

Antarctic Bottom Water formation and export in PanAntarctic-MOM6: effect of horizontal resolution

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Motivation

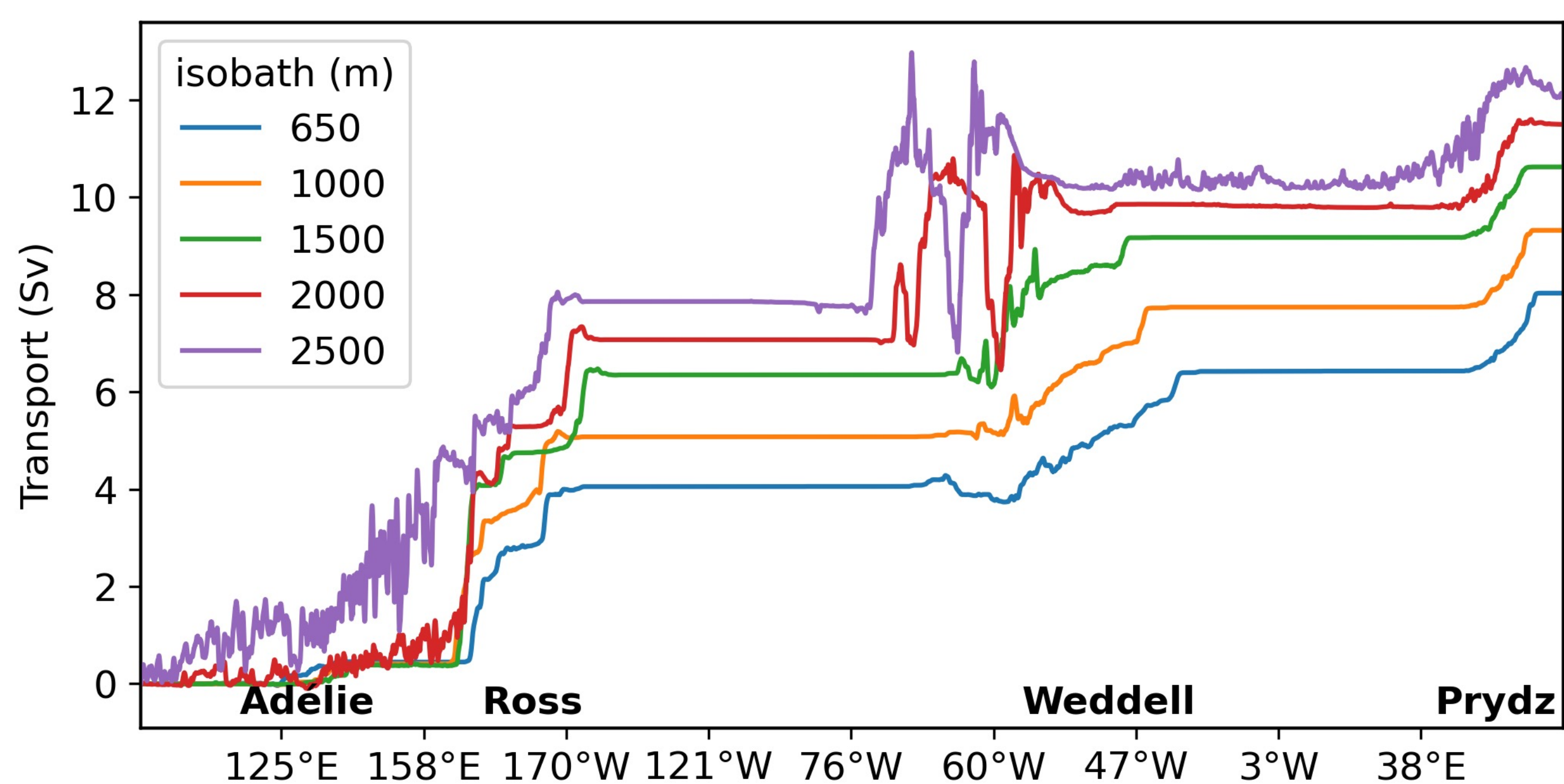
The formation of Antarctic Bottom Water (AABW) is a key process in the global ocean circulation. Modelling the formation and downslope flow of AABW represents an ongoing challenge for ocean and climate models due to the complex processes and high horizontal resolution required.

We have developed a PanAntarctic ocean-sea ice model based on MOM6 with horizontal resolutions of 1/10°, 1/20° and 1/40° where we investigate the formation and export of AABW to the abyss in more detail and determine the effect of horizontal resolution.

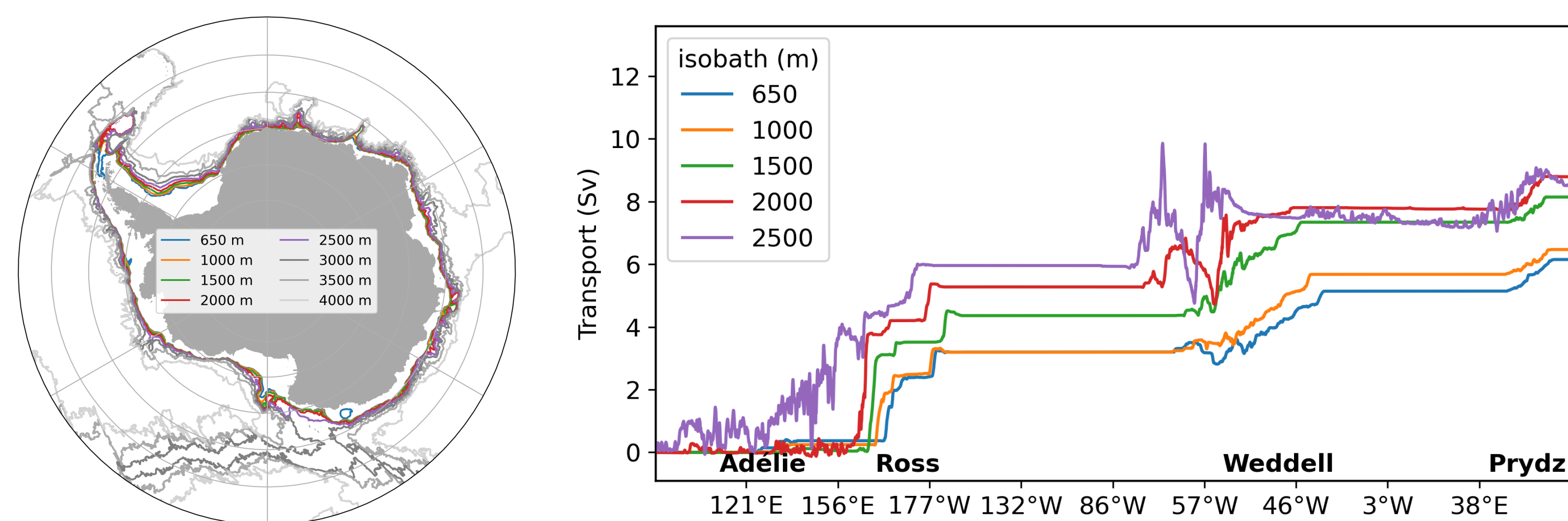
Circumpolar offshore transport and mixing

Continues entrainment during downslope flow of dense shelf waters. Higher offshore transport in 1/20° compared to 1/10°.

Offshore transport in 1/20° for $\sigma_2 > 1037.15$



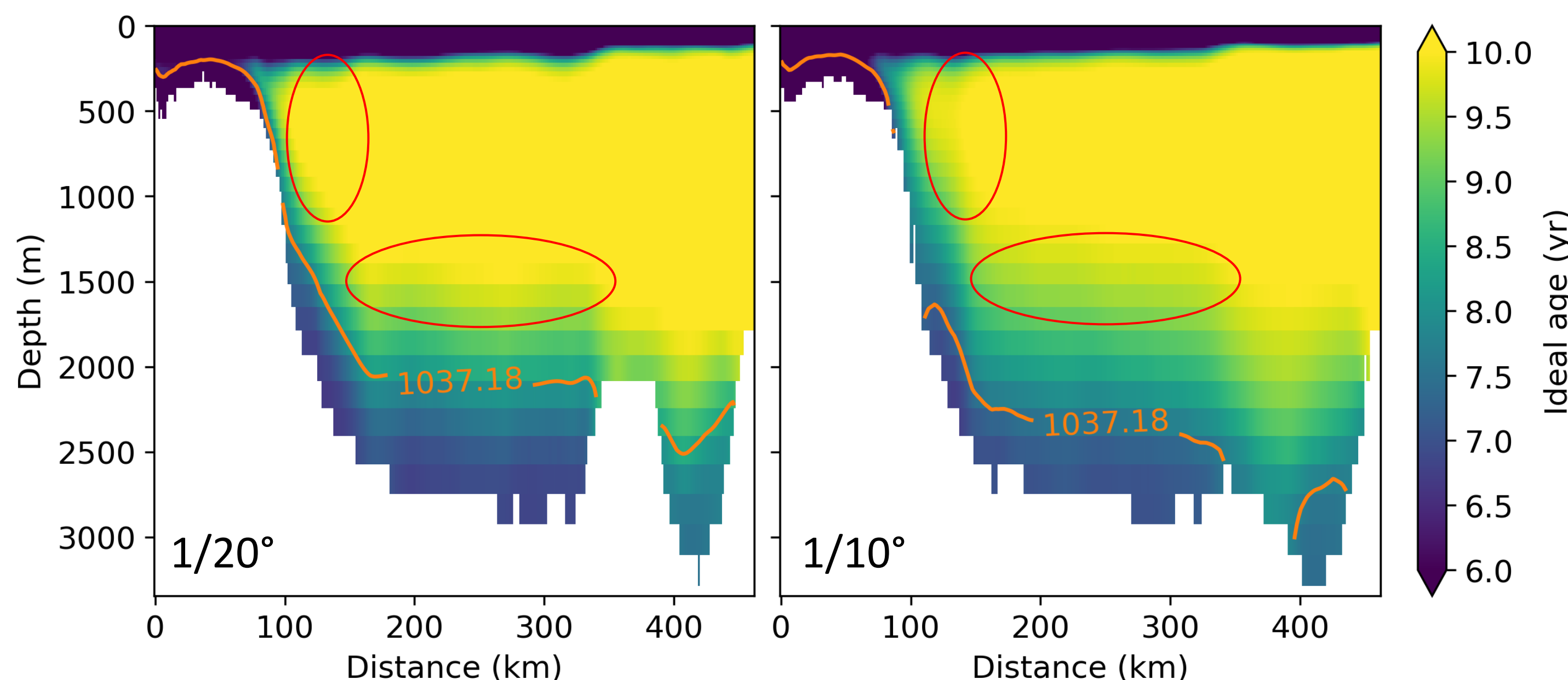
Offshore transport in 1/10° for $\sigma_2 > 1037.15$



Downslope flow of water from the shelf to the abyss (> 4000 m) with $\sigma_2 > 1037.18$ kg m⁻³ in the Ross Sea in 1/20°, but in 1/10° waters are not as dense.

More mixing during downslope flow in 1/10°, not only in the Ross Sea but also in other AABW formation regions.

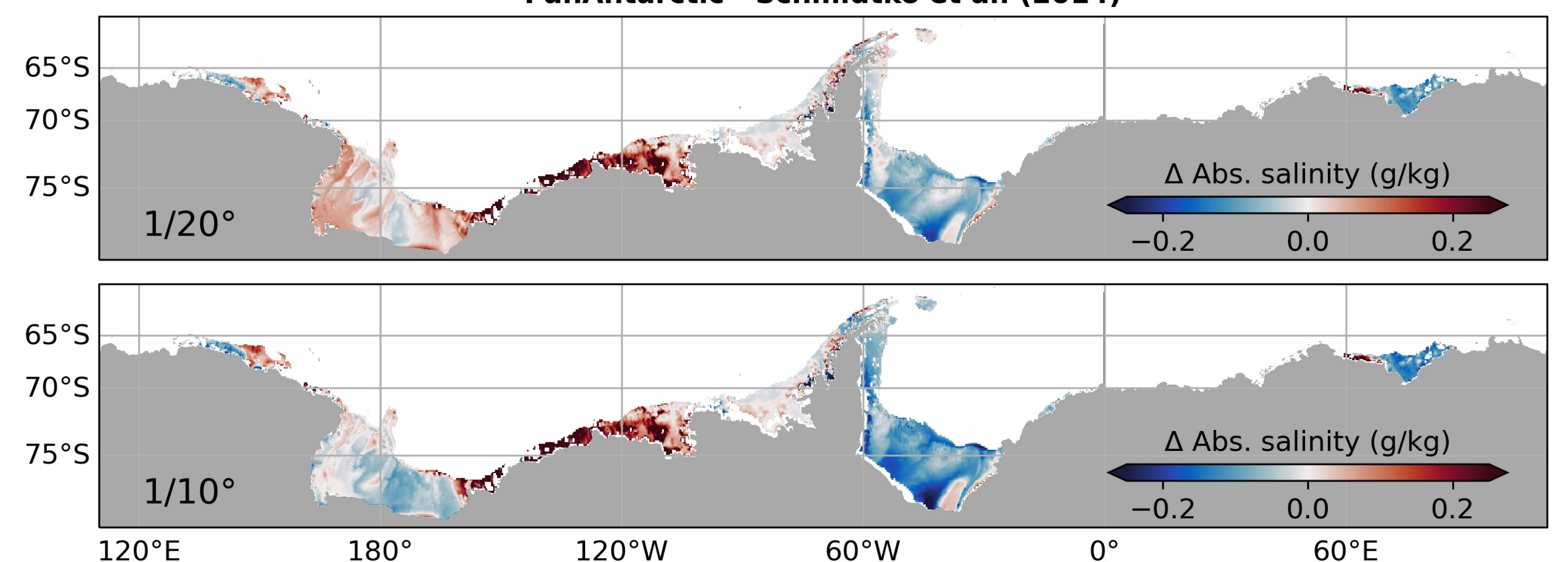
Drygalski Trough in the Ross Sea



Current status and validation

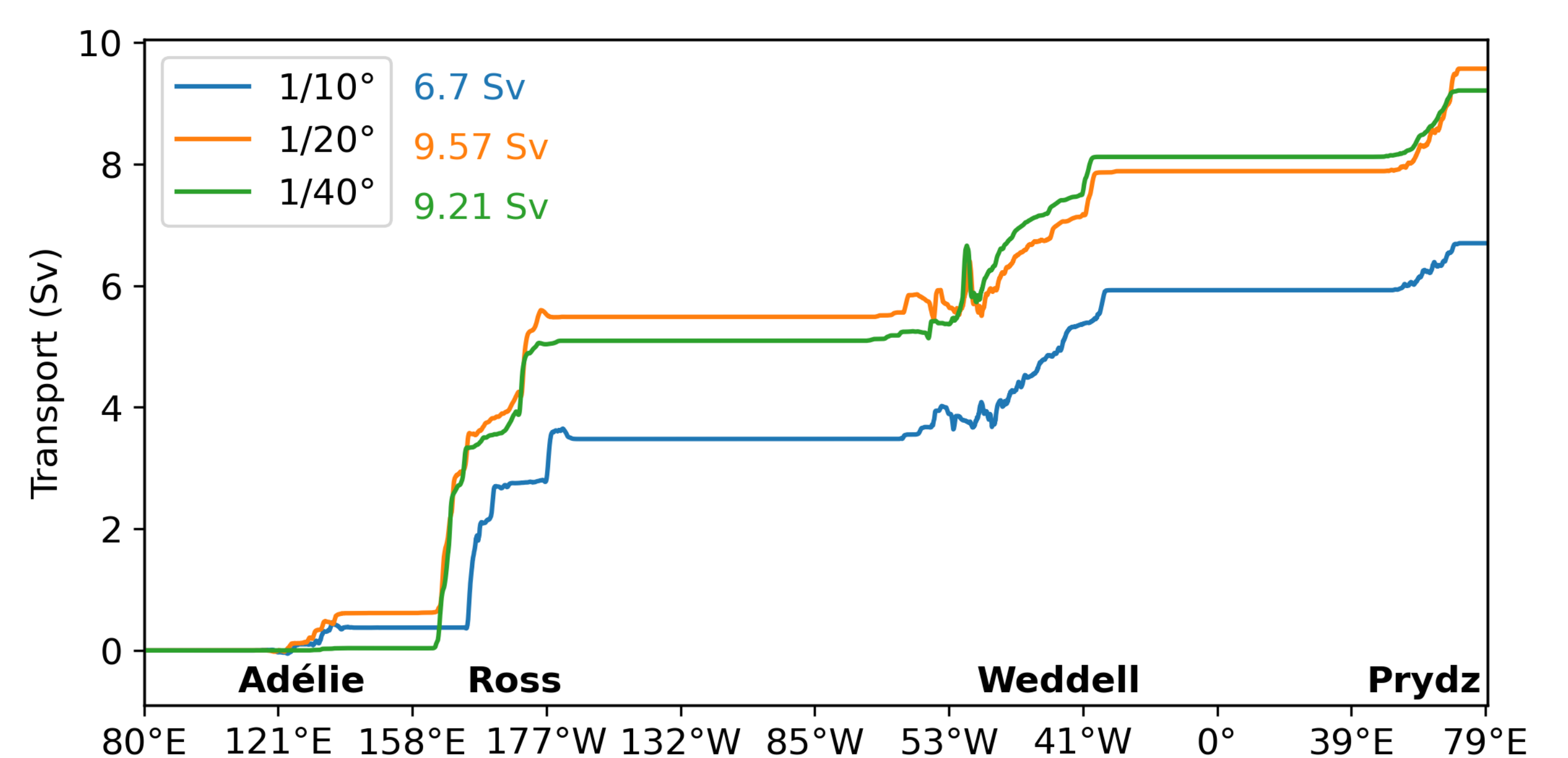
- ocean model MOM6 and sea ice model SIS2
- regional configuration for Antarctica and the Southern Ocean extending to 37°S
- horizontal resolutions of 1/10°, 1/20° and 1/40° with 75 z* vertical levels
- forced by the JRA55-do repeat year May 1990 to April 1991 for
 - 20 years for 1/10°
 - 13 years for 1/20°
 - 9 years for 1/40° (to be continued)
- monthly output of T, S, MLD, SSH, velocity, volume transport, components of SWMT, wind stress, age tracer, sea ice concentration and thickness
- daily output for last years for selected variables
- all data are available on gadi through the Cosima database

PanAntarctic - Schmidt et al. (2014)



Outlook: How does the 1/40° compare?

Offshore transport across 1000m isobath for $\sigma_2 > 1037.15$



Increasing the resolution further does not increase the offshore transport strongly. Highest surface water mass transformation (SWMT) in 1/20°, lowest in 1/10° (except for Adélie Coast).

Could there be less mixing and a better overflow in 1/40° given the reduced SWMT?

Offshore transport across 2500m isobath for $\sigma_2 > 1037.15$

