



Surface Layer

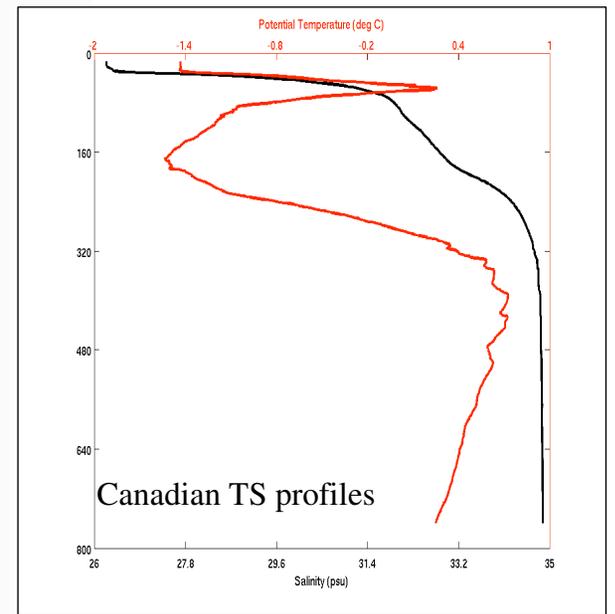
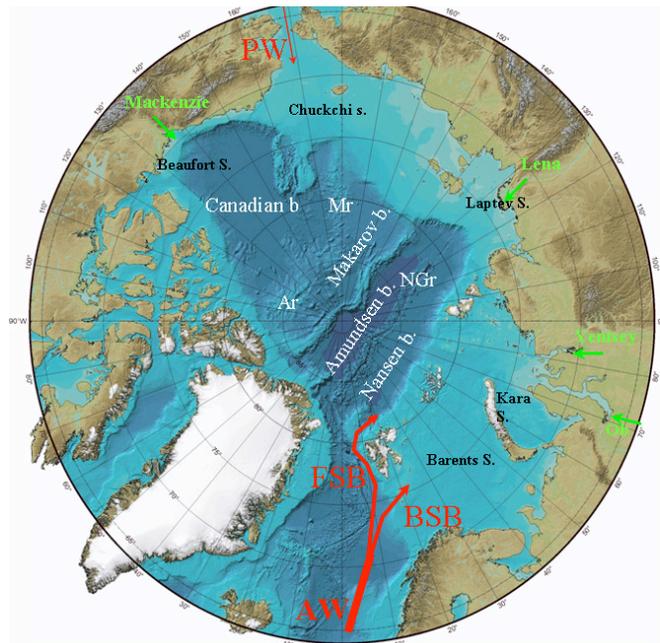
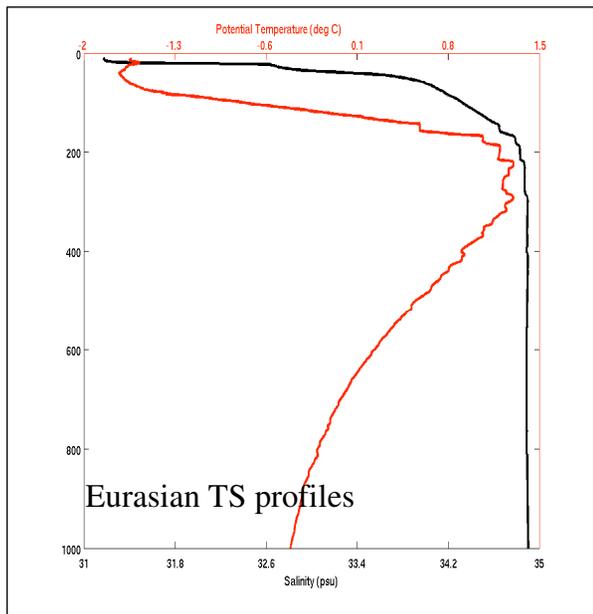
50-m

Halocline Layer

150-m

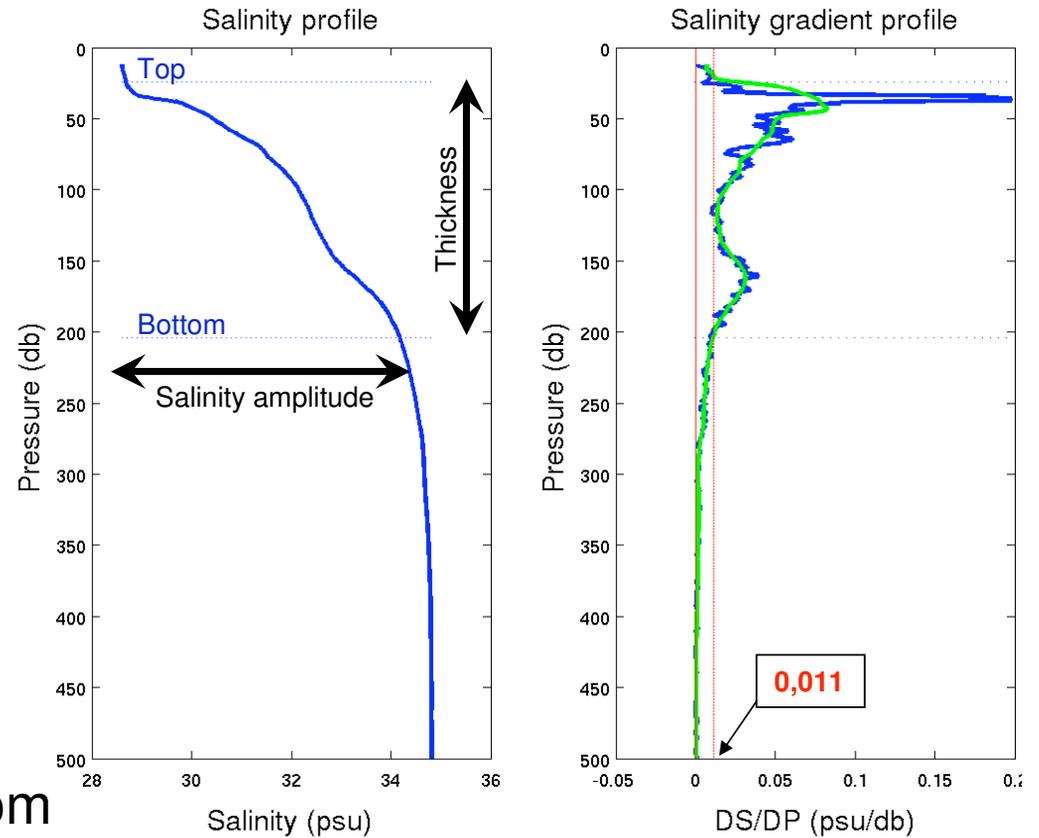
Atlantic Layer

500-m



Motivation:

Halocline = Salinity Gradient



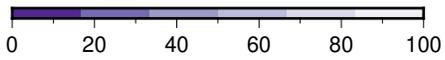
- Halocline Top : Mixed layer bottom
- Halocline Bottom : fixed by a salinity gradient constant (=0,011 psu/db)
- Halocline stratification : Brunt Väisala's frequency averaged over the halocline thickness

Winter

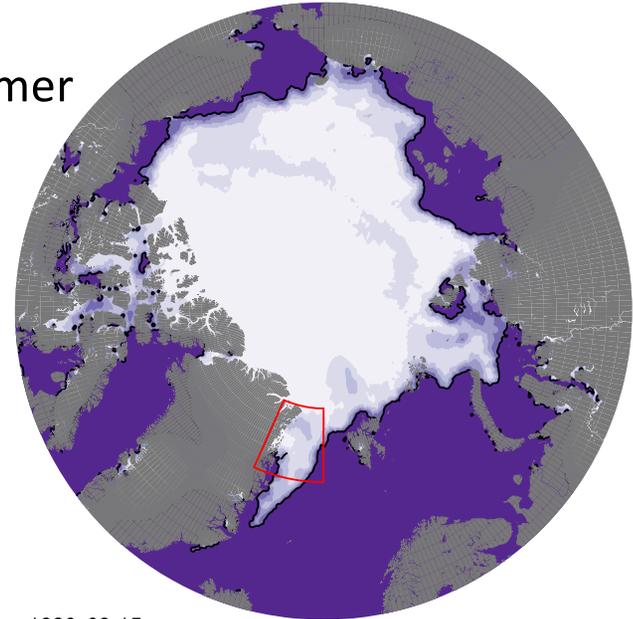


1980-01-15

Ice Cover

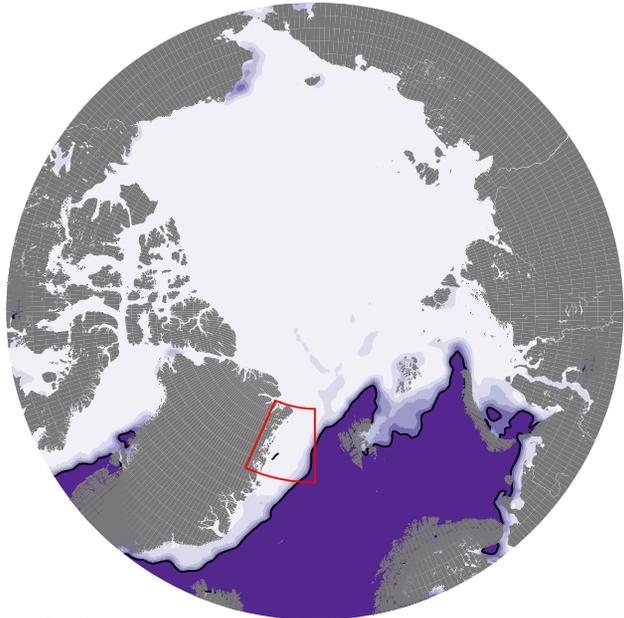
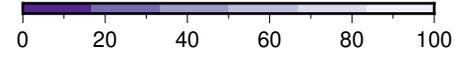


Summer

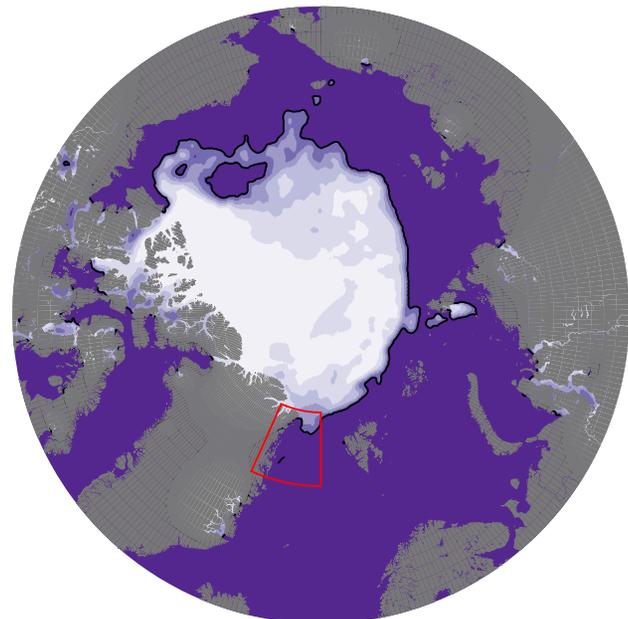


1980-09-15

Ice Cover

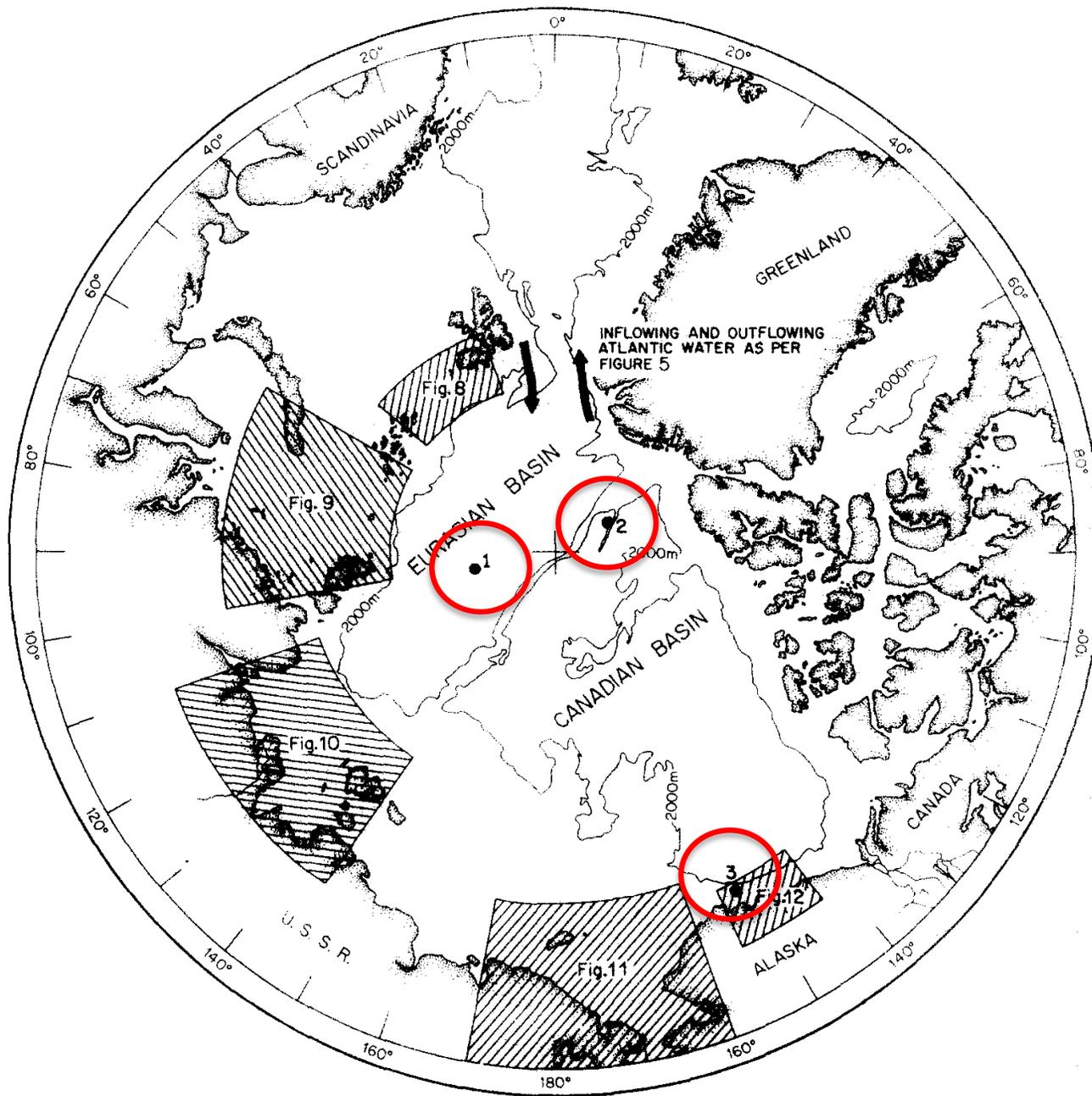


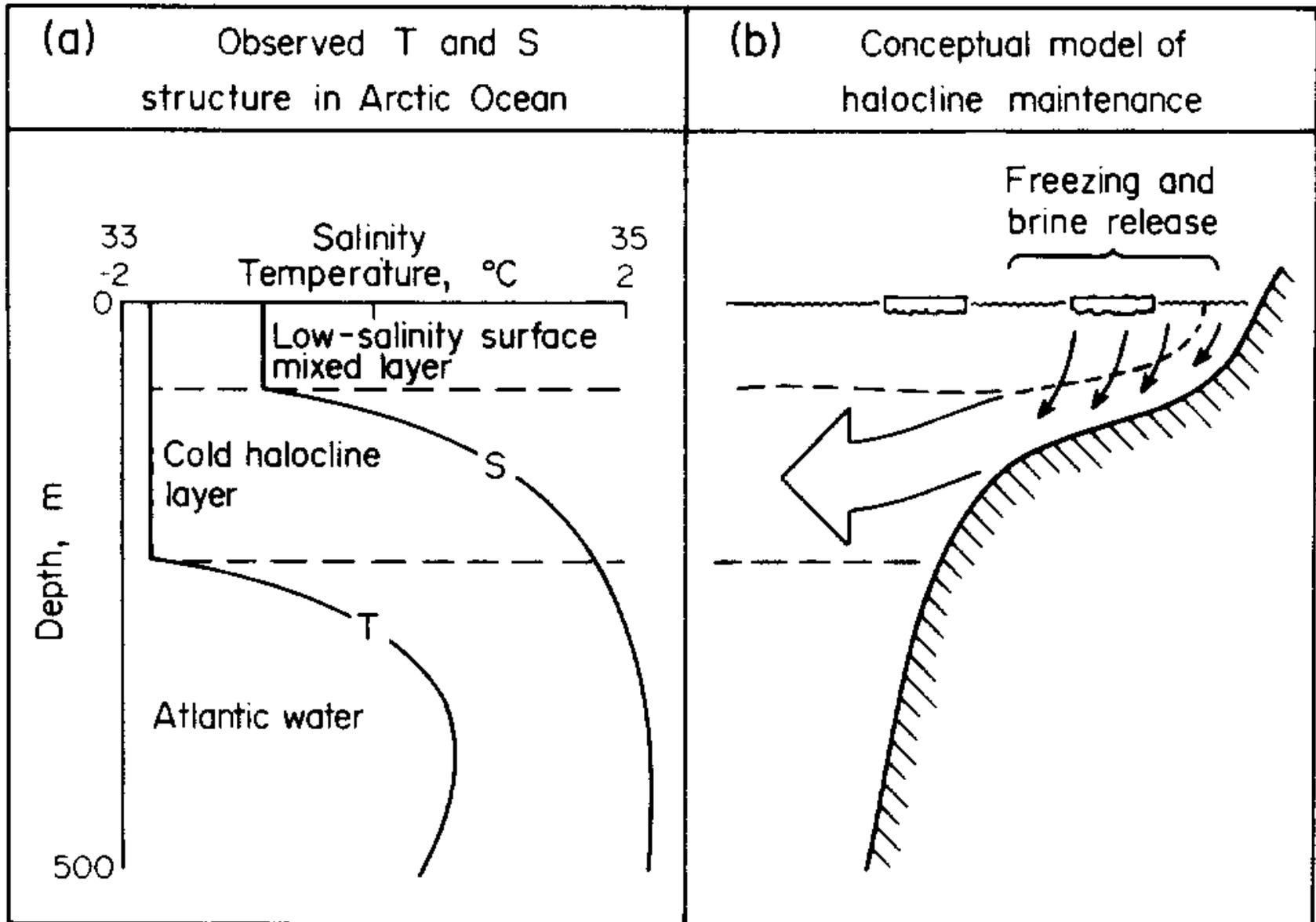
2021-01-15

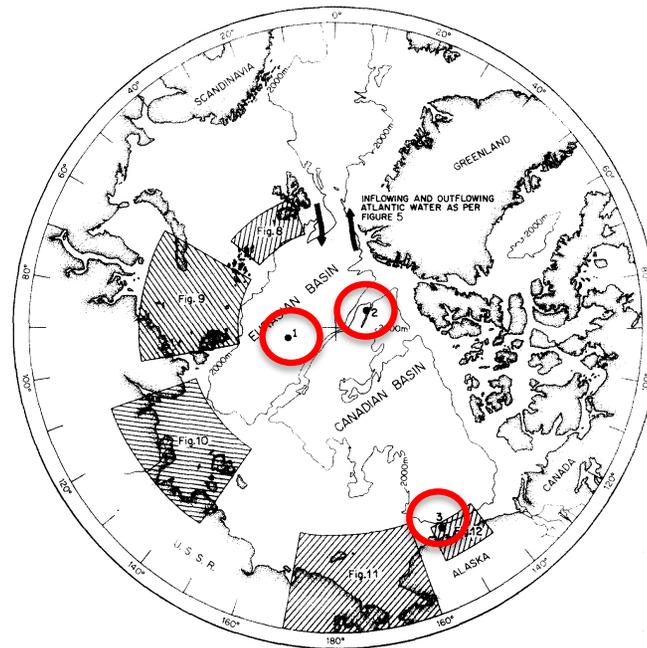
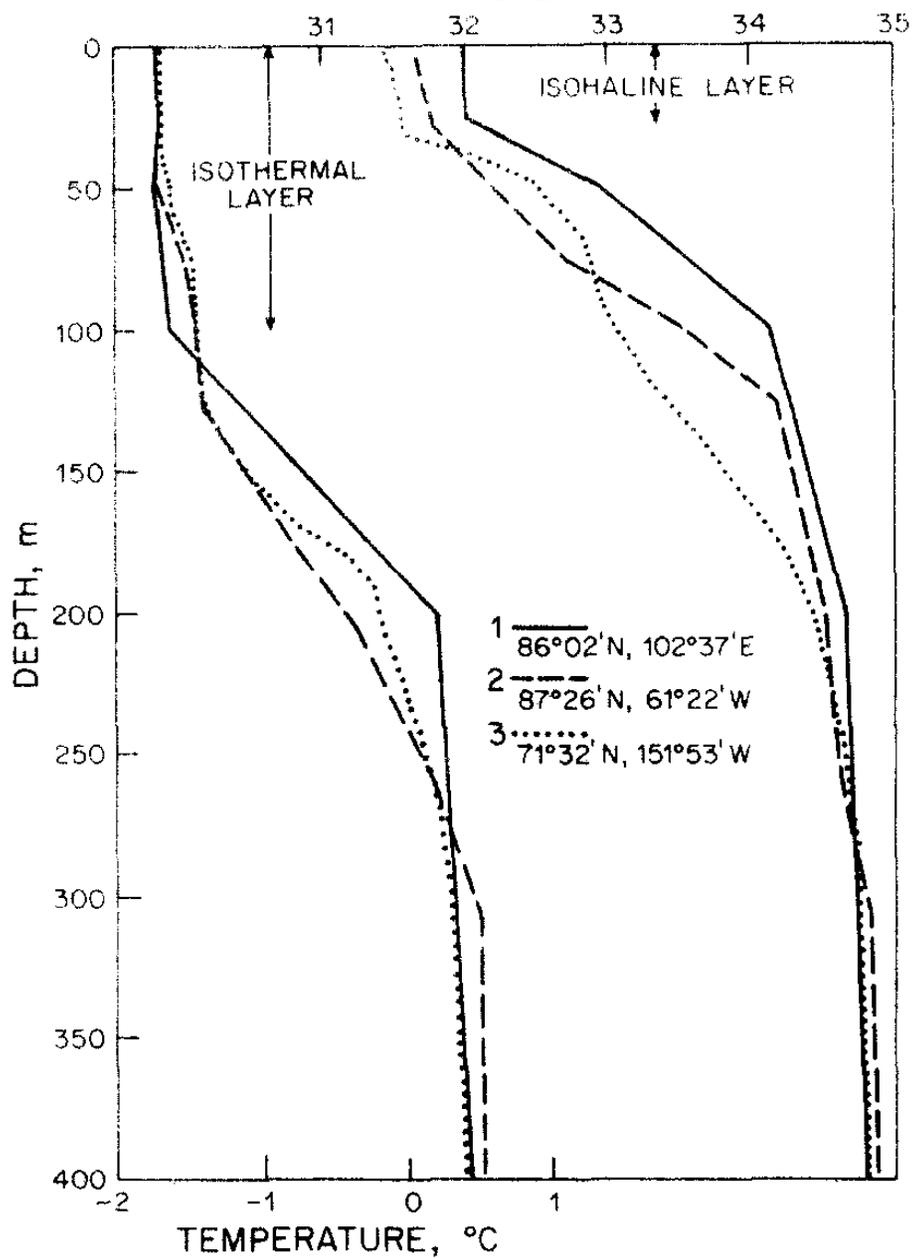


2021-09-15

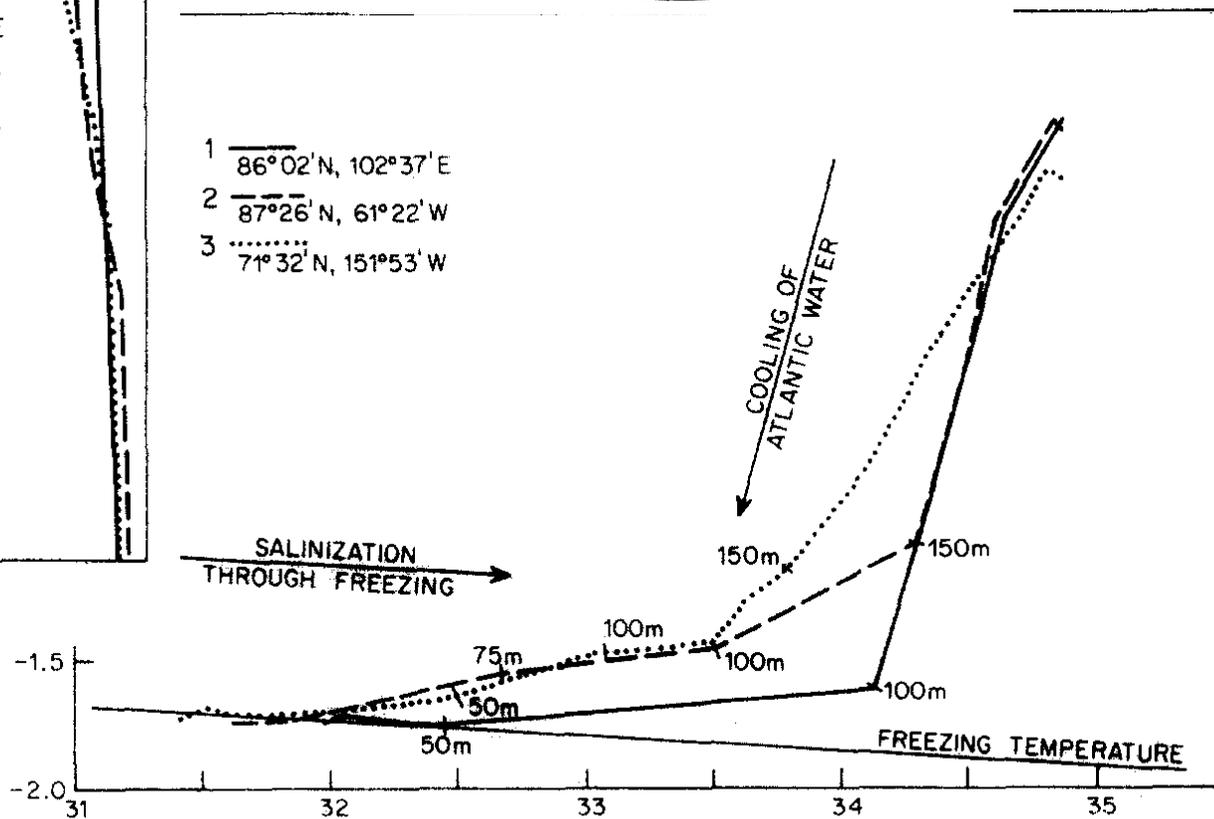
Halocline Formation

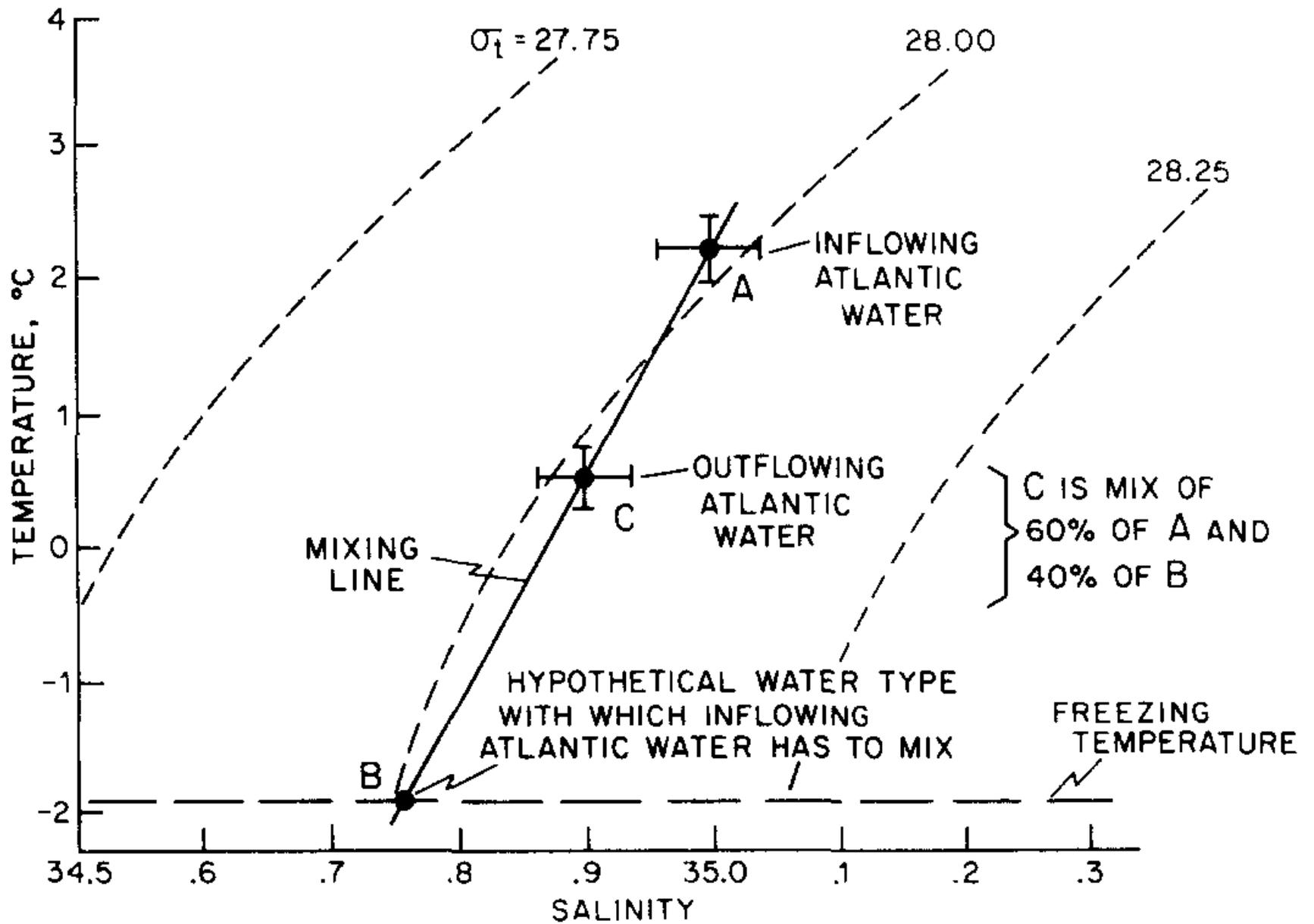






Aagaard et al. (1981)





Northern Barents Sea: Good source for Halocline Water

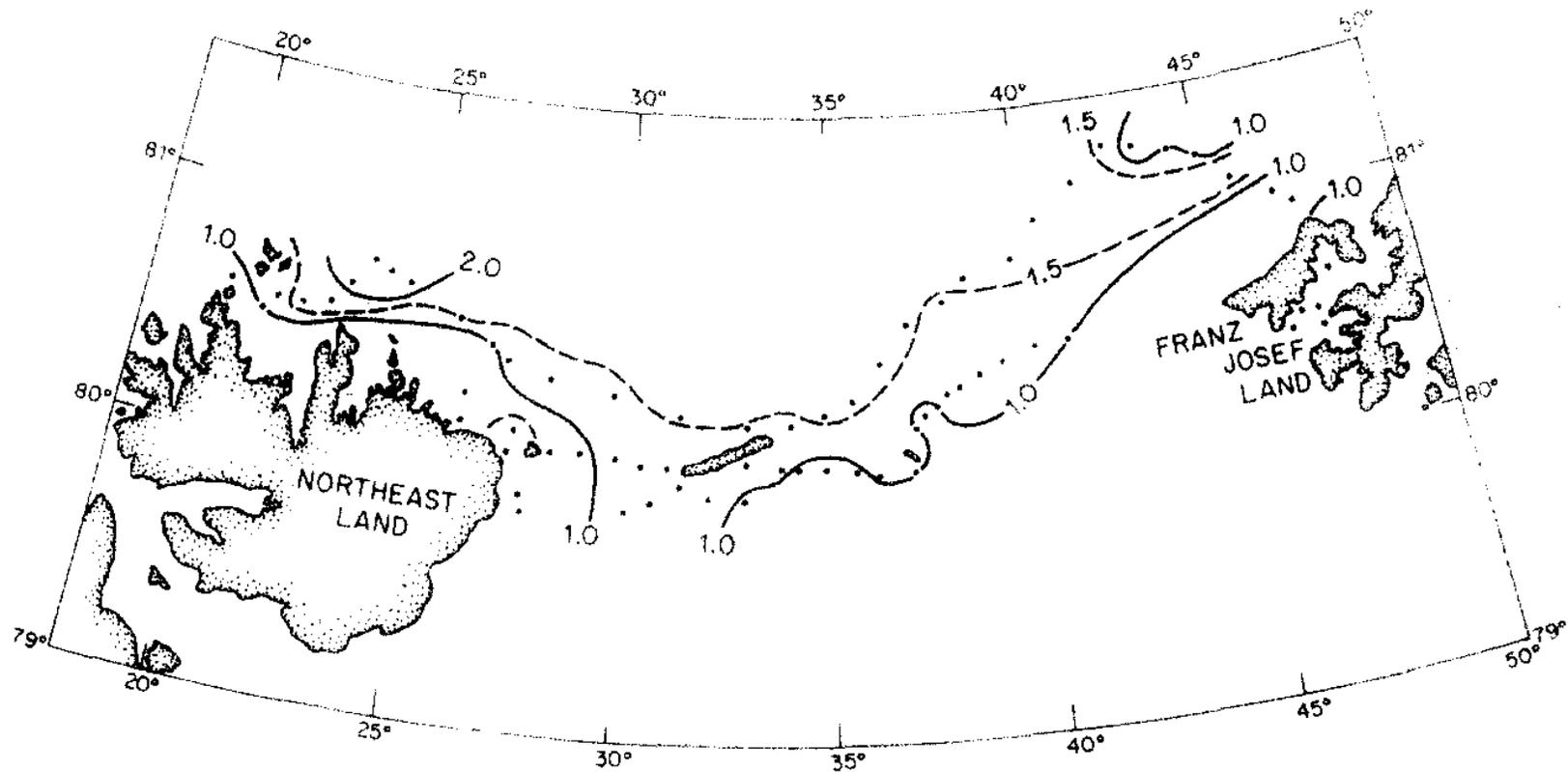


Fig. 8. Ice growth (m) required to raise the salinity of the summer water column on the shelf to 34.5. This salinity corresponds to the break in the T-S diagram at the closest off-shelf stations. The area location is shown in Fig. 1.

Western Barents Sea:
Good source for
Halocline waters

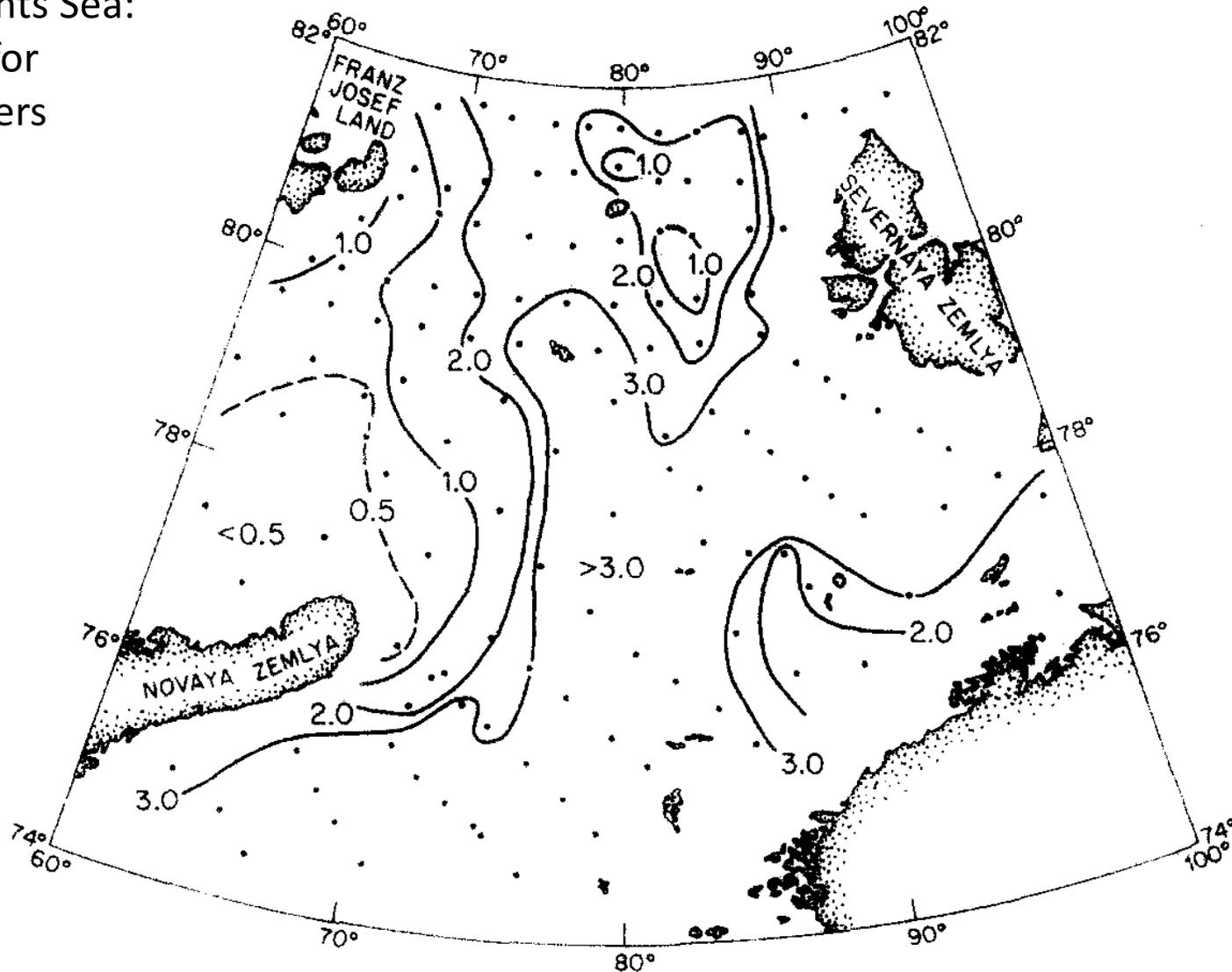


Fig. 9. Ice growth (m) required to raise the salinity of the column on the shelf to 34.0. This salinity corresponds to the break in the T-S diagram at the closest off-shelf stations. The area location is shown in Fig. 1.

Aagaard et al. (1981)

Laptev Sea:
Unlikely source
For Halocline
waters

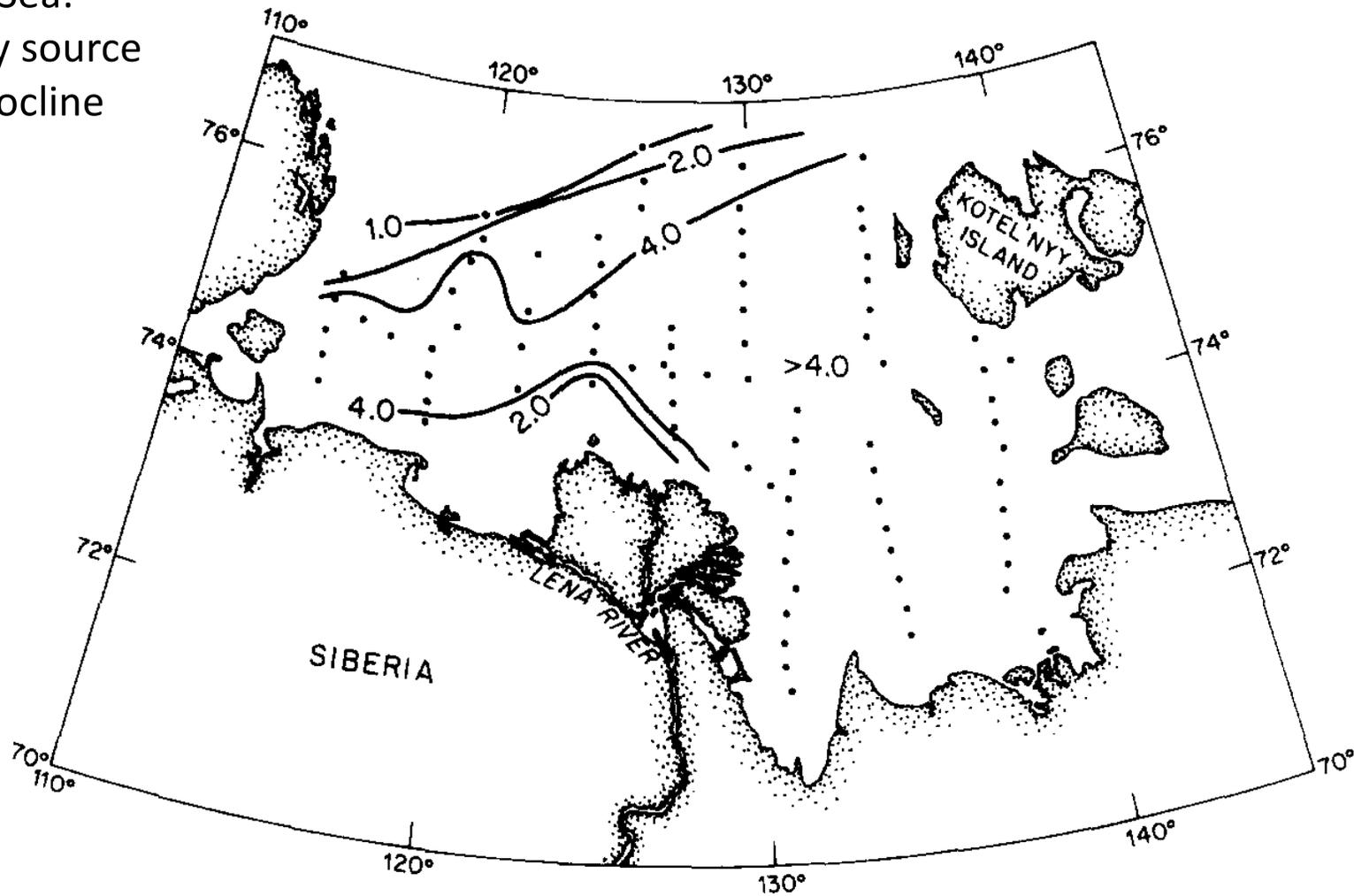


Fig. 10. Ice growth (m) required to raise the salinity of the summer water column on the shelf to 33.5. This salinity corresponds to the break in the T-S diagram at the closest off-shelf stations. The area location is shown in Fig. 1.

Northern Chukchi Sea: Good source for Halocline waters

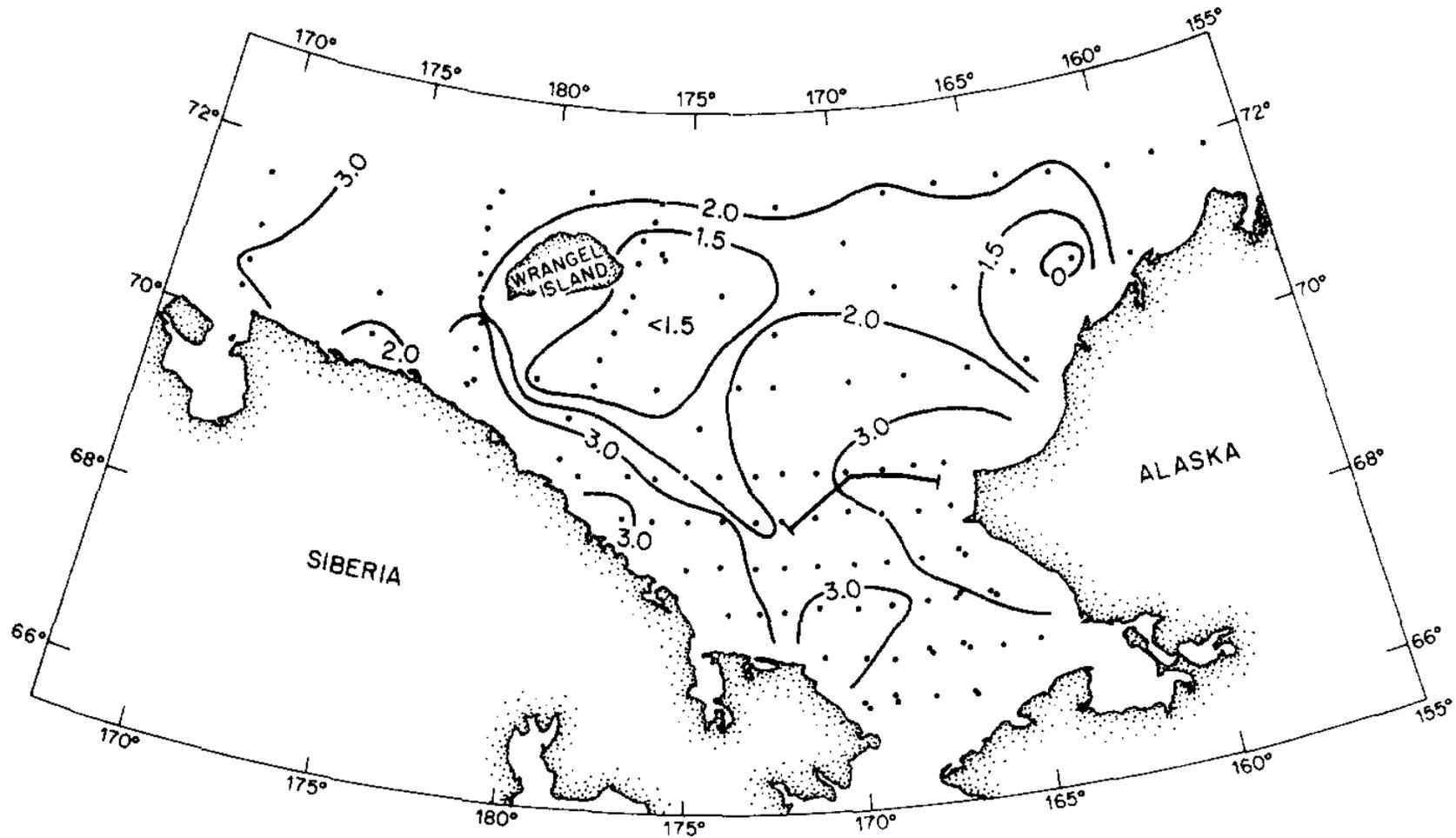


Fig. 11. Ice growth (m) required to raise the salinity of the summer water column on the shelf to 33.5. The salinity corresponds to the break in the T-S diagram at the closest off-shelf stations. The area location is shown in Fig. 1. The location of the section shown in Fig. 14 is indicated by the heavy bracketed line near 69°N.

Beaufort Sea: Unlikely source for Halocline water

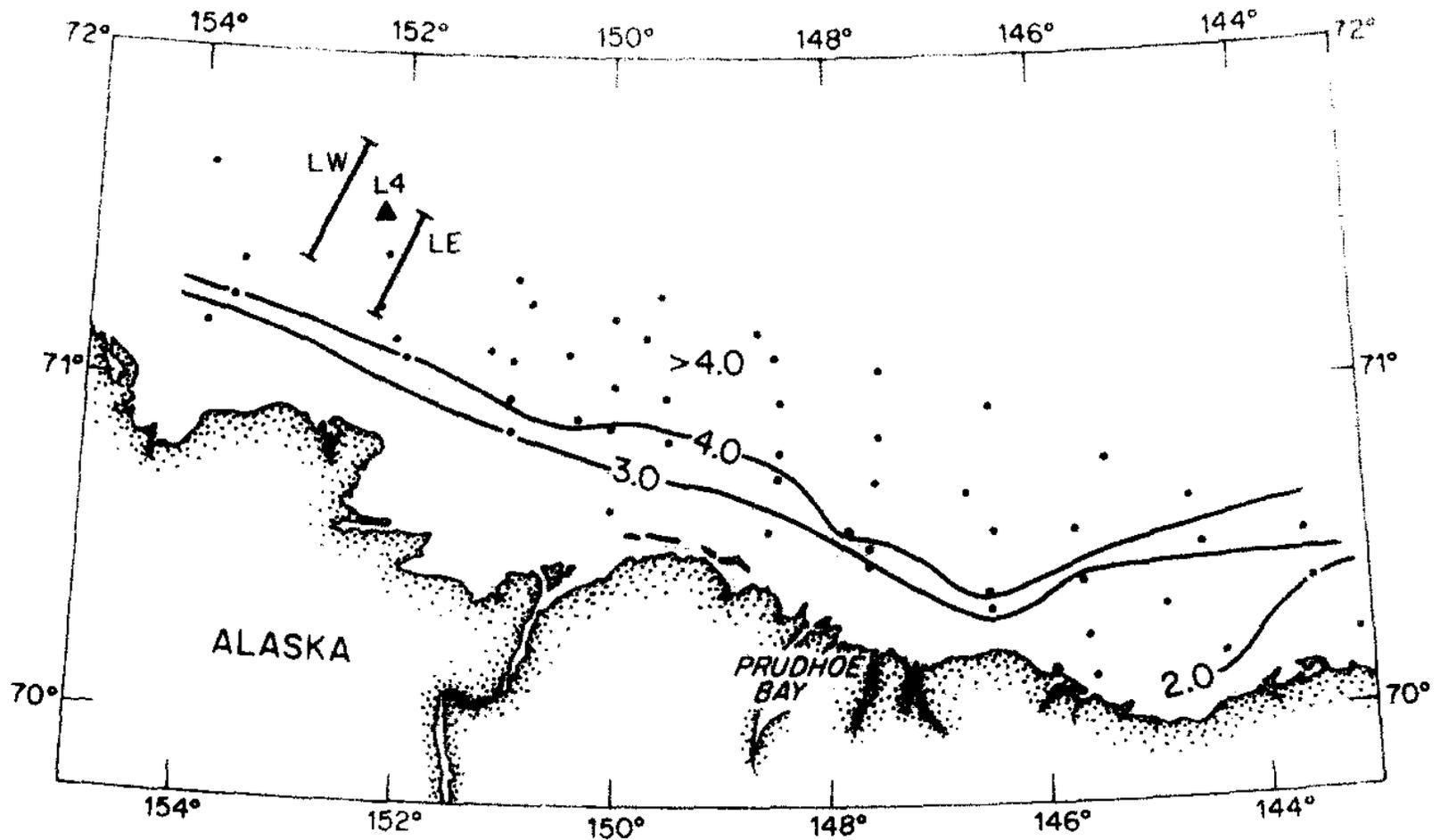


Fig. 12. Ice growth (m) required to raise the salinity of the summer water column on the shelf to 33.5. This salinity corresponds to the break in the T-S diagram at the closest off-shelf stations. The area location is shown in Fig. 1. The location of the sections shown in Fig. 6 is indicated by lines LW and LE, and the site of the temperature record shown in Fig. 7 is indicated by triangle L4.

Chukchi Shelf Halocline Water Formation Winter 1977

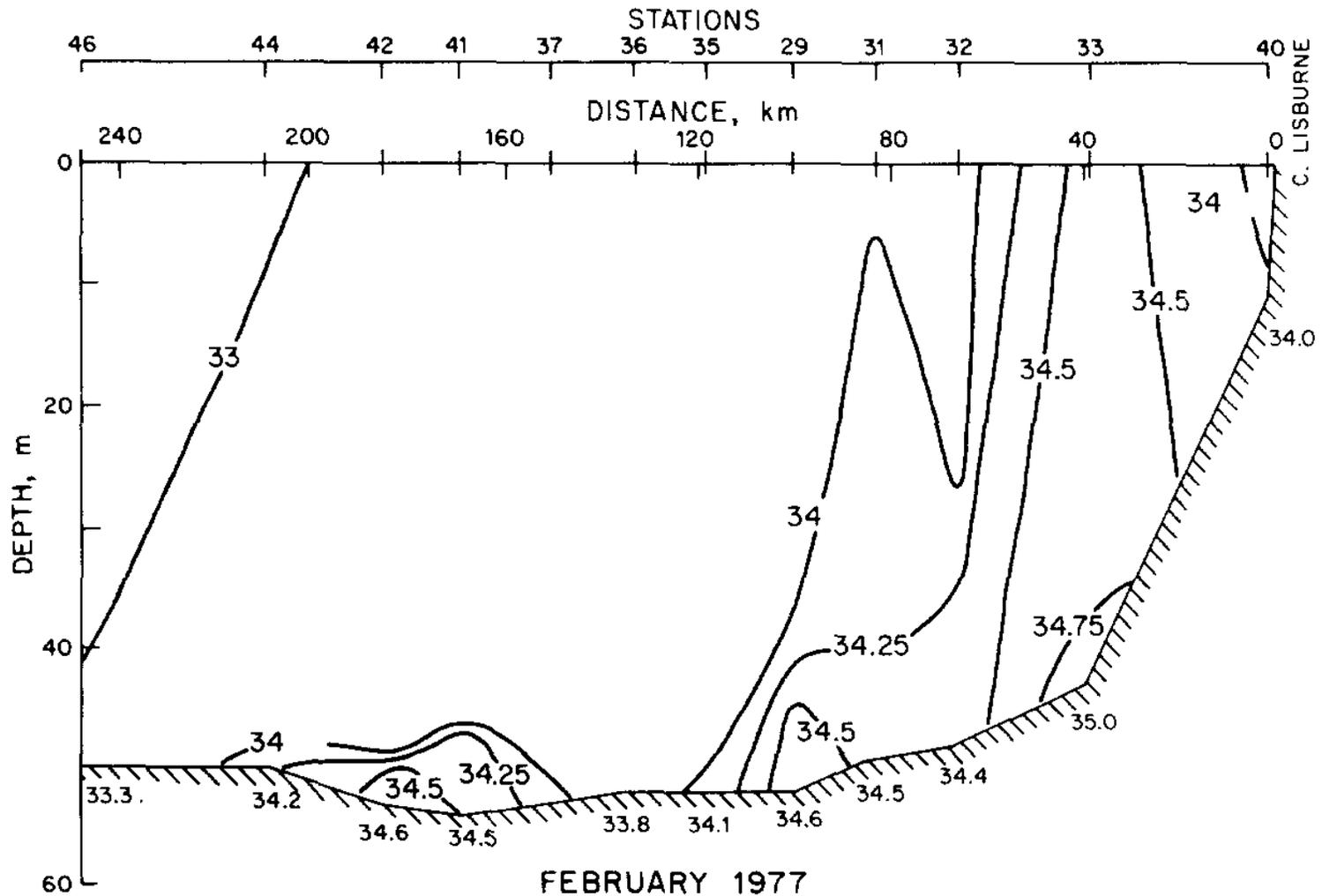
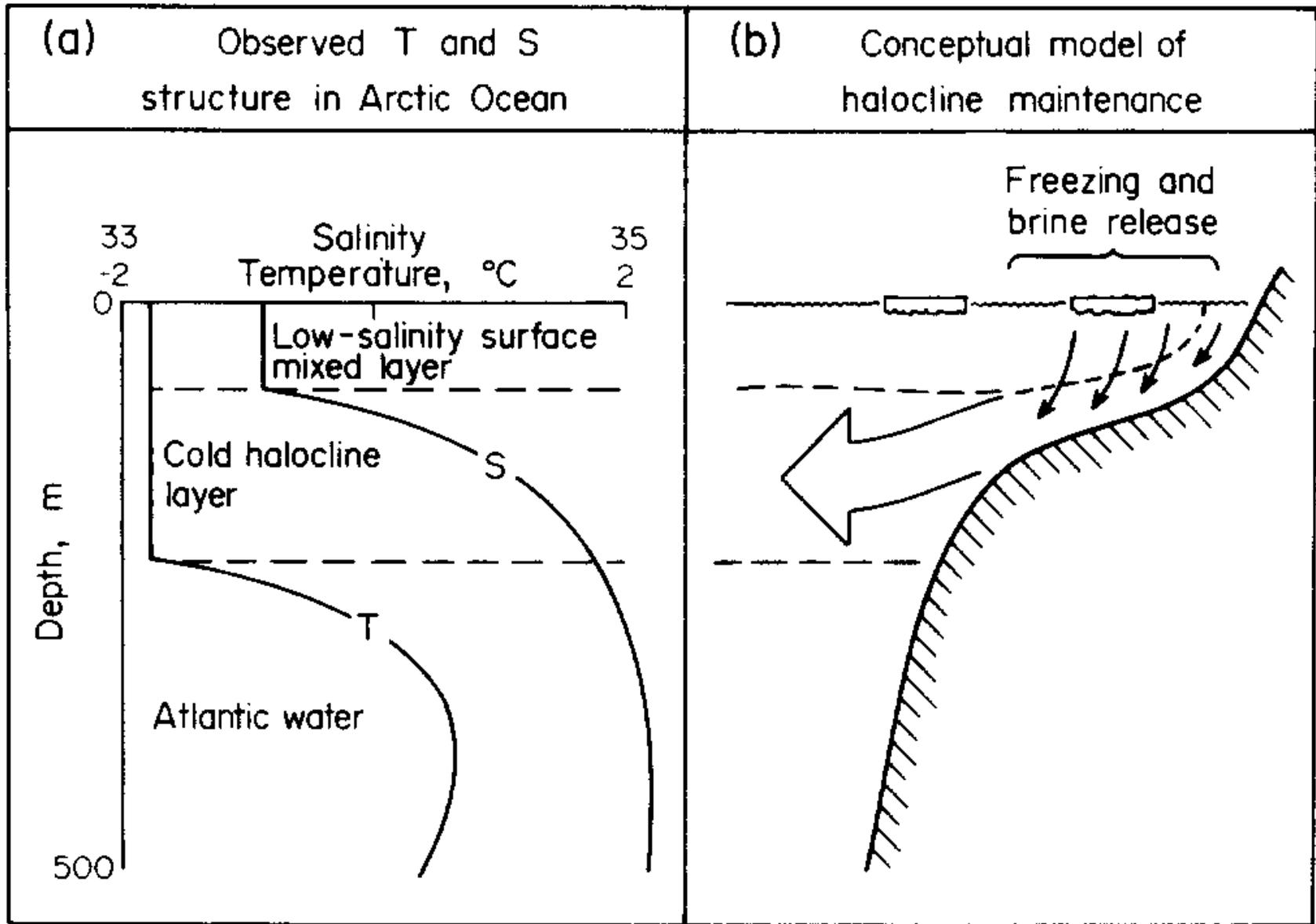


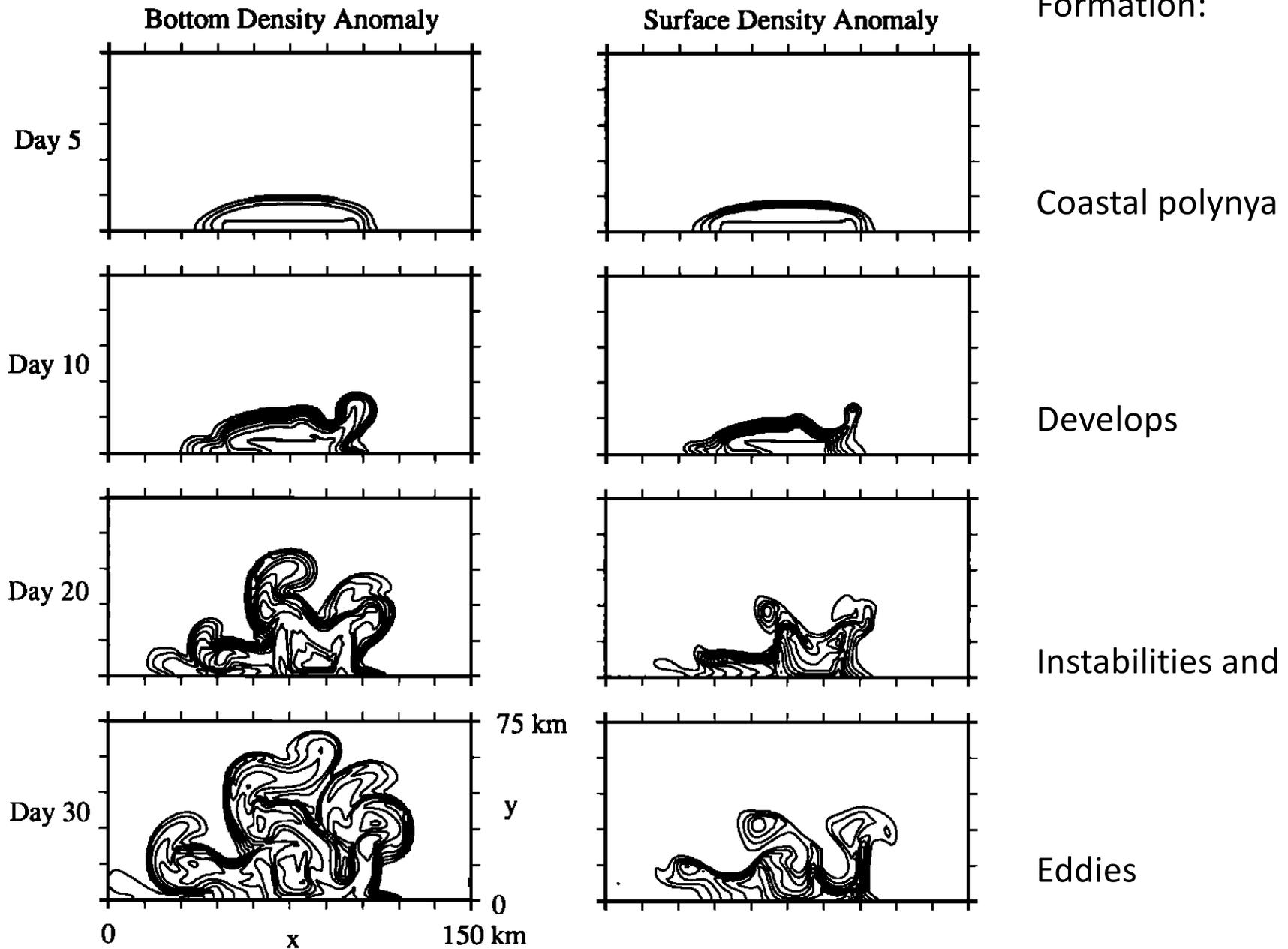
Fig. 14. Salinity section across the Chukchi Sea, February to March, 1977. The section location is shown in Fig. 11.

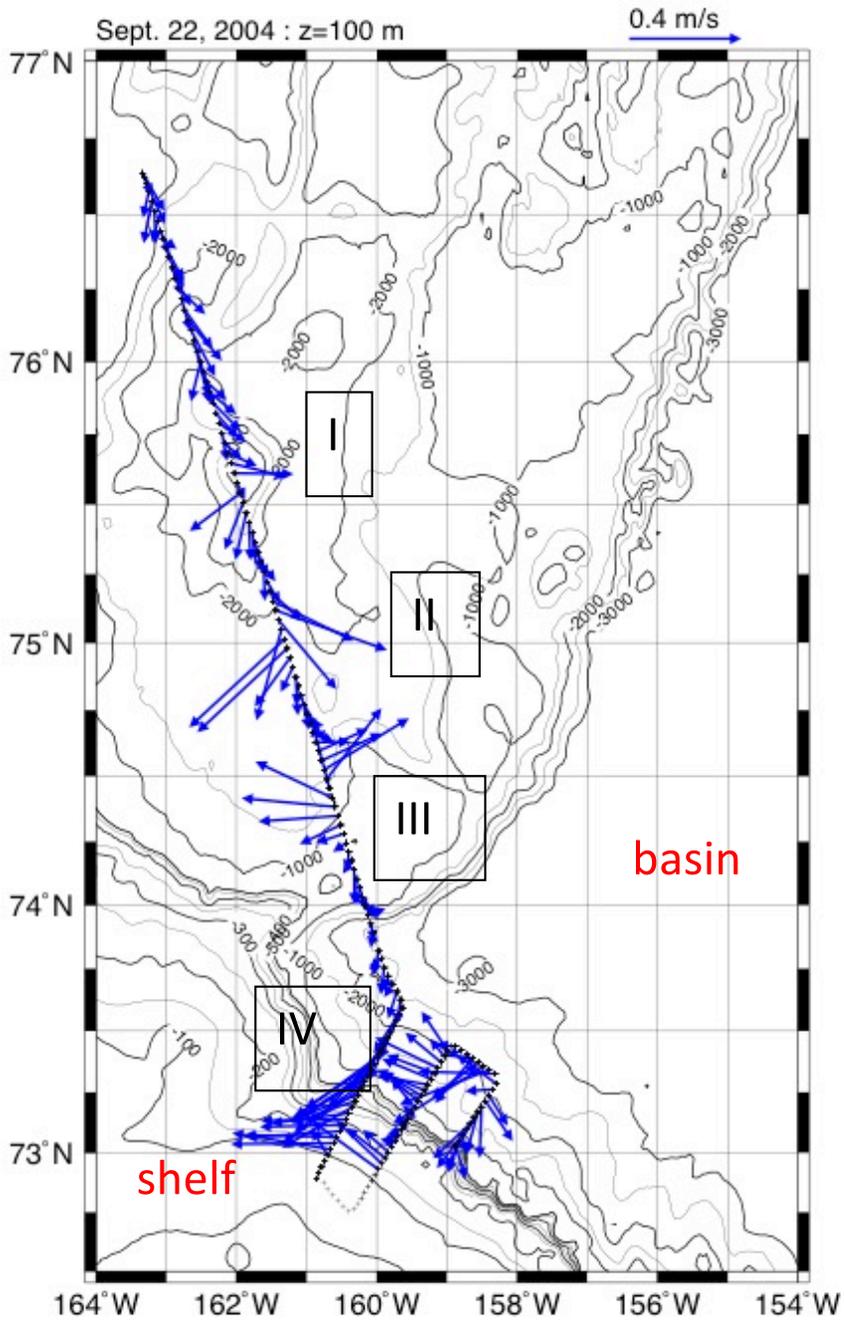
Conceptual Sketch of Halocline Water Formation



GAWARKIEWICZ AND CHAPMAN: DENSE WATER FORMATION

Modeled Halocline
Formation:

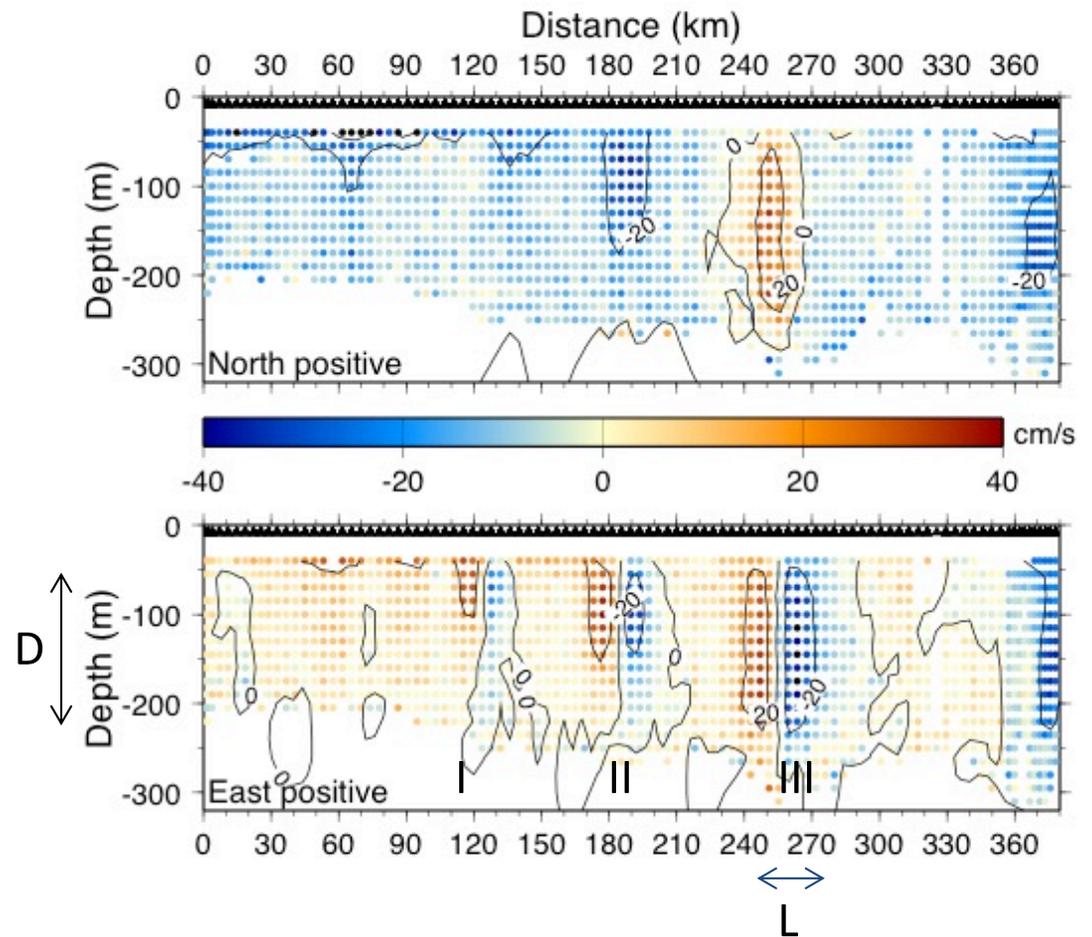




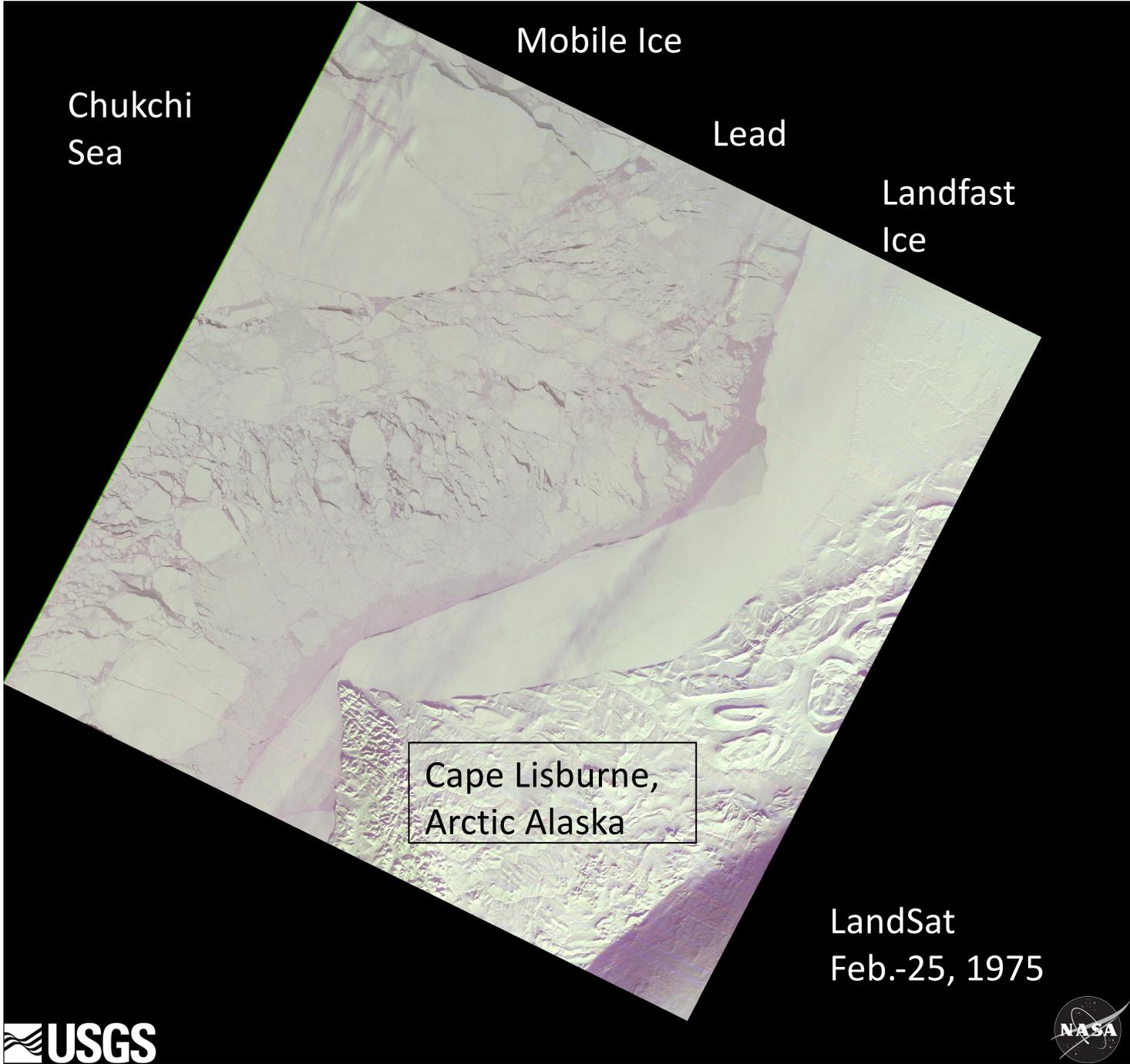
4 clock-wise rotating
(anti-cyclonic) vortices

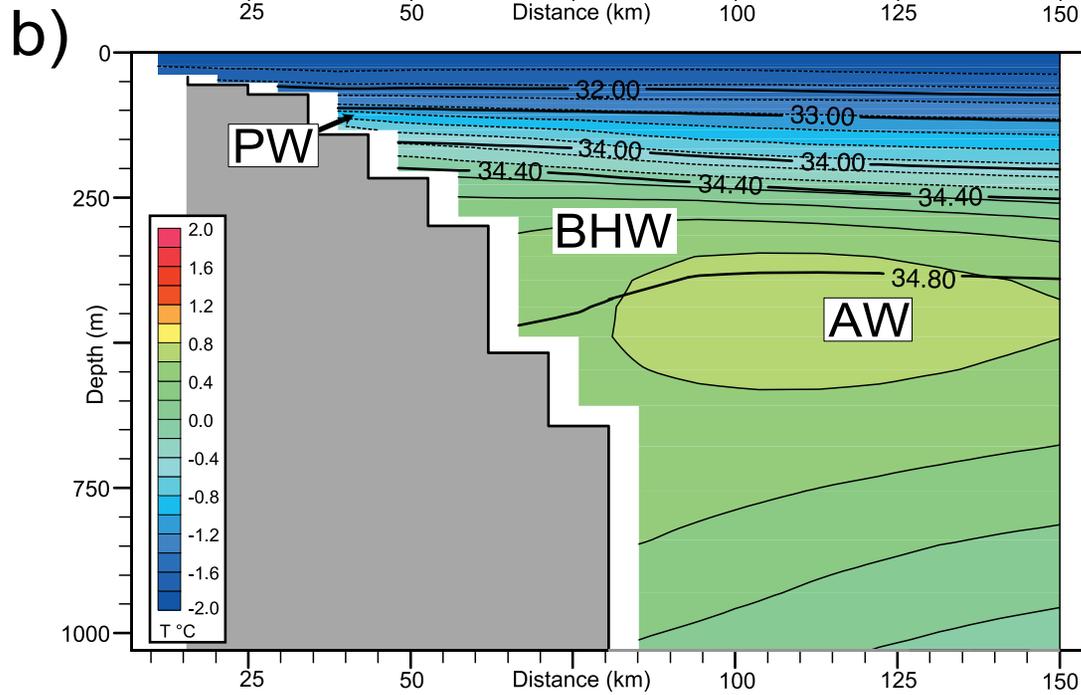
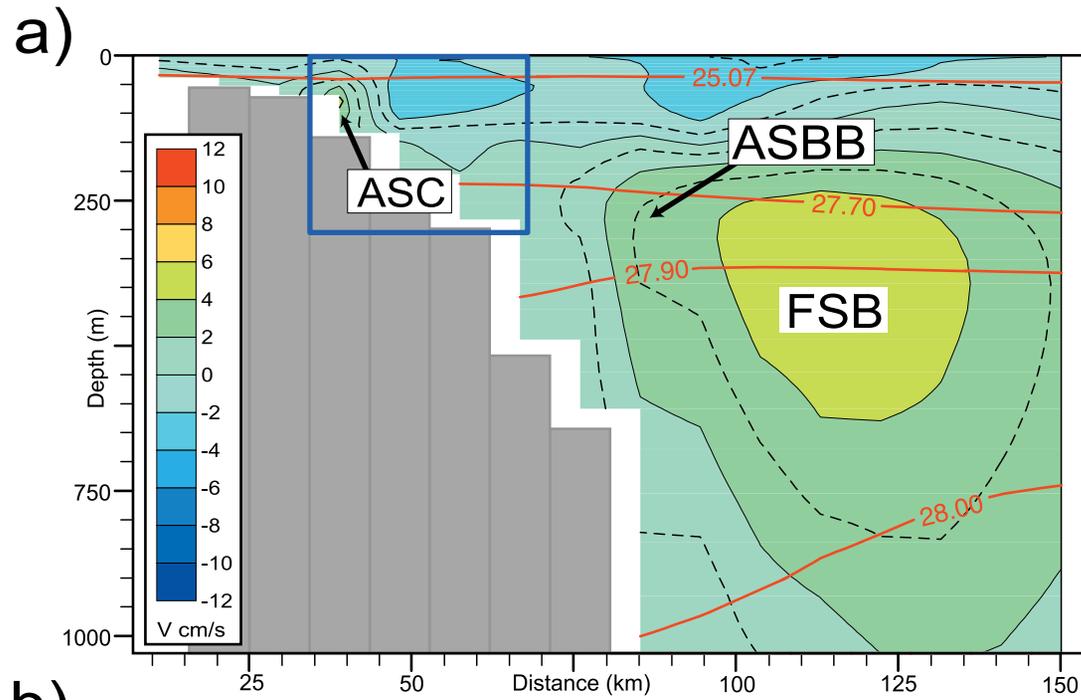
Eddies in the Arctic

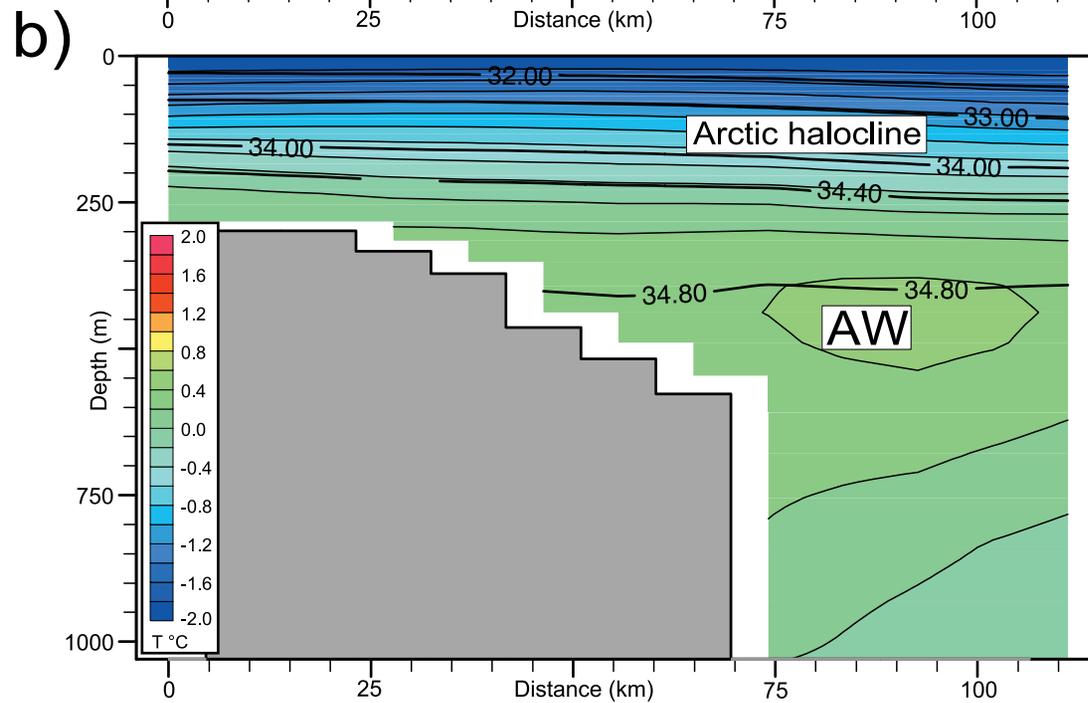
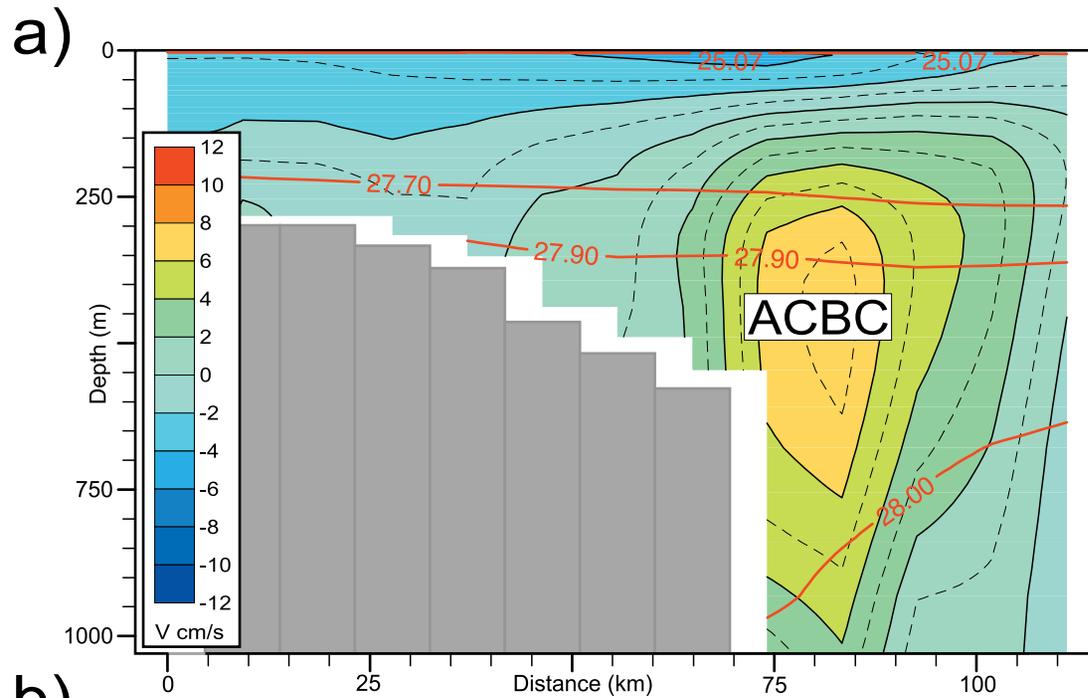
Sept.-21/22, 2004



USCGC Healy 75-kHz ADCP







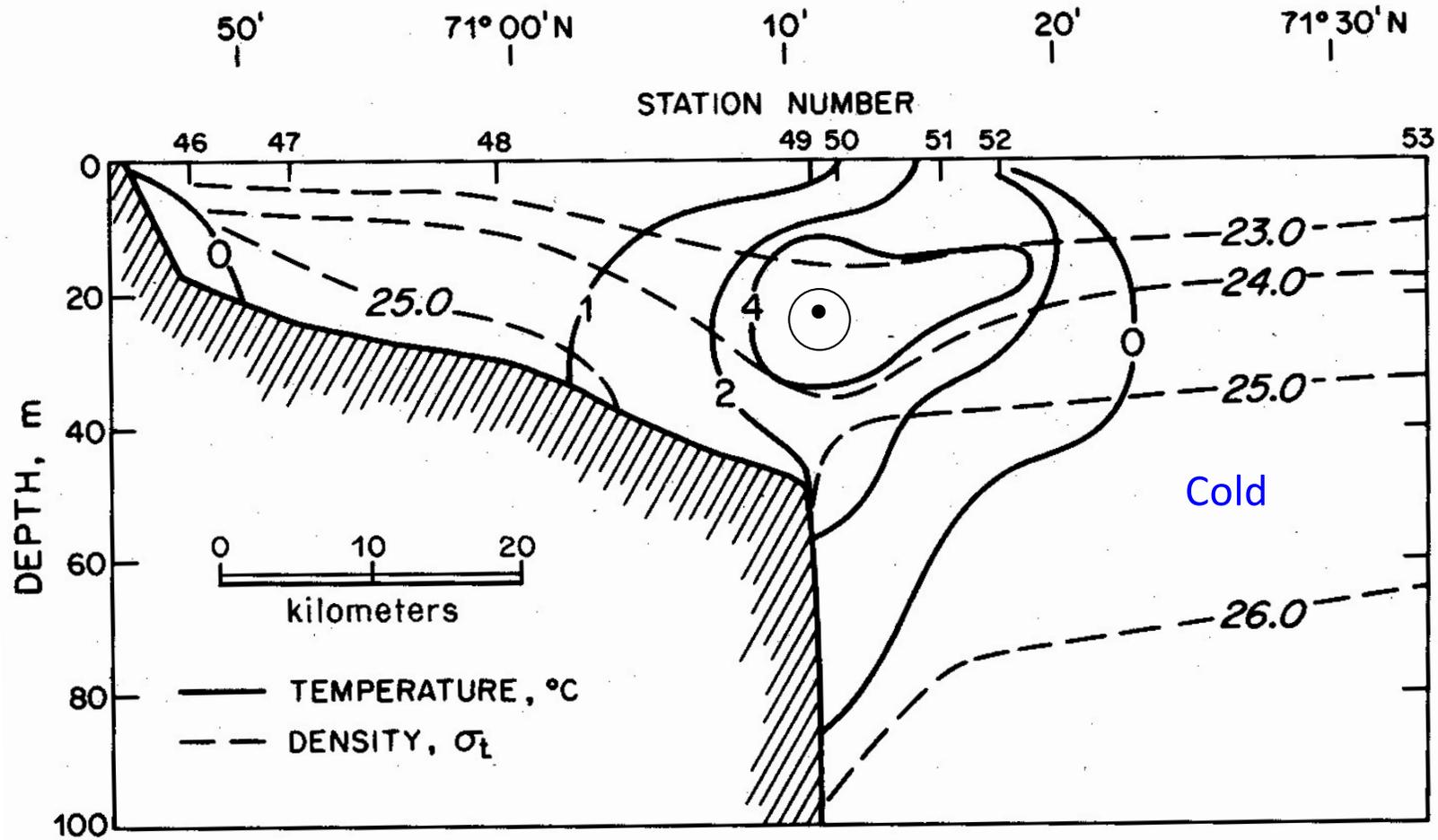
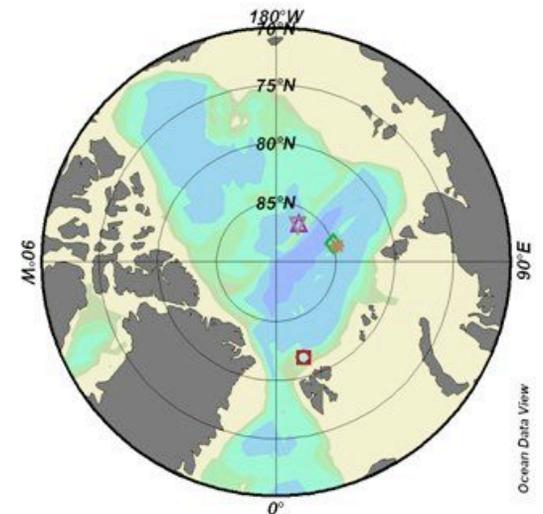
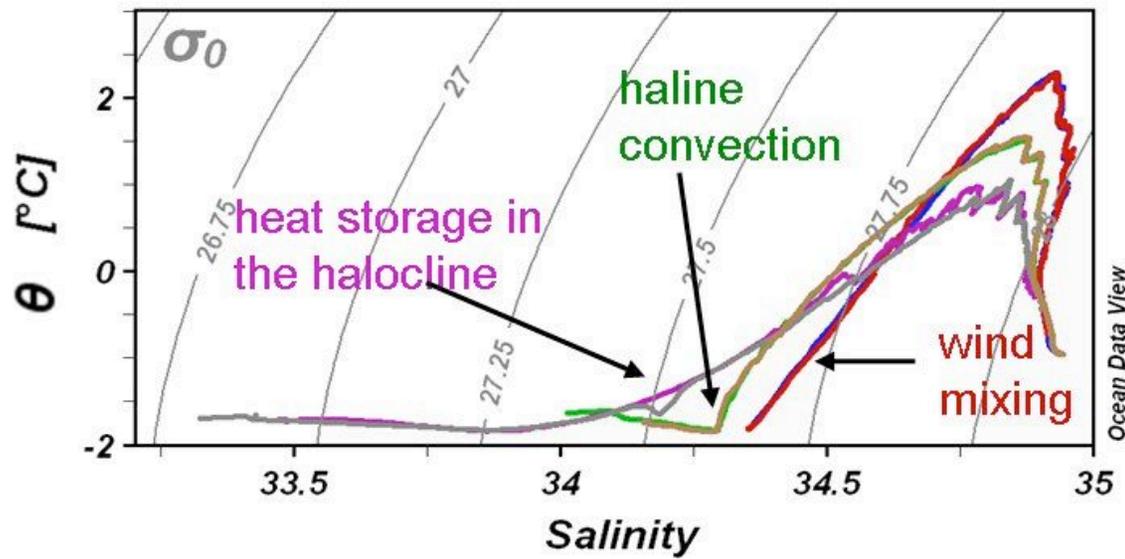
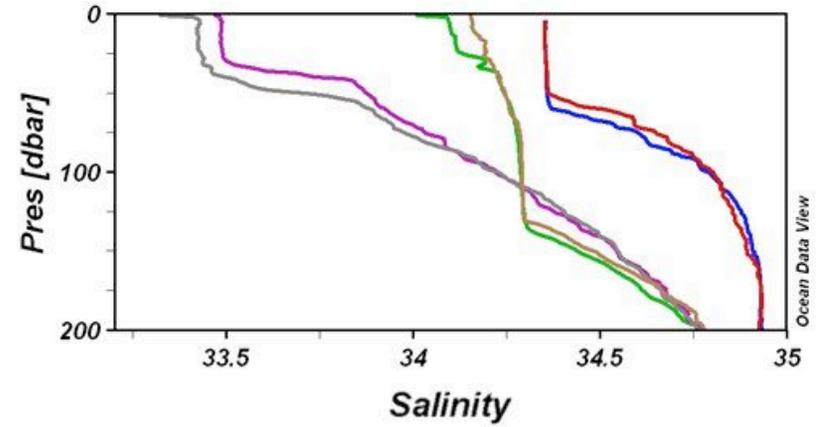
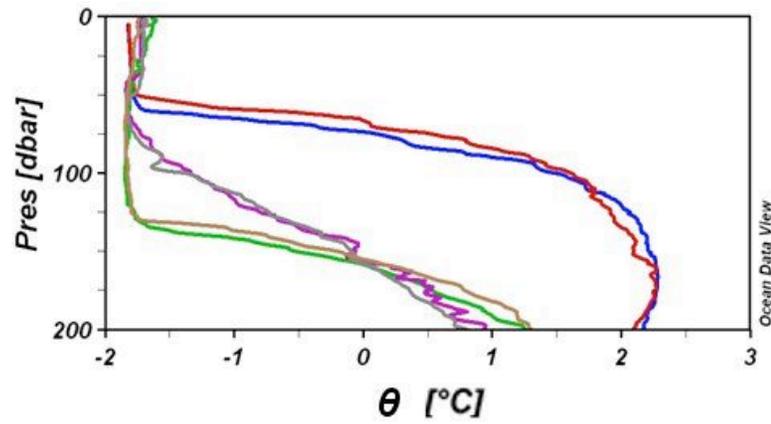
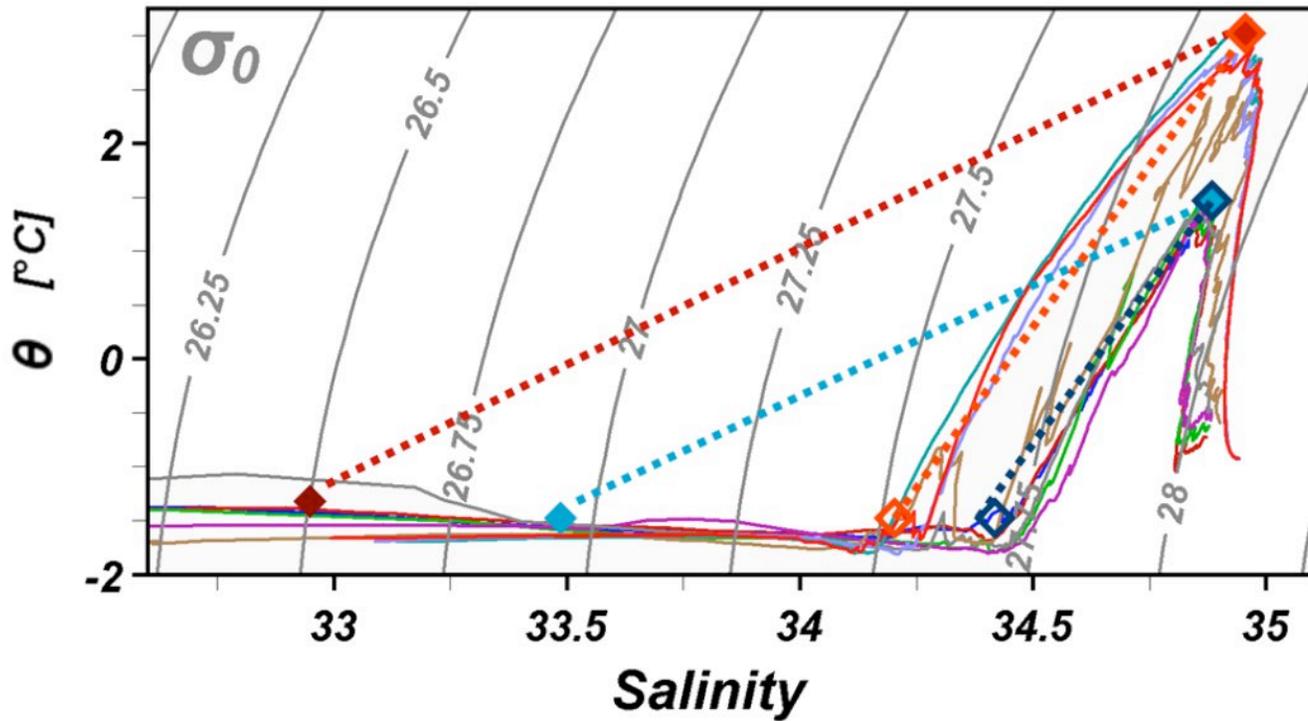


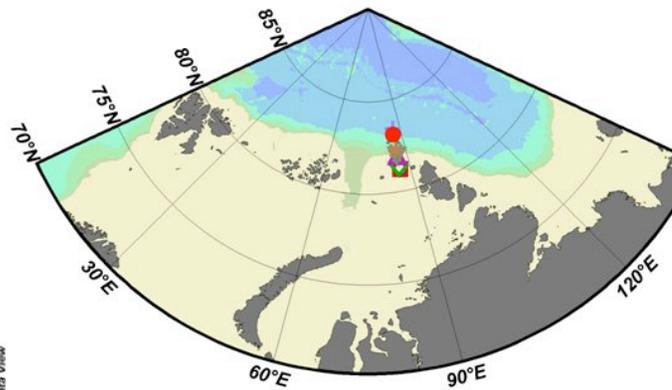
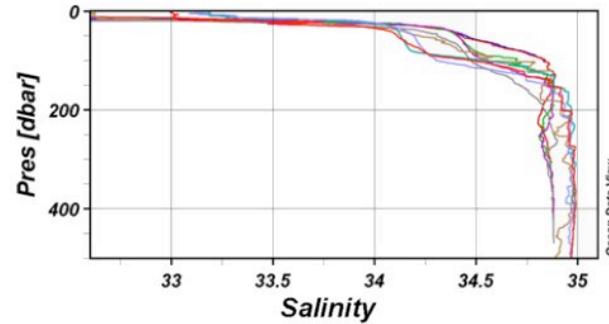
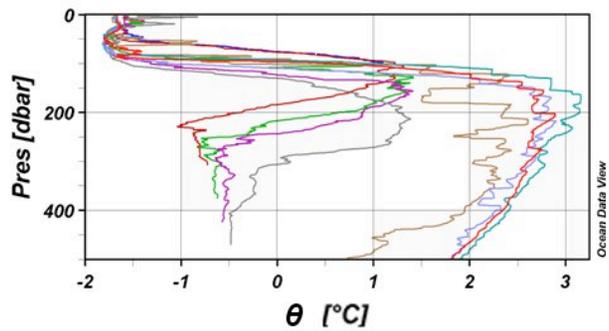
FIGURE 4. Summer temperature and density section across the shelf and upper slope at 150°W. Adapted from Mountain (1974).

Aagaard (1984)



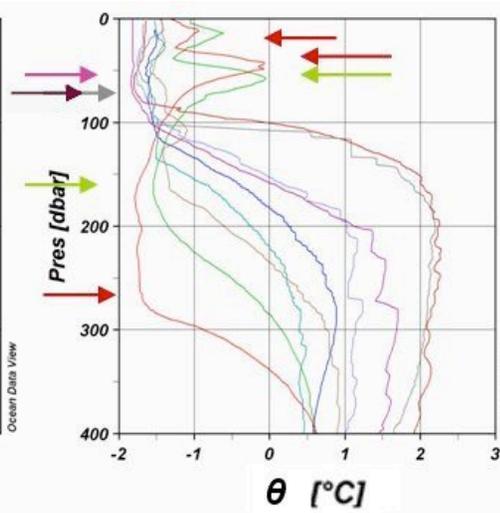
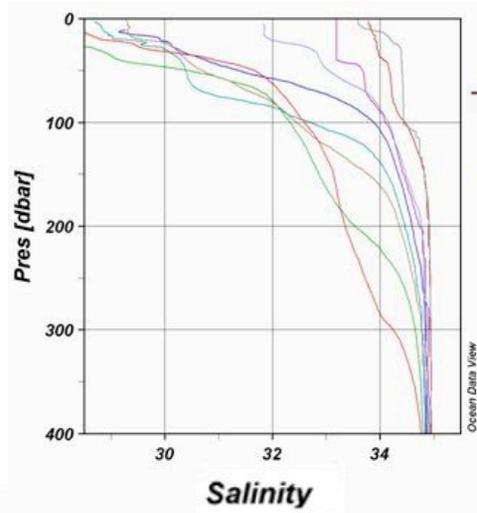
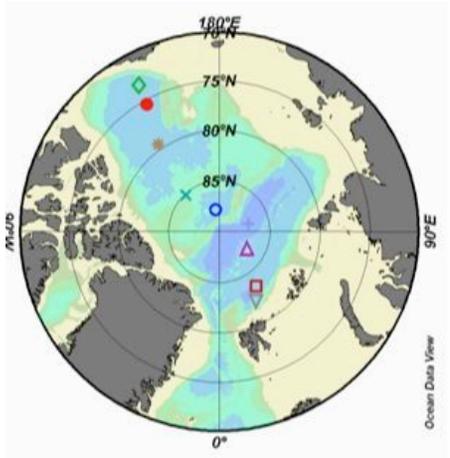


Atlantic T_{max}
 Max Heat into Melt
 vs.
 Min Heat into Melt



Atlantic Cores:

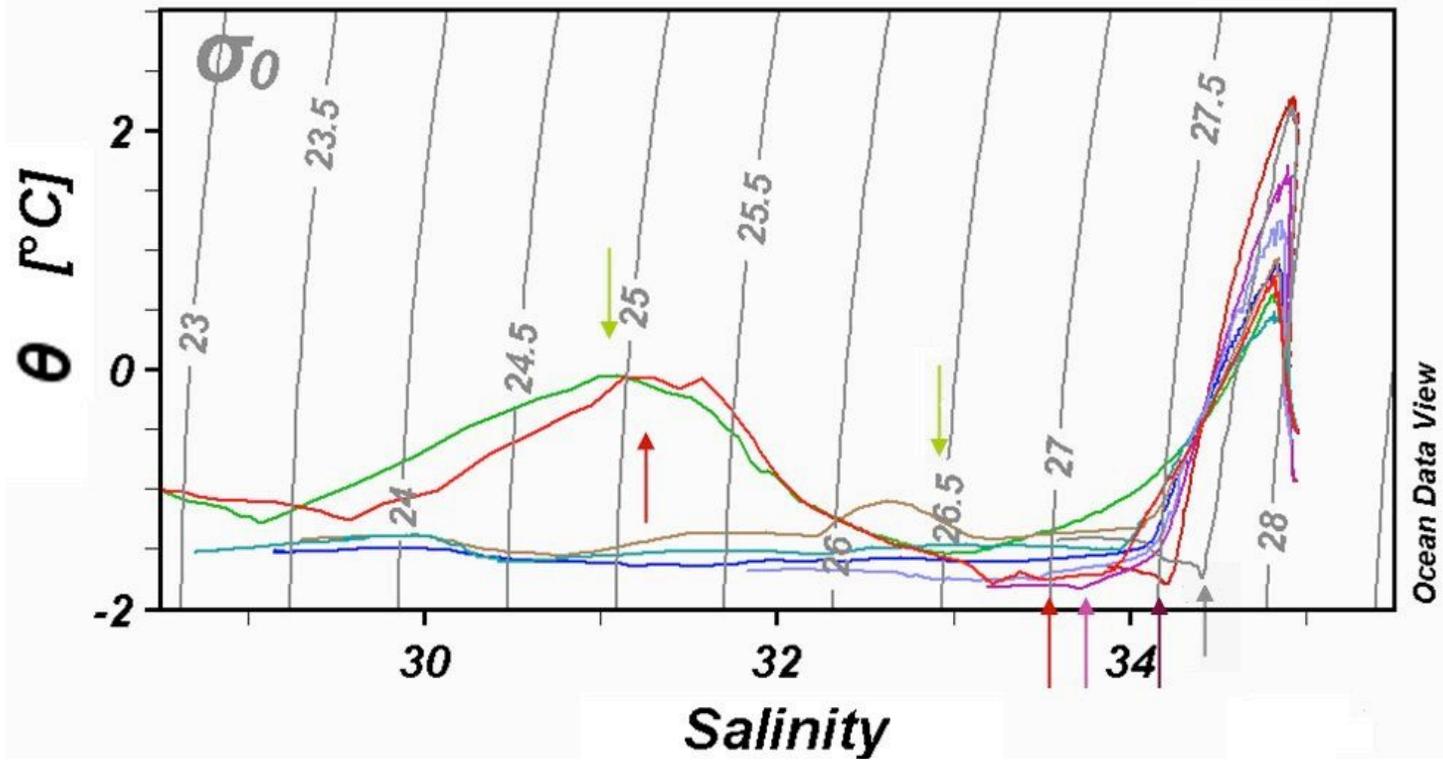
1. Fram – red
2. Barents - blue

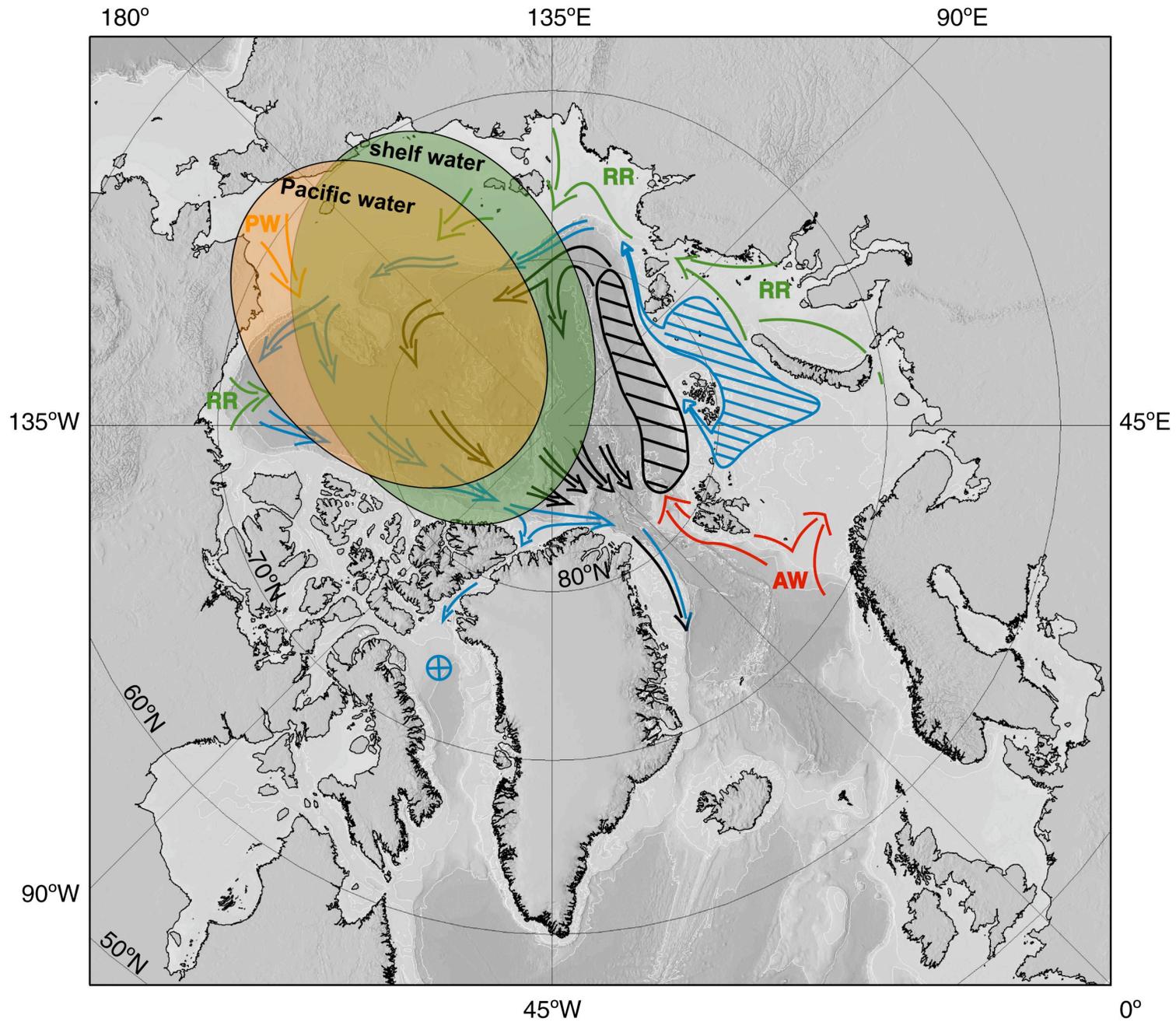


Halocline:

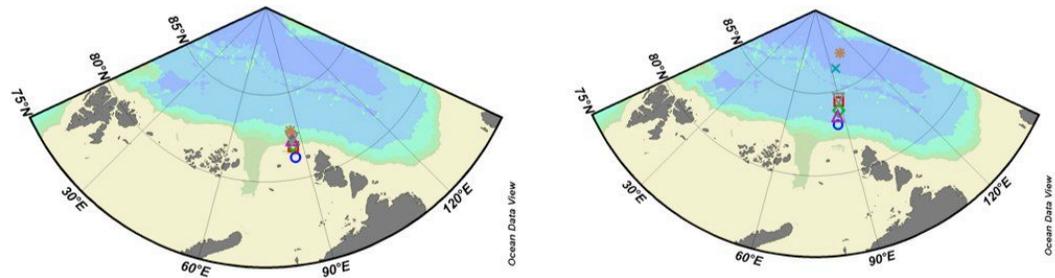
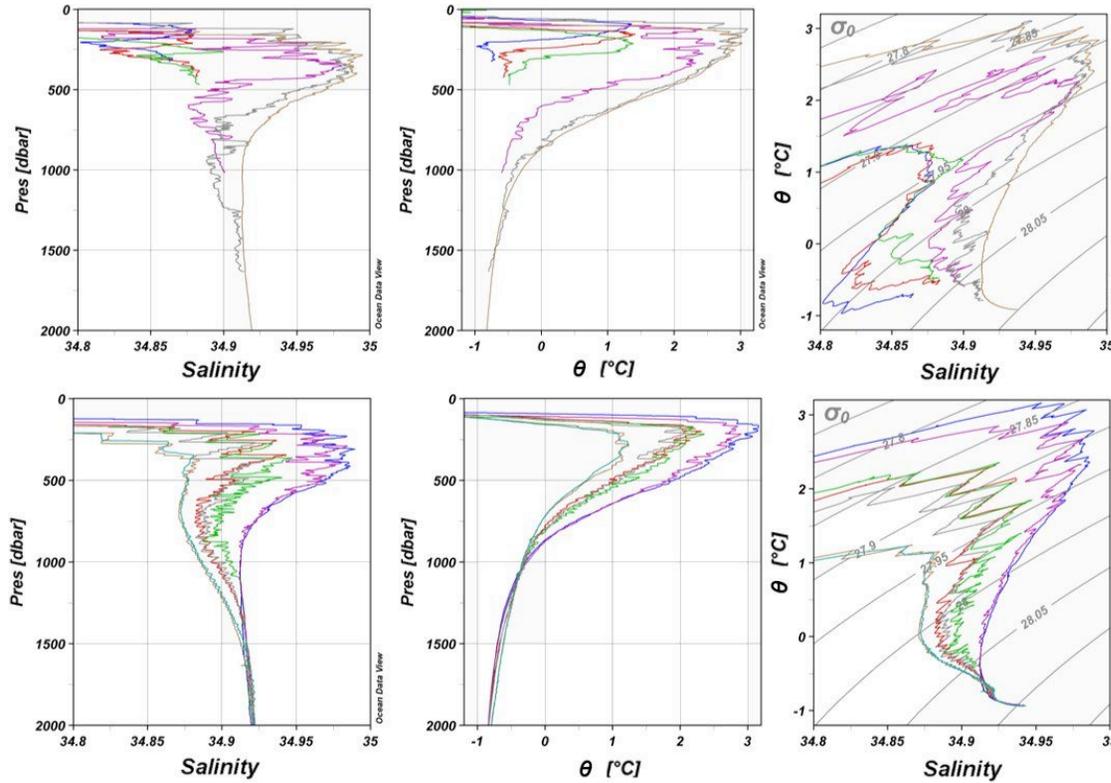
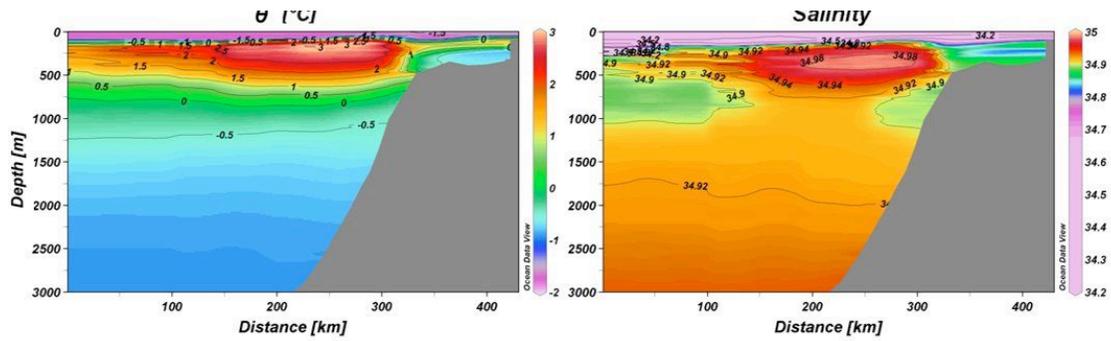
Tmax

Tmin

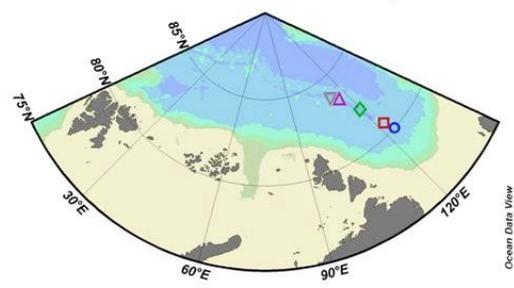
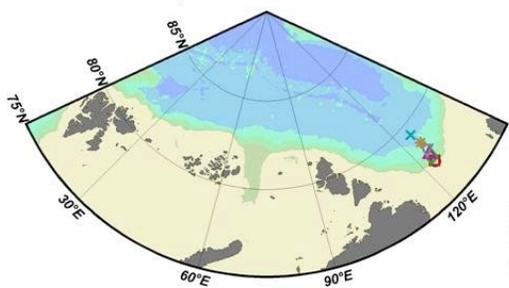
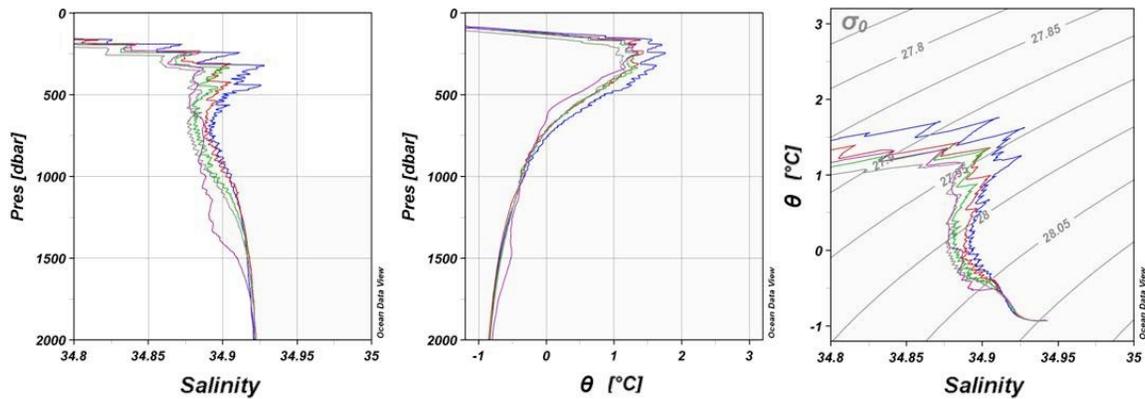
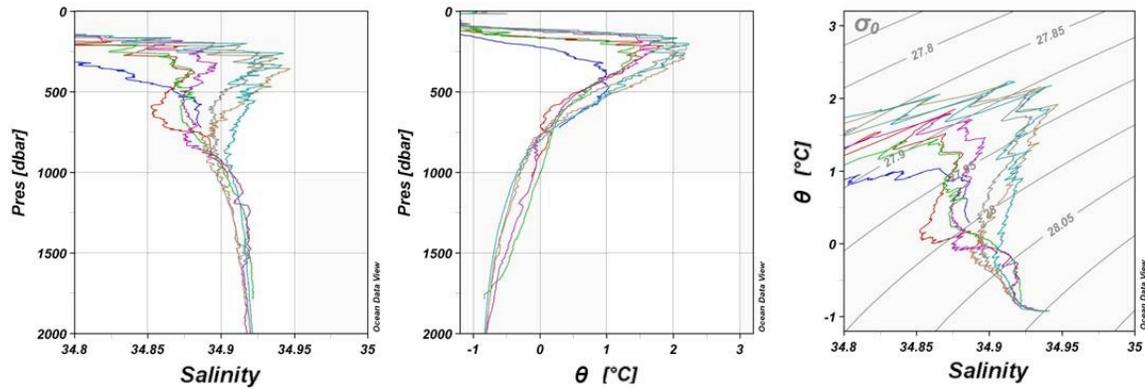
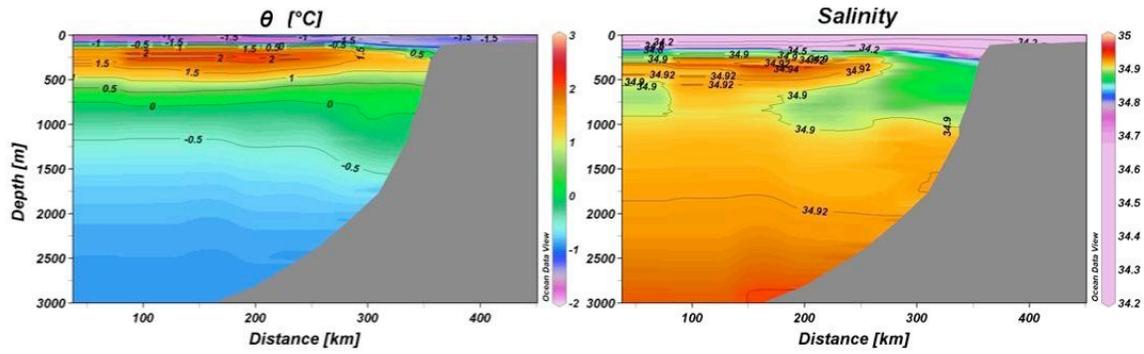


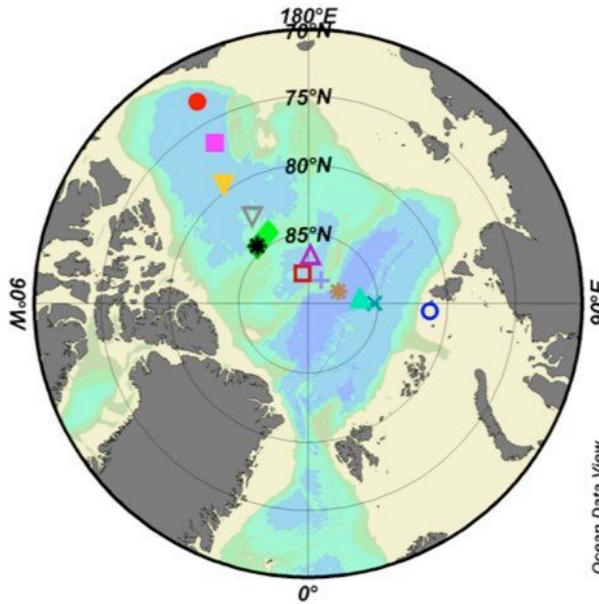
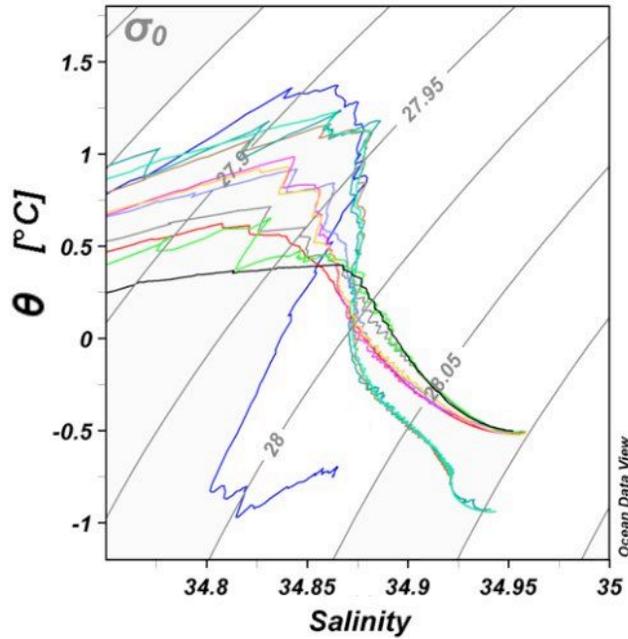
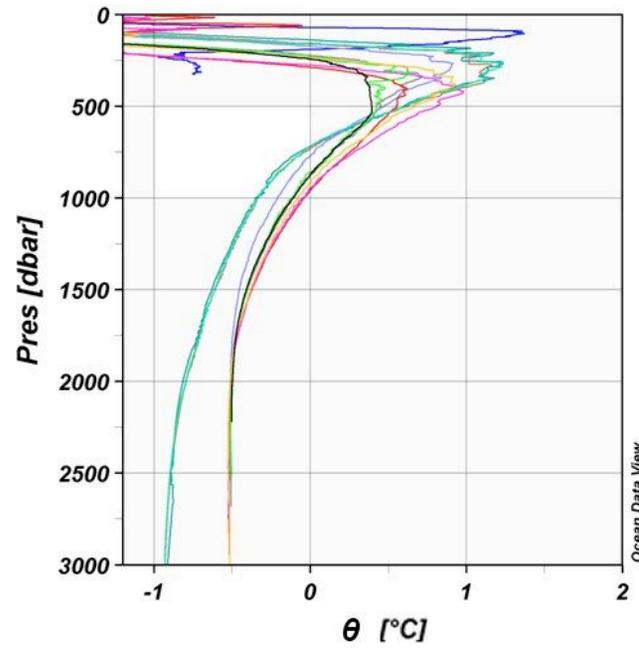
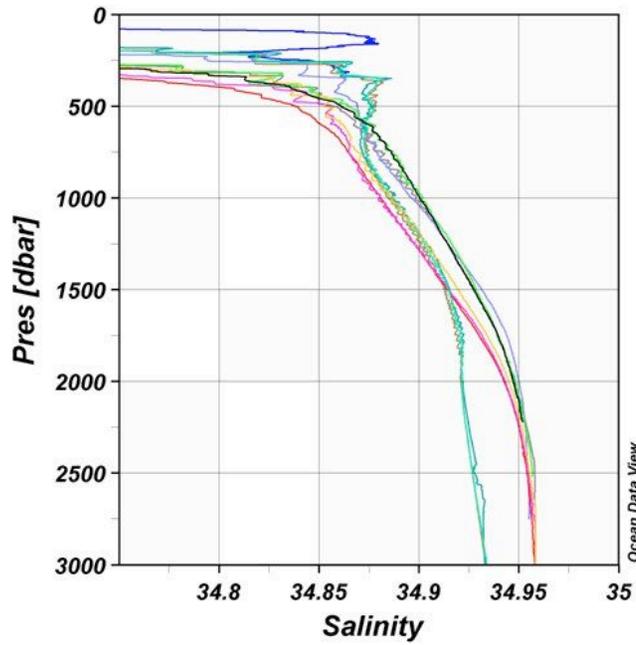


Rudels (2012)



Interleaving of waters with similar density, but different (T,S) off Siberia





Barents Sea Branch of
Atlantic Waters supplies
Arctic Basins with
Atlantic Waters?

Brine enriched bottom water formation on shelf and sinking

from Rudels (2012)

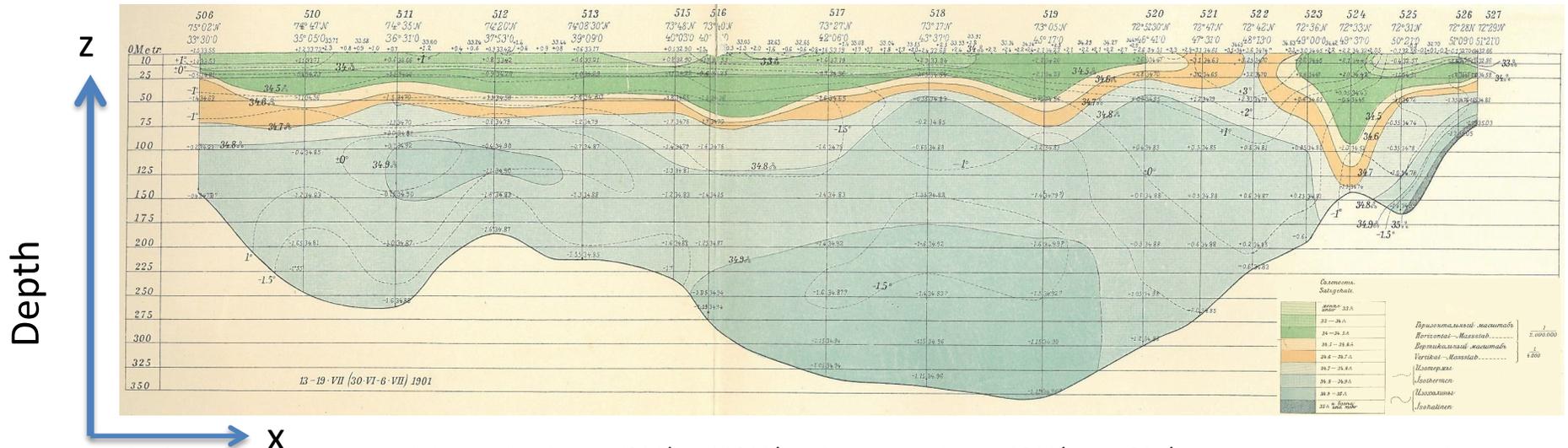
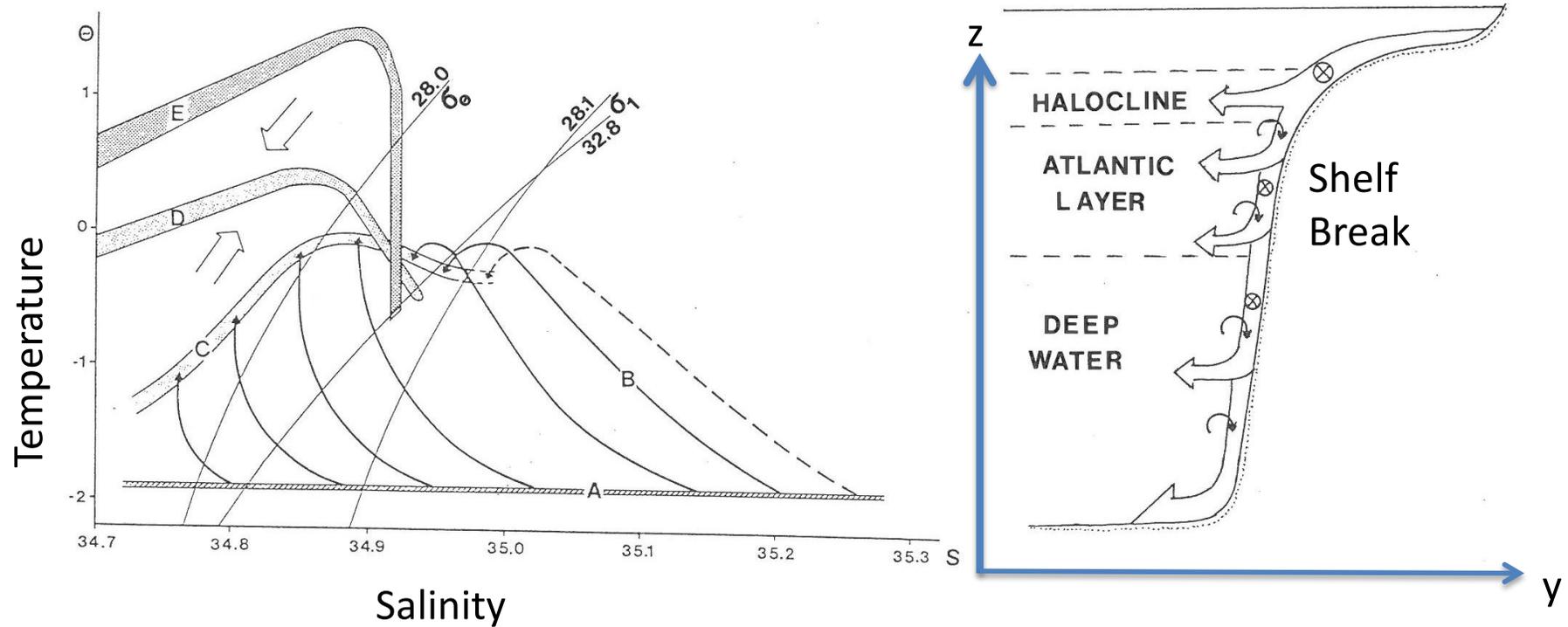


Fig. 15. Temperature and salinity section from 75°02' N, 33°30' E (Central Bank) to 72°29' N, 51°21' E (Novaya Zemlya) showing cold and brine enriched saline water on the shallow area west of Novaya Zemlya in 1901. From Knipowisch (1905).



Deep and Bottom Waters in the Arctic Basins

