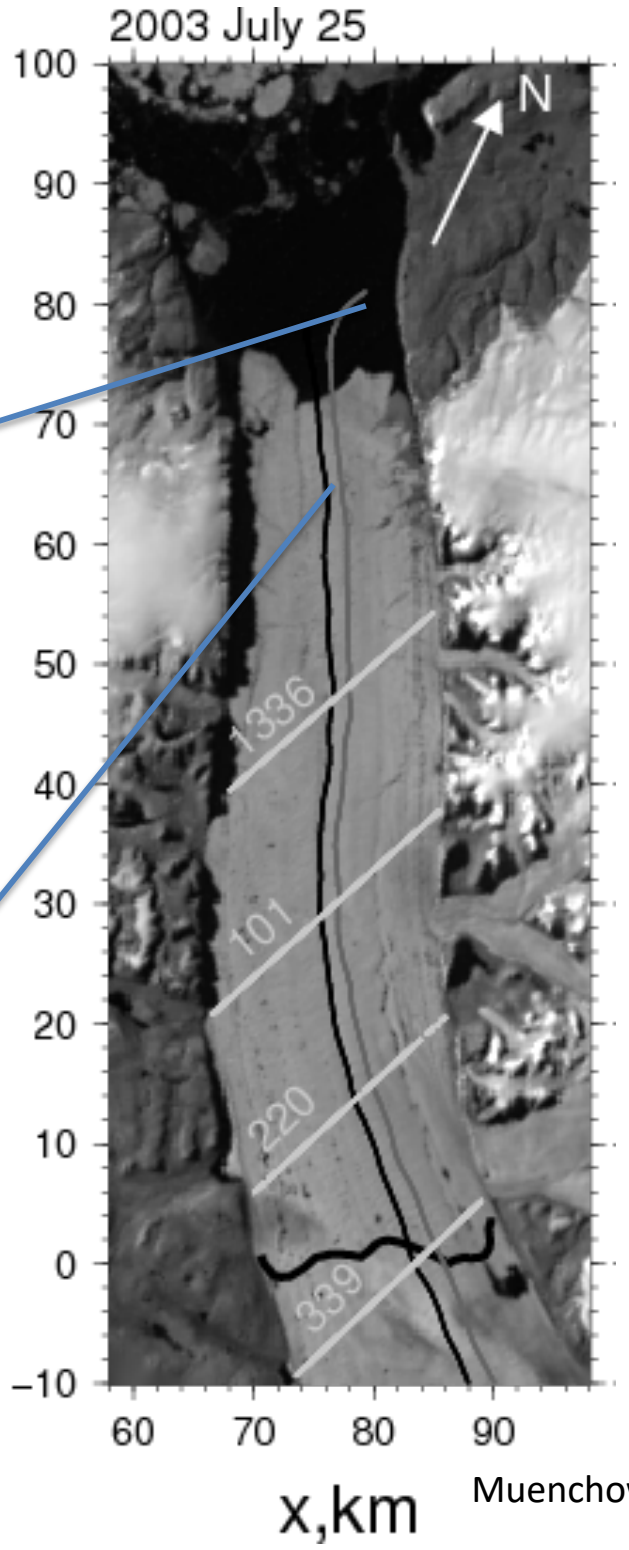
Petermann Gletscher
79N Glacier

Carr (2013)

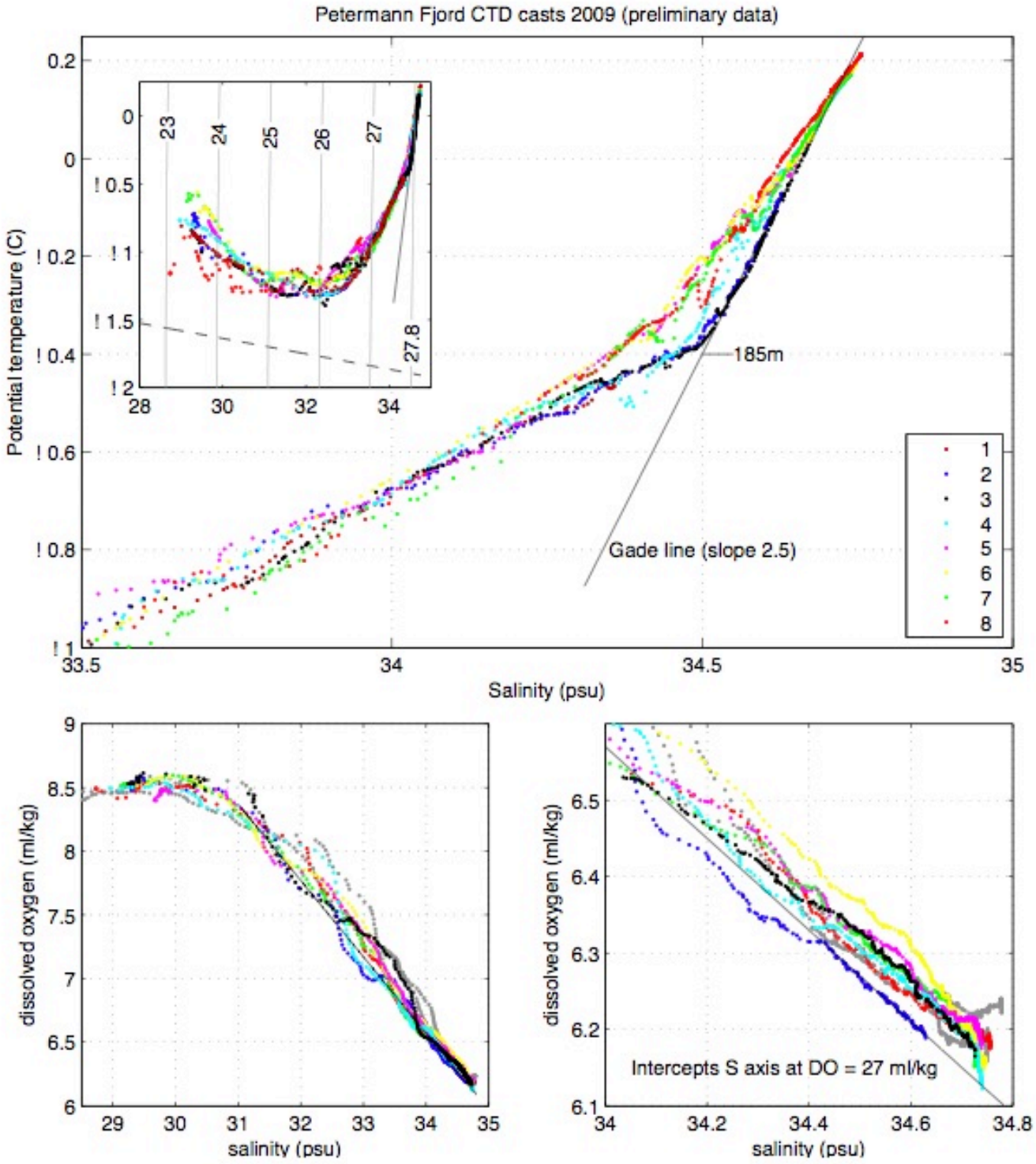
Petermann Gletscher





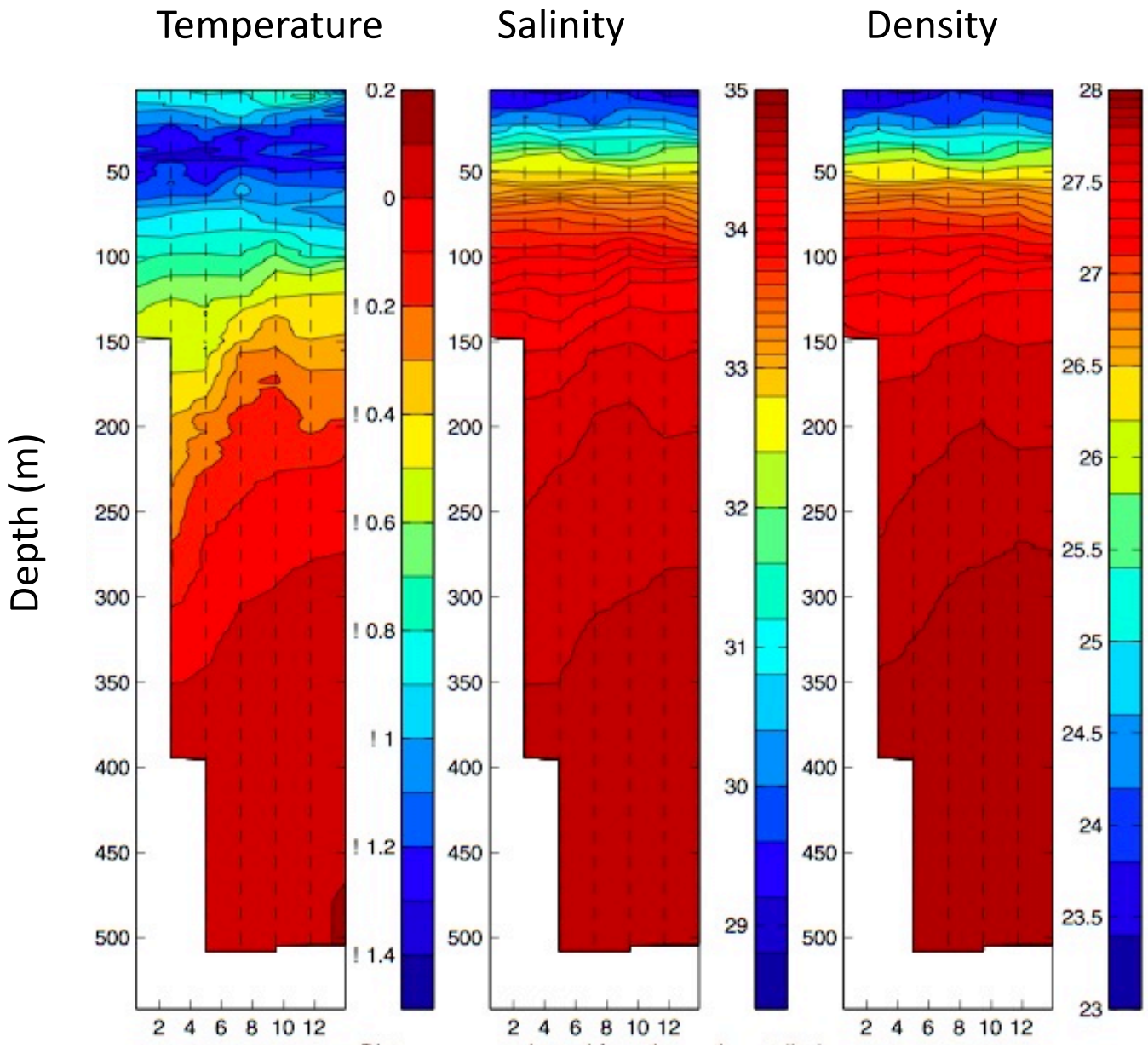


Muenchow et al (2014)



Johnson et al (2011)

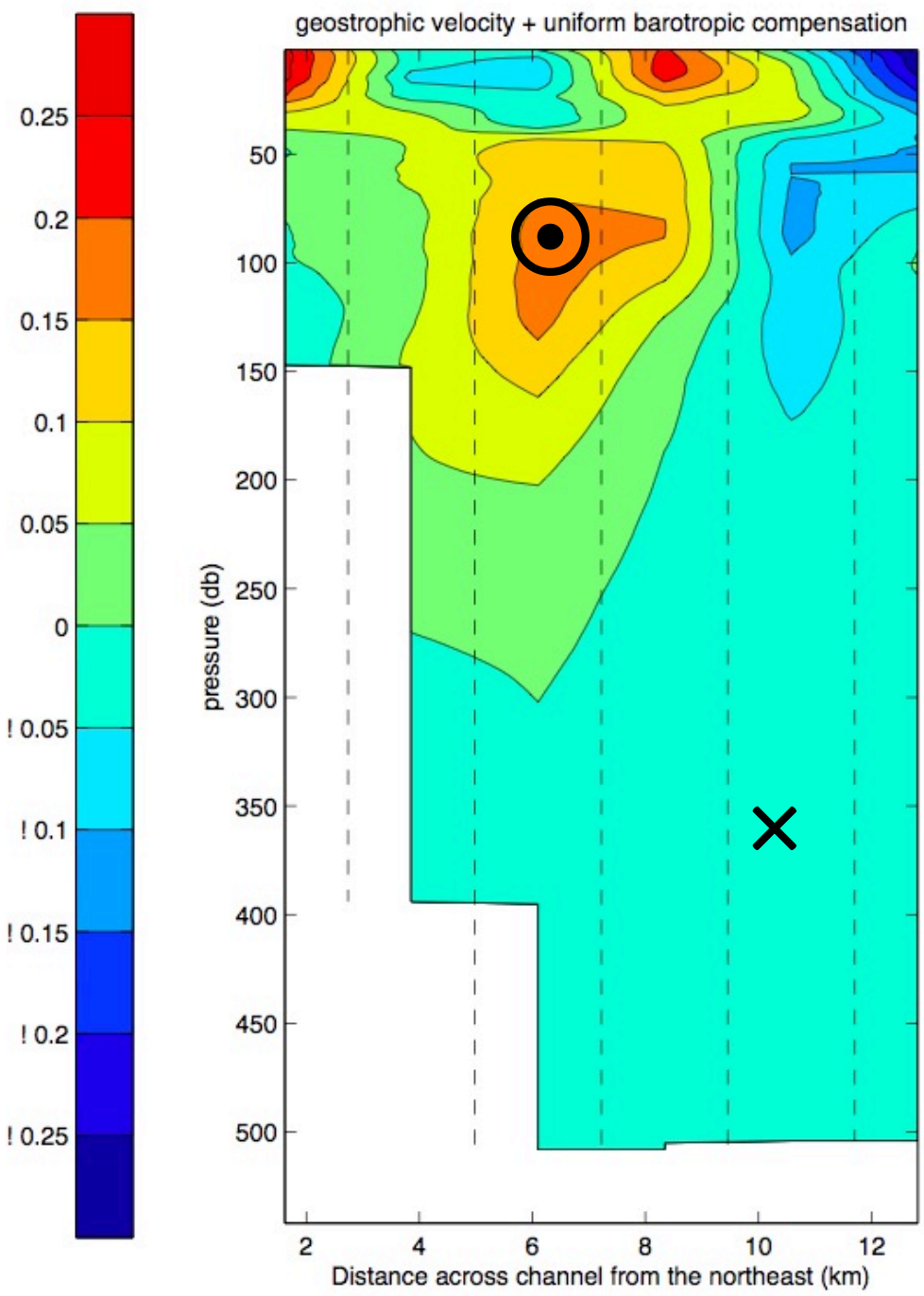
Petermann Fjord 2009: Across-Fjord Property Distributions



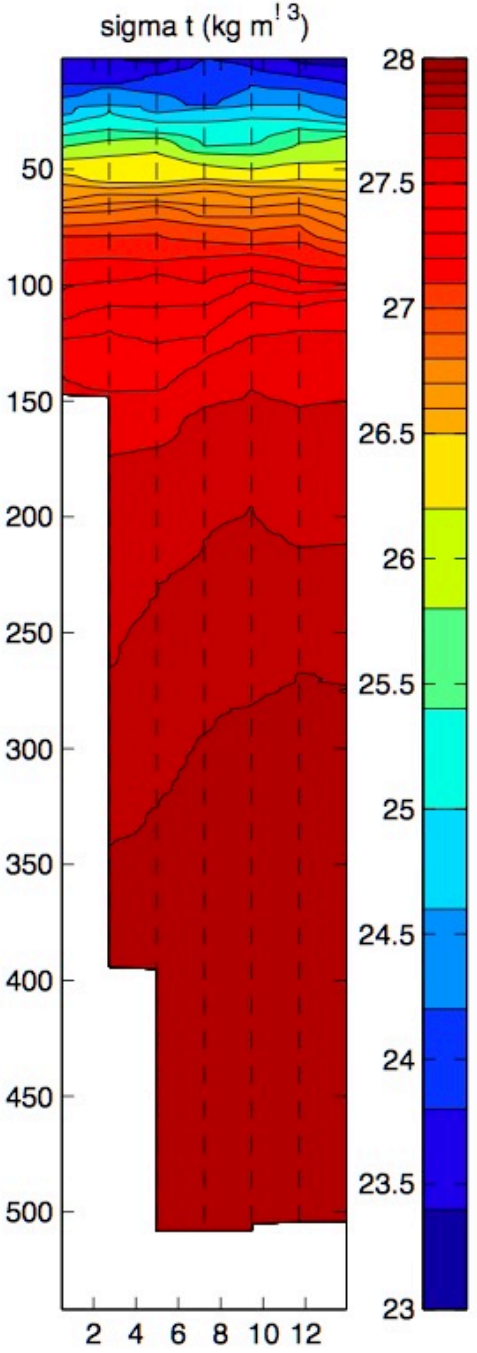
Johnson et al (2011)

m/s

Geostrophic Velocity



Density Anomaly



Aug.-20
2009

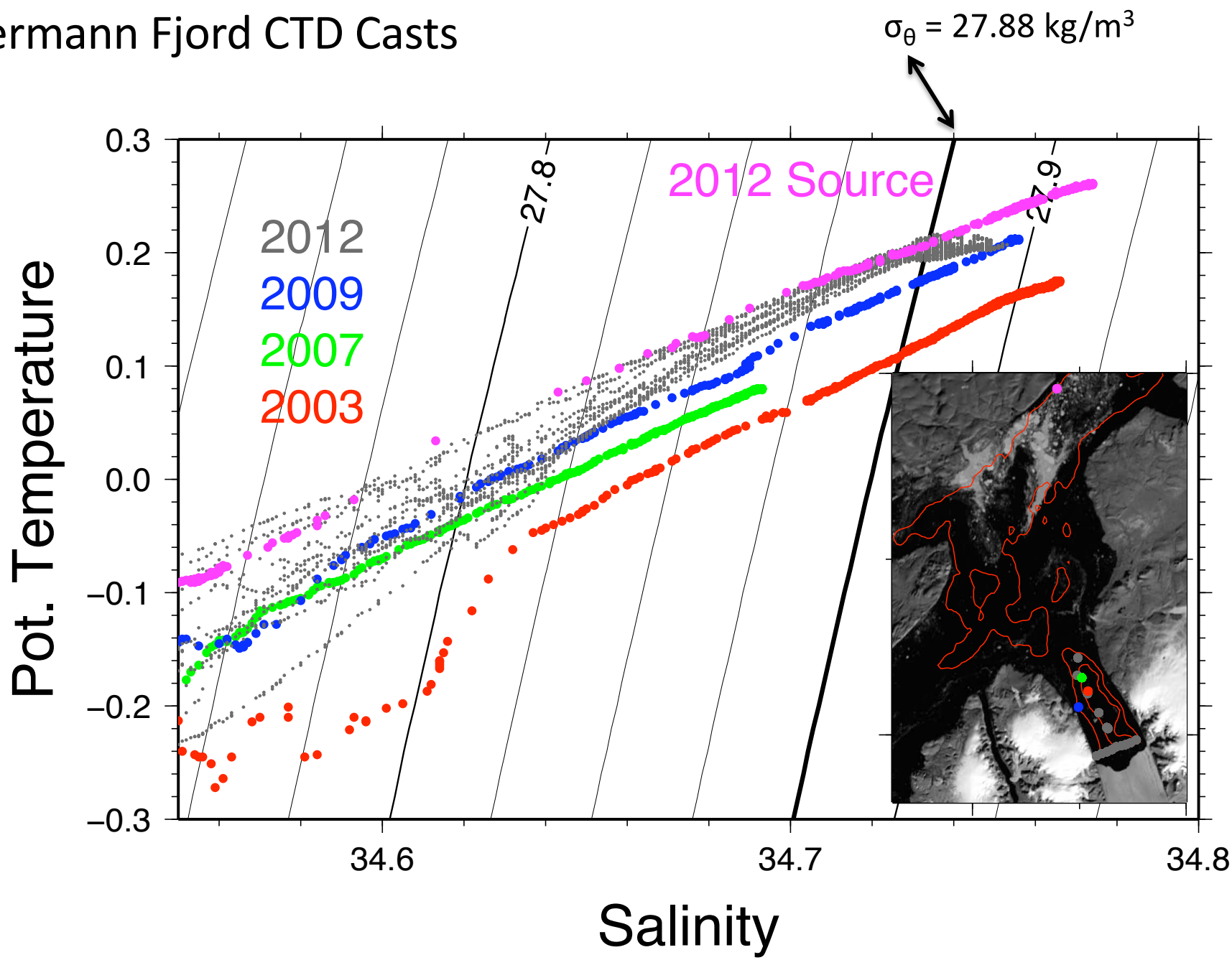
Heat flux
to melt ice:

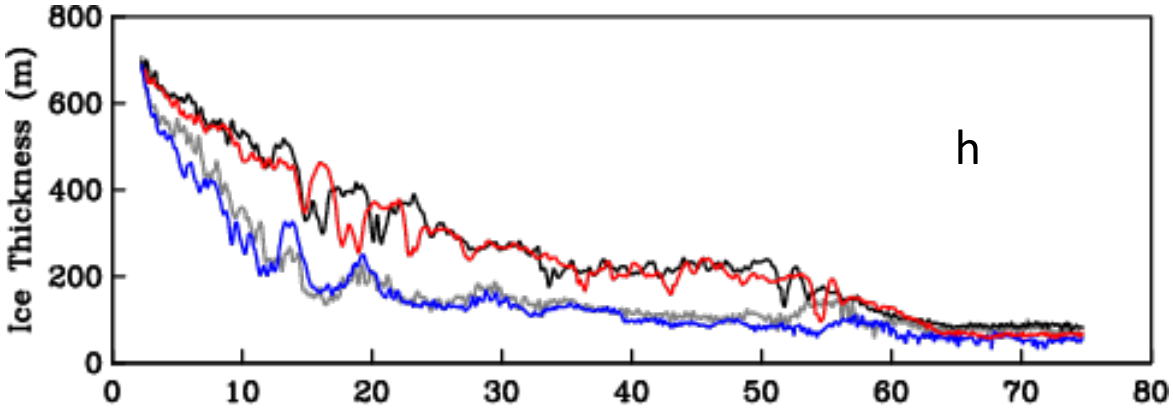
Needed to melt
1.1×10^{11} J/s

Available to melt
3.1×10^{11} J/s

Johnson et al (2011)

Petermann Fjord CTD Casts

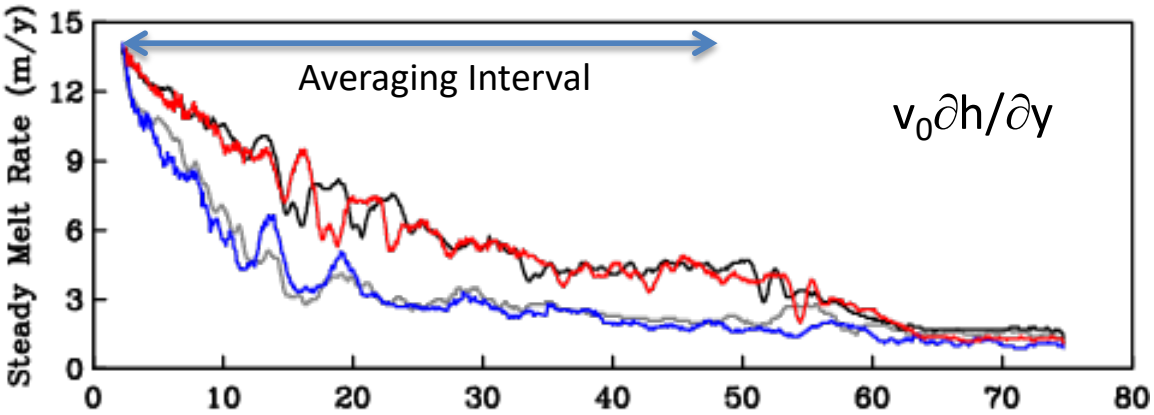




Mass Conservation:

$\partial h/\partial t + v_0 \partial h/\partial y =$

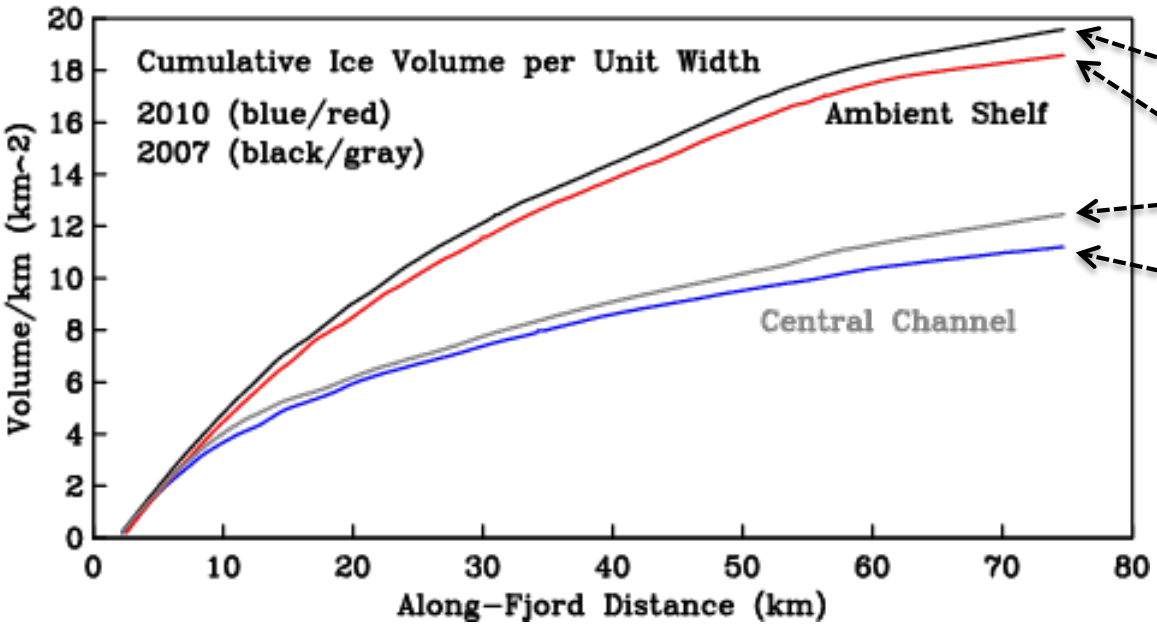
(accumulation-ablation)-(basal melt)



Mean Steady Thinning:

4.9 m/year Central Channel

8.0 m/year Ambient Shelf

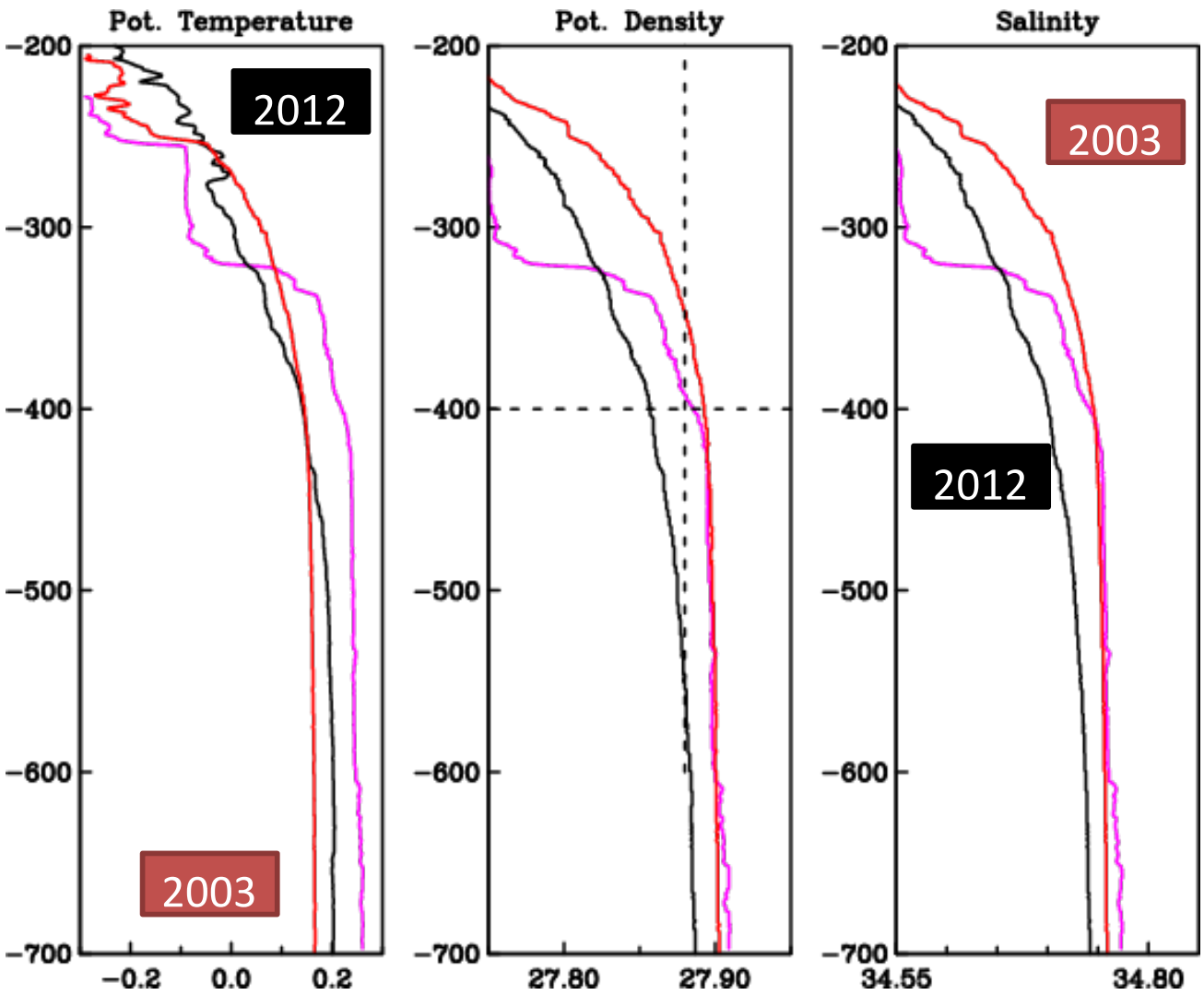


2007

2010

Mean Non-Steady Thinning:

5 m/year



Water Mass Change 2003-2012:

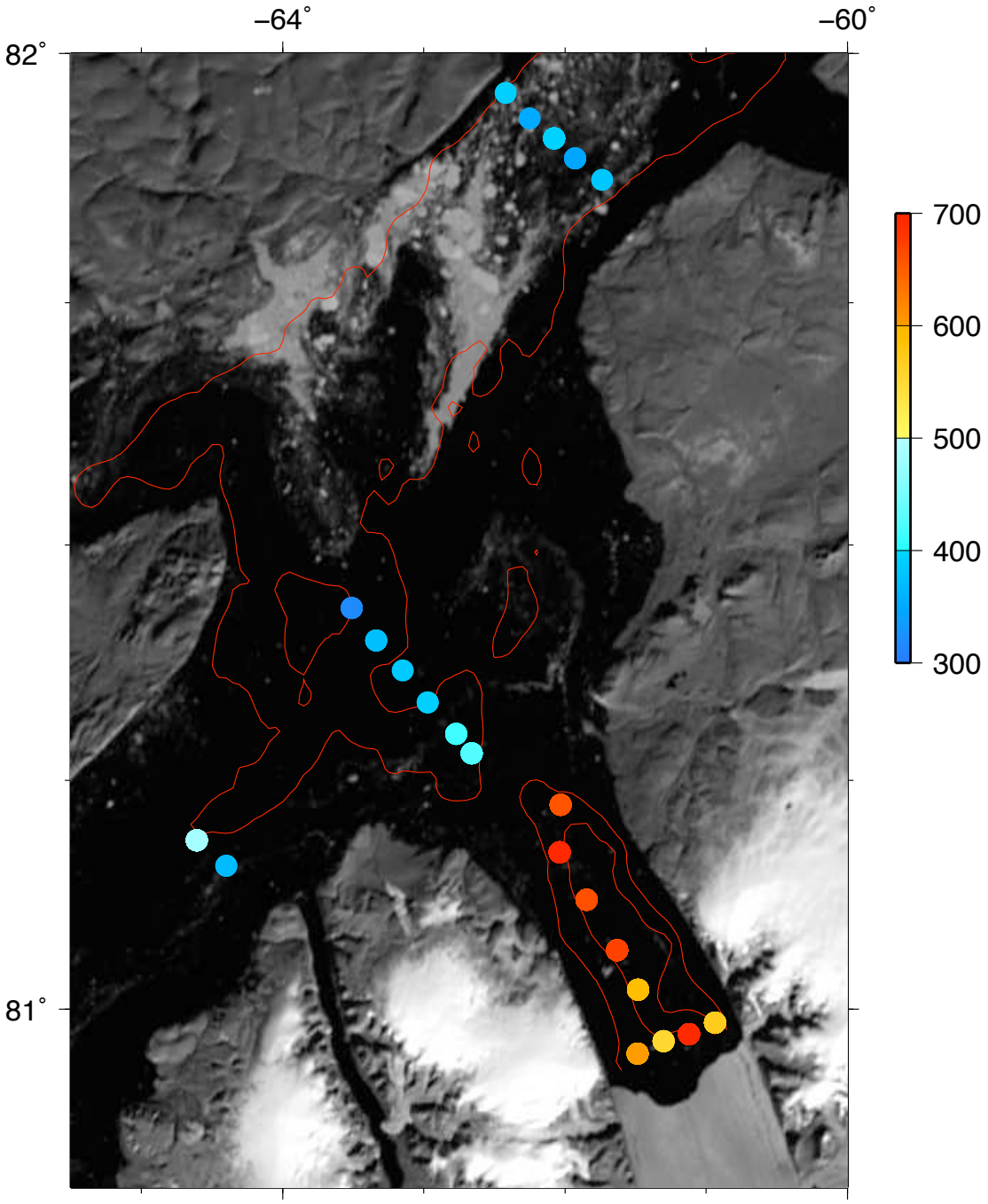
A little warmer

+

Much fresher

=

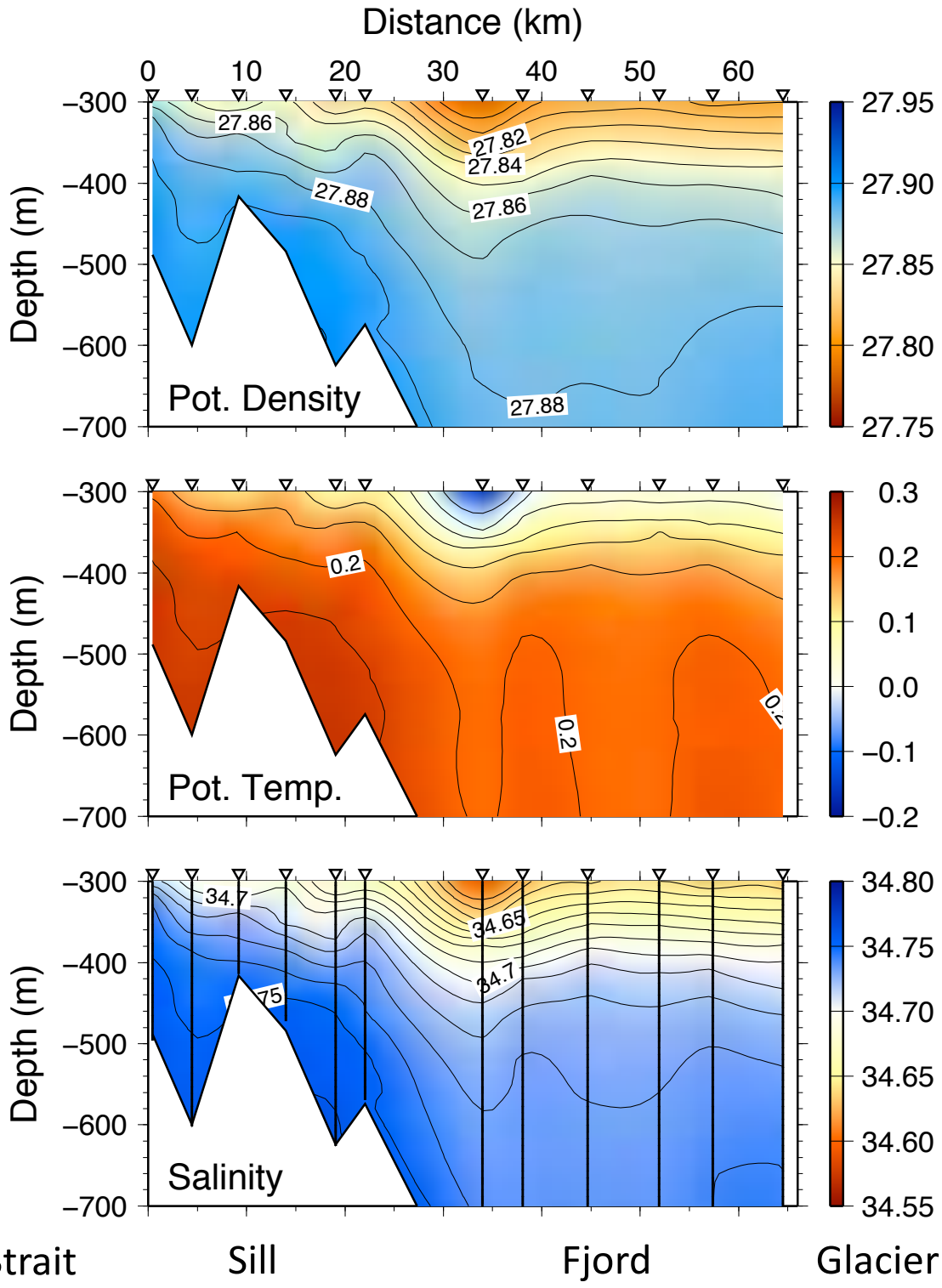
More melting



Depth of

σ_θ = 27.88 kg/m^3

Isopycnal



Along-Fjord Section
August 2012

400-m plunge of
σ_θ = 27.88 kg/m^3
isopycnal

200-m thick
moving
ice island at
km-30

200-m thick
stationary
ice shelf at
km-70