Is weaker Arctic sea ice changing the Atlantic water circulation?

How can it be?

The Arctic sea ice is getting weaker and more mobile [1]. The sea ice conditions at the Atlantic Water (AW) gateways to the Arctic and also in the central Arctic are changing. Can this bear consequences for the mid-depth properties and circulations?

We attempt to mimic two sea ice strength modes, prior and during the climate change, in a sensitivity study where we compare two sea ice-ocean model simulations.

Experiment setup

MITgcm ocean model [2] coupled to to sea ice model [3] with linear free surface, C-grid, ½° horizontal grid spacing, 36 vertical layers, z* [4], volume river runoff, 100 years spinup with CORE 1 climatology and atmospheric forcing CORE2 (1948-2007). We are comparing:

control run (CTRL):

weak ice run (WEAK):

\[ P^* = 27500 \text{ N/m}^2 \]

\[ P^* = 15000 \text{ N/m}^2 \]

Summary

Lower sea ice cover in the Barents Sea contributes to high negative ocean surface heat fluxes and to formation of cooler and stronger Barents Sea branch water. The increased sea ice mobility in the central Arctic in WEAK results in faster and deeper ocean’s anticyclonic Beaufort Gyre which hampers the cyclonic circulation of the AWL. This extends the importance of the Arctic sea ice mobility also on the water masses feeding the Atlantic Meridional Overturning in the North Atlantic.