Table S1. Viscosity and diffusion coefficients used in the 1/12° global ocean simulation

|  |  |
| --- | --- |
| Parameters | Values |
| Laplacian coefficient for momentum | 20 m2 s-1 |
| Biharmonic diffusive velocity for momentum | 1 cm s-1 |
| Biharmonic diffusive velocity for layer thickness | 1.5 cm s-1 |
| Laplacian diffusive velocity for tracers | 0.5 cm s-1 |

Chart

Description automatically generated with medium confidence

Figure S1: Observed and modeled sea-surface height (SSH) anomaly along the Prime Meridian in latitude range 20-40°S from 1993 to 2018. The high SSH anomaly denotes the west-/northwestward translation of the Agulhas Rings that pass the Prime Meridian.

Chart, line chart

Description automatically generated

Figure S2: a) Variability of the modeled ACC transport through the Drake Passage at the 65°W, with thin and thick lines represent monthly means and annual means, respectively; b) Seasonal variability of the modeled ACC transports averaged over 1979-2018.

Chart, line chart

Description automatically generated

Figure S3. Latitudinal variability of the time averaged AMOC transports (black line), and contributions from the near surface Water (<35.65 kg m-3, red line) and the Antarctic Intermediate Water (35.65<<36.58 kg m-3, blue line) in the South Atlantic Ocean.