# Supplemental Material

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Decadal Trends in the Southern Ocean Meridional Eddy Heat Transport

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Supplemental Material for

# Decadal trends in the Southern Ocean meridional eddy heat transport

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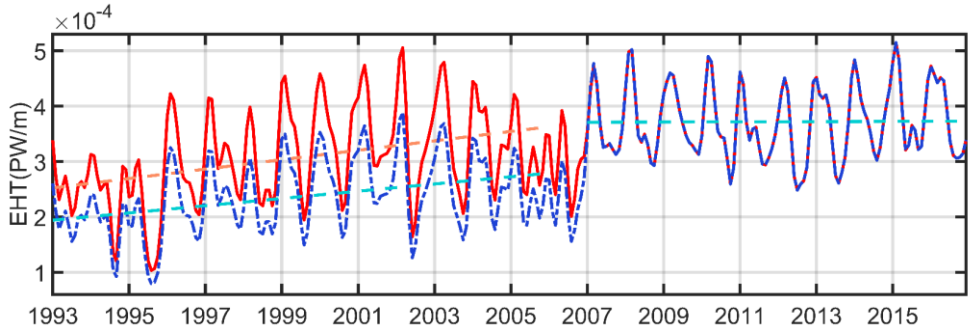


Fig. S1. Time series of satellite data-derived surface EHT averaged in the ACC band (i.e., 40–60 $^{o}$S). Blue dotted and red solid lines denote results from original and corrected data, respectively. Cyan and orange dashed lines denote the linear trends of the associated solid lines. For the red line, the mesoscale SST anomalies before 2007 are multiplied by a factor of 1.3 before the calculation of surface EHT.

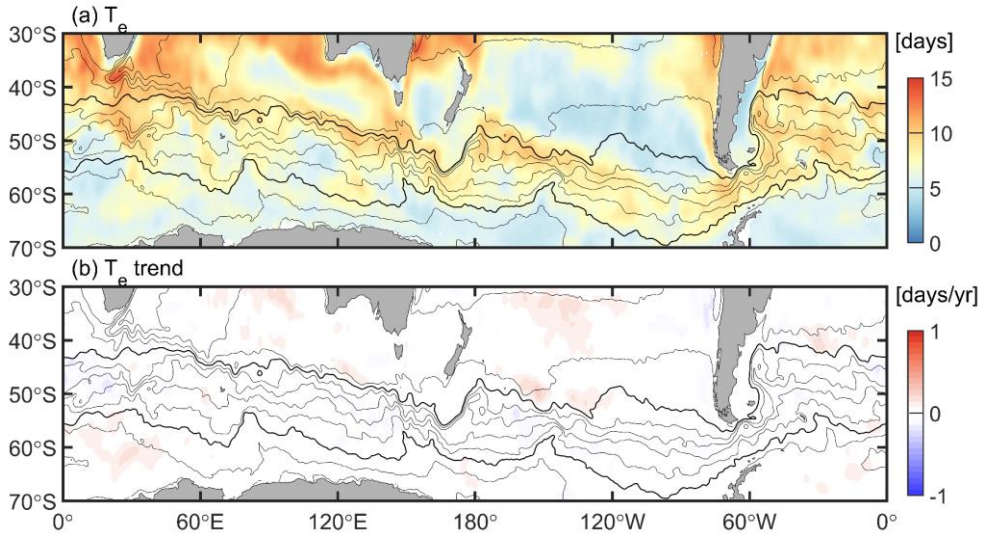


Fig. S2. Spatial distributions of (a) time-mean and (b) linear trend of eddy mixing timescale $T_e$ between 1993–2016 obtained from ECCO2 data.

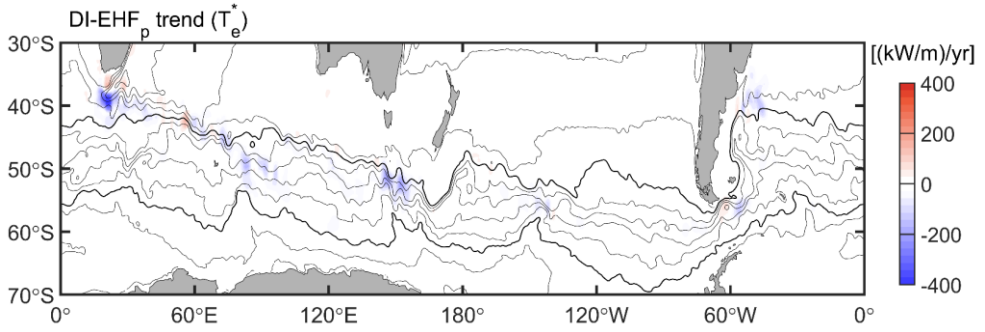


Fig. S3. Linear trends of the DI-EHF$_p$ due to the change of $T_e$ between 1993–2016.

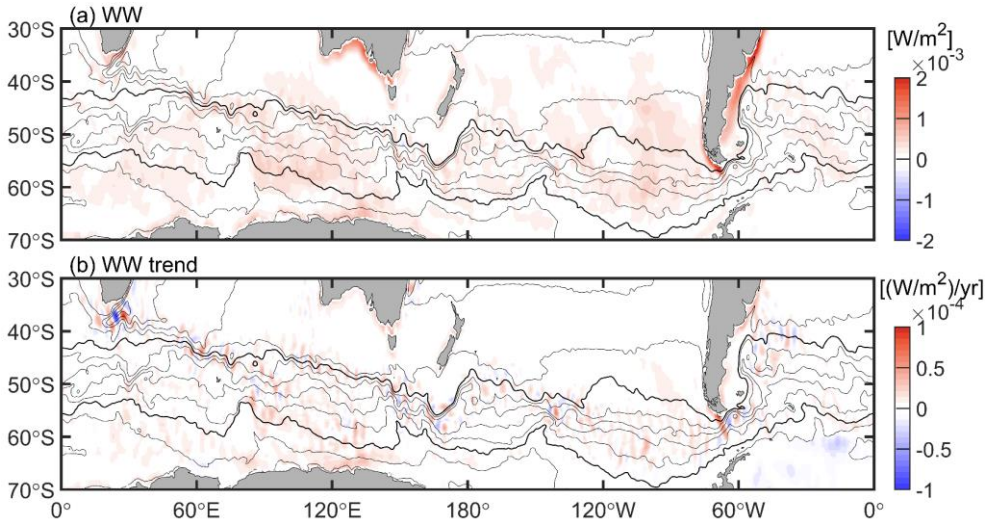


Fig. S4. Same as Fig. S2 but for the mesoscale wind stress work (WW).

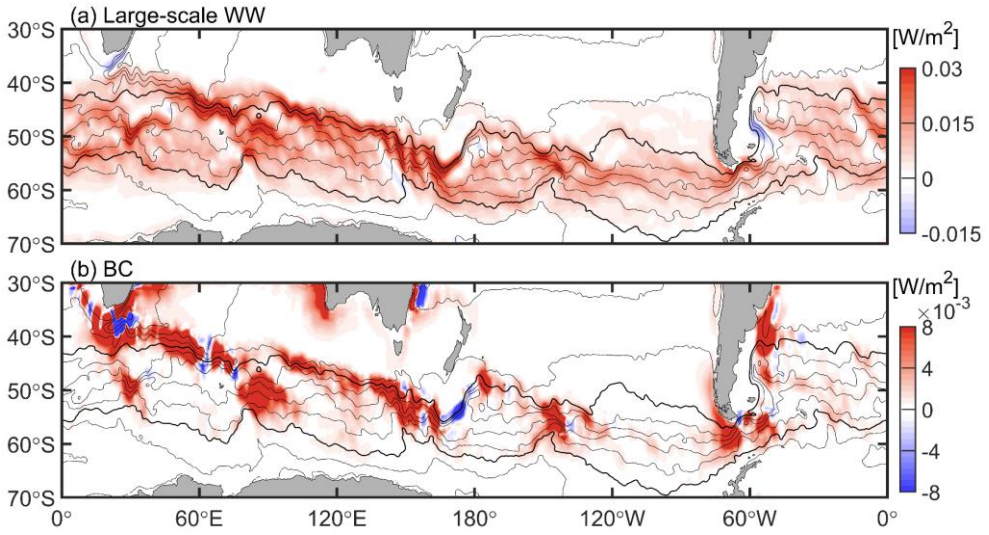


Fig. S5. Spatial distributions of time-mean (a) large-scale WW and (b) baroclinic conversion integrated over the upper 1000 m between 1993–2016 obtained from ECCO2 data. The baroclinic conversion is defined as $BC = -\left(g^2/\rho_0 N^2\right)\overline{\mathbf{v}_h'\rho_a'}\cdot\nabla_h\bar{\rho}_a$, where $N^2 = -\left(g/\rho_0\right)\left(d\rho_r/dz\right)$, $\rho_a\left(x,y,z,t\right) = \rho\left(x,y,z,t\right) - \rho_r\left(z\right)$, $\rho_r$ is averaged potential density over the study region for the period of 1993–2016, and the subscript h indicates the horizontal components.

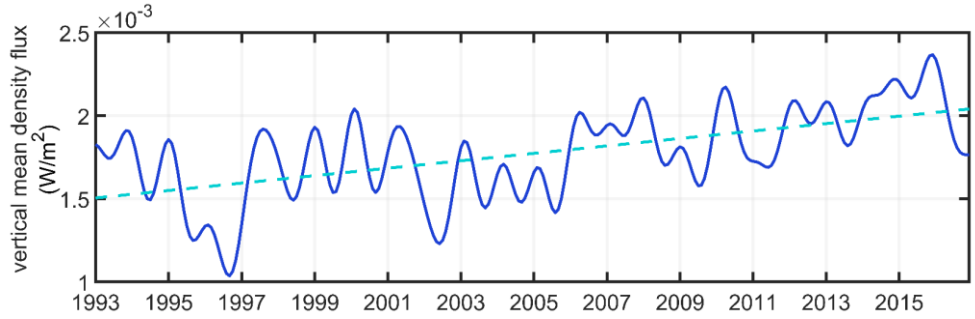


Fig. S6. Time series of the 13-month low-pass filtered vertical mean density flux integrated over the upper 1000 m. The result is averaged in the ACC band (i.e., 40–60 $^{o}$S). The vertical mean density flux is defined as $g\bar{\rho}_a\bar{w}$.

Table. S1. The decadal trends of EHTs averaged every 2.5° from 40 to 60 °S (with the 95% confidence level).

| Latitude band (°S) | Increasing rate of EHT ($\times 10^{-2}$ PW per decade) |
|---|---|
| 40.0–42.5 | $1.4 \pm 0.5$ |
| 42.5–45.0 | $0.8 \pm 0.3$ |
| 45.0–47.5 | $0.1 \pm 0.2$ |
| 47.5–50.0 | $1.1 \pm 0.2$ |
| 50.0–52.5 | $0.6 \pm 0.2$ |
| 52.5–55.0 | $1.5 \pm 0.2$ |
| 55.0–57.5 | $1.9 \pm 0.2$ |
| 57.5–60.0 | $1.8 \pm 0.2$ |
| 40.0–60.0 | $1.1 \pm 0.2$ |