Supplementary information:

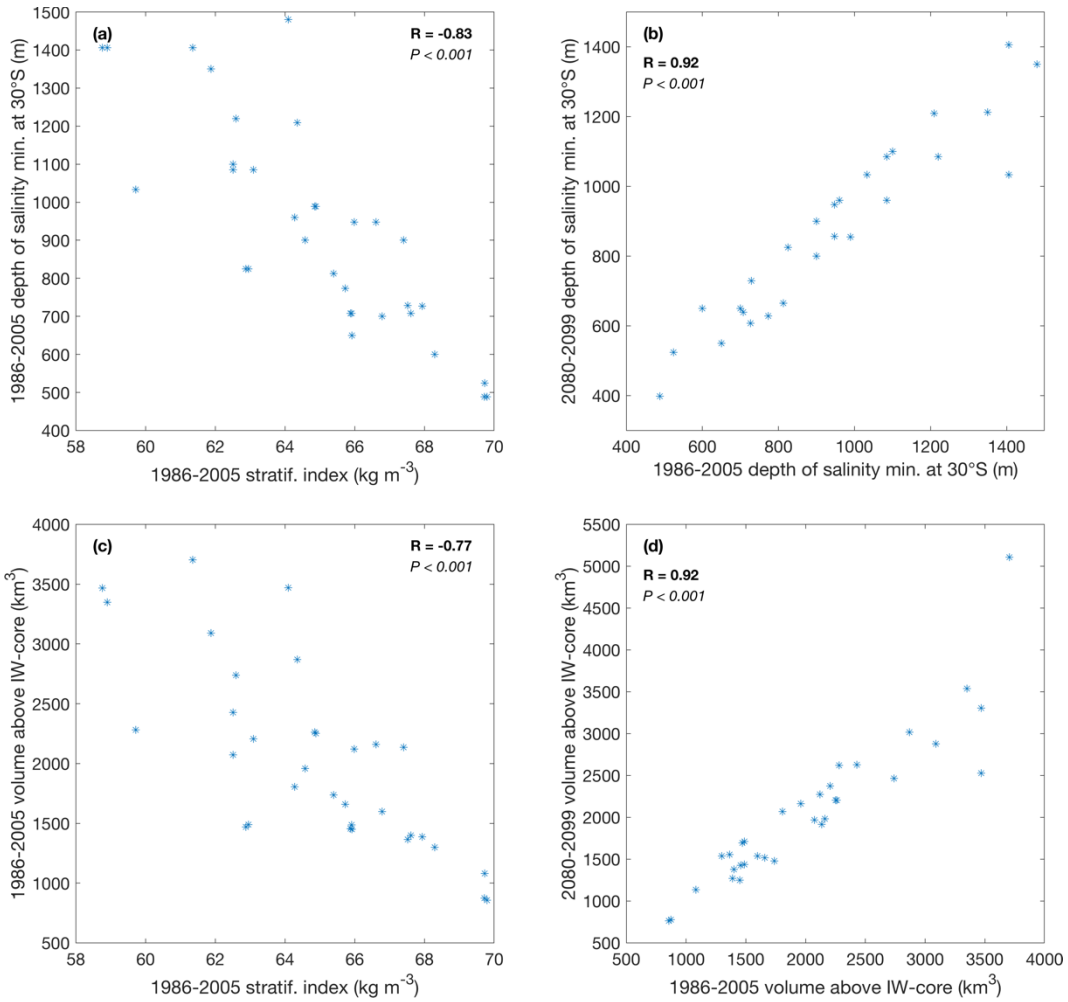
"Stratification constrains future heat and carbon uptake in the Southern Ocean"

Supplementary Table 1: CMIP5 ensemble

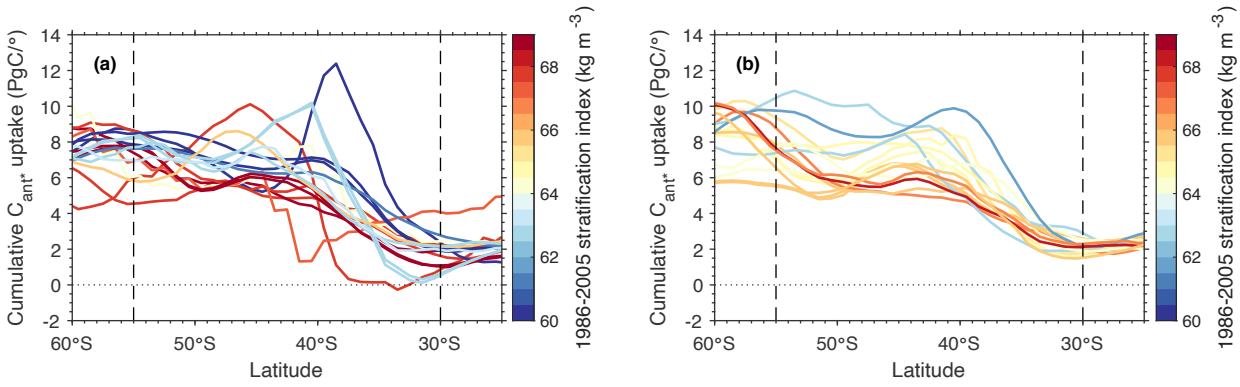
Model name	Modelling center
CanESM2[1]	CCCma
CESM1-BGC[2,3]	NSF-DOE-NCAR
CMCC-CESM[4,5]	CMCC
GFDL-ESM2G[6]	NOAA GFDL
GFDL-ESM2M[6]	NOAA GFDL
GISS-E2-R-CC[7]	NASA GISS
GISS-E2-H-CC[7]	NASA GISS
HadGEM2-CC[8]	MOHC
HadGEM2-ES[8]	MOHC and INPE
IPSL-CM5A-LR[9]	IPSL
IPSL-CM5A-MR[9]	IPSL
IPSL-CM5B-LR[9]	IPSL
MIROC-ESM[10]	MIROC
MIROC-ESM-CHEM[10]	MIROC
NorESM1-ME[11,12]	NCC
MPI-ESM-LR[13]	MPI-M
MPI-ESM-MR[13]	MPI-M

Supplementary Table 2: CMIP6 ensemble

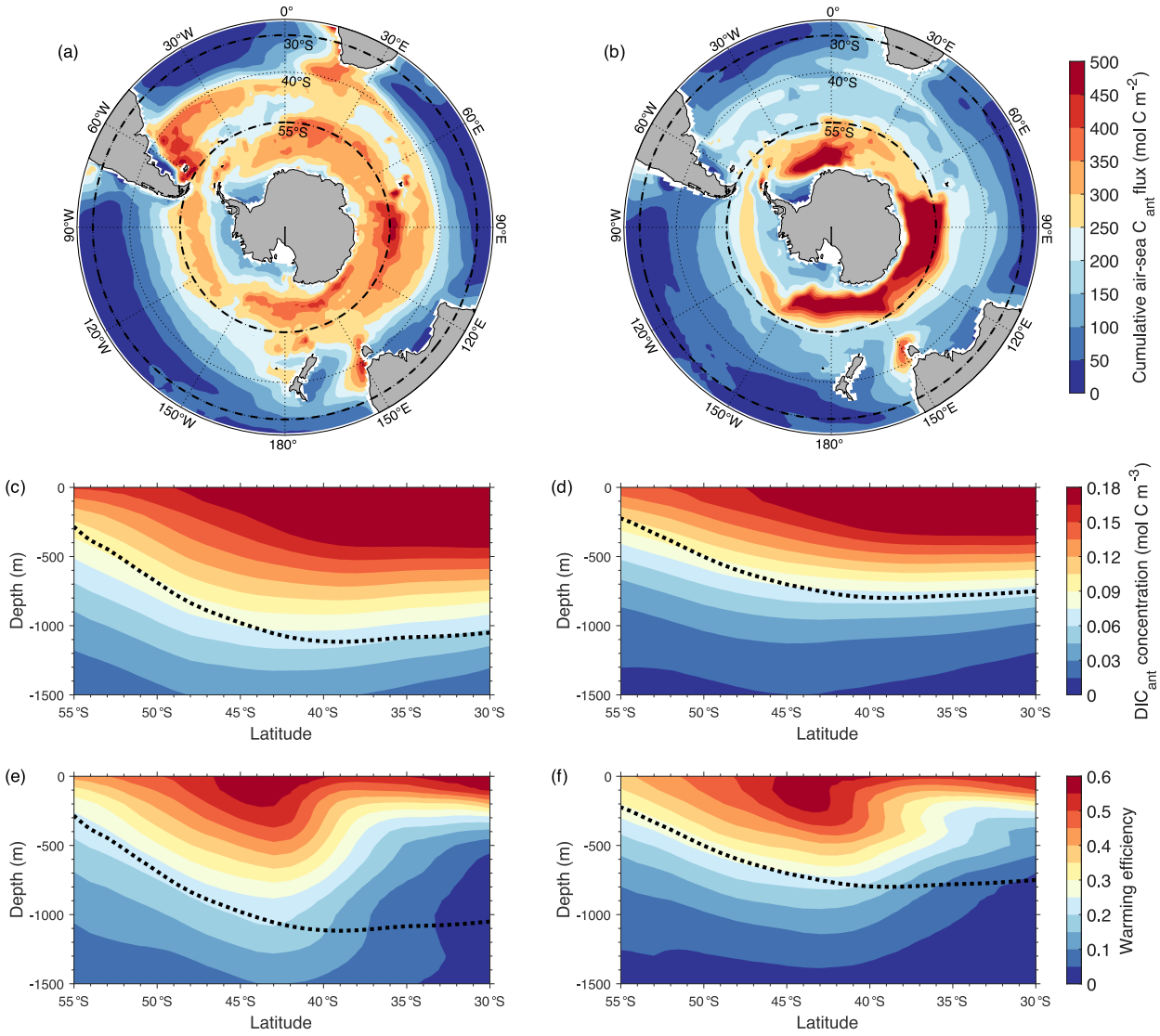
Model name	Modelling center
ACCESS-ESM1-5[14]	CSIRO
CanESM5[15]	CCCma
CanESM5-CanOE[15]	CCCma
CESM2[16]	NCAR
CESM2-WACCM[16]	NCAR
CNRM-ESM2-1[17]	CNRM-CERFACS
GFDL-CM4[18,19]	NOAA-GFDL
GFDL-ESM4[20,21]	NOAA-GFDL
IPSL-CM6A-LR[22]	IPSL
MIROC-ES2L[23]	MIROC
MPI-ESM1-2-LR[24,25]	MPI-M
MPI-ESM1-2-HR[24,25]	MPI-M
MRI-ESM2-0[26]	MRI
NorESM2-LM[27,28]	NCC
NorESM2-MM[27,28]	NCC
UKESM1-0-LL[29]	MOHC



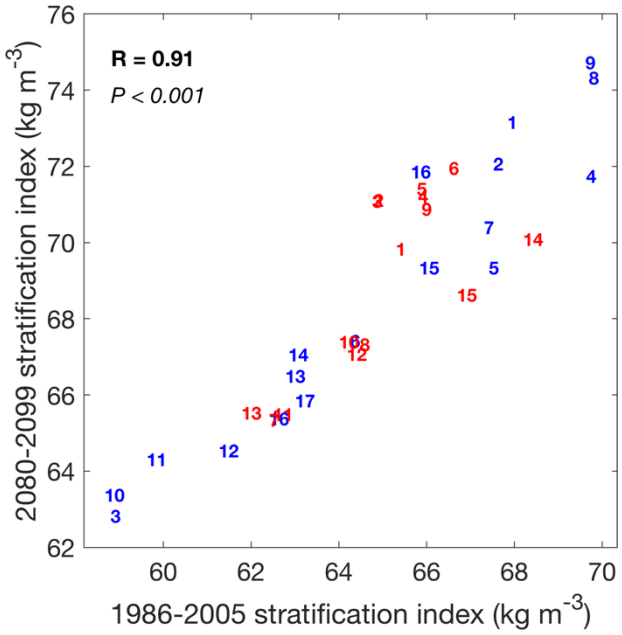
Supplementary Figure 1: Relationship between the 1986-2005 stratification index and (a) the 1986-2005 depth of the zonal average salinity minimum at 30°S and (c) the 1986-2005 volume above the intermediate-water core (IW-core). (b,d) Relationship between contemporary (1986-2005) and future (2080-2099) depth of the salinity minimum at 30°S and the volume of water above the IW-core. The volume above IW-core is defined as the volume between 30°S and 55°S and between the surface and the longitudinally averaged density isoline crossing the depth of salinity minimum at 30°S (ref. [30]). The 1986-2005 and 2080-2099 periods are from the historical and RCP8.5/SSP5-8.5 experiments, respectively. Correlations are given at the top of each panel.



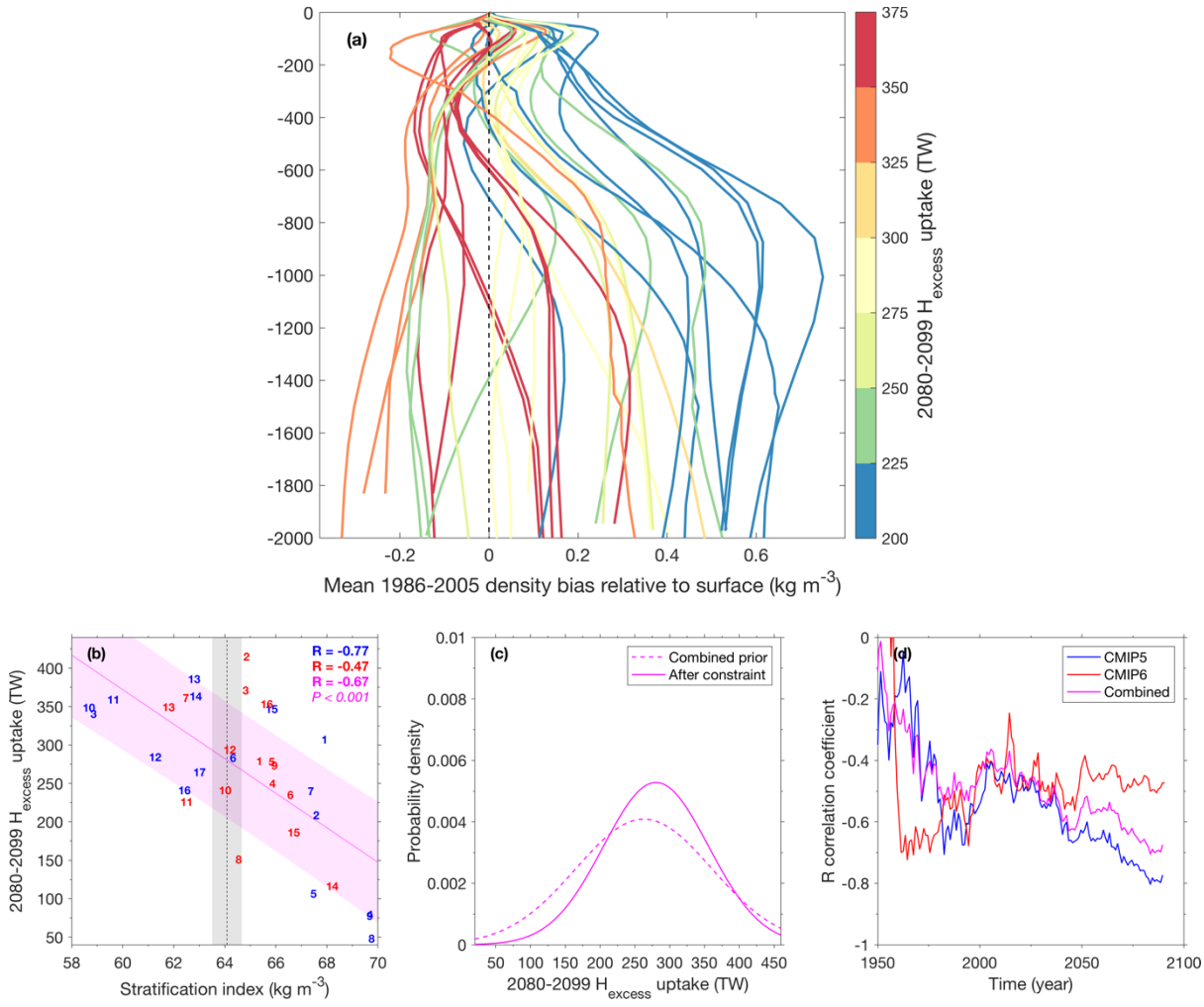
Supplementary Figure 2: Longitudinally averaged zonal 1850-2100 cumulative C_{ant} uptake for the (left) CMIP5 and (right) CMIP6 ensemble. The values are per degree of latitude using historical and RCP8.5/SSP5-8.5 experiments. Each line shows a single ESM and the colour depict its stratification index for the period 1986-2005. Vertical black dashed lines depict the regional boundaries of our Southern-Ocean subduction region.



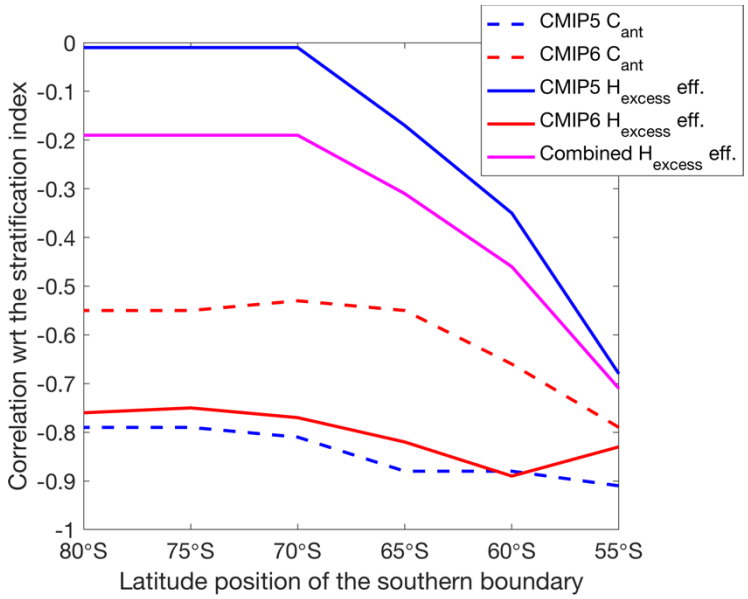
Supplementary Figure 3: Same as Article Figure 3 for CMIP6 models with **(a, c, e)** the low-stratification models (GFDL-CM4, MPI-ESM1-2-HR and MRI-ESM2-0) and **(b, d, f)** the high-stratification models (CNRM-ESM2-1, NorESM2-LM and NorESM2-MM).



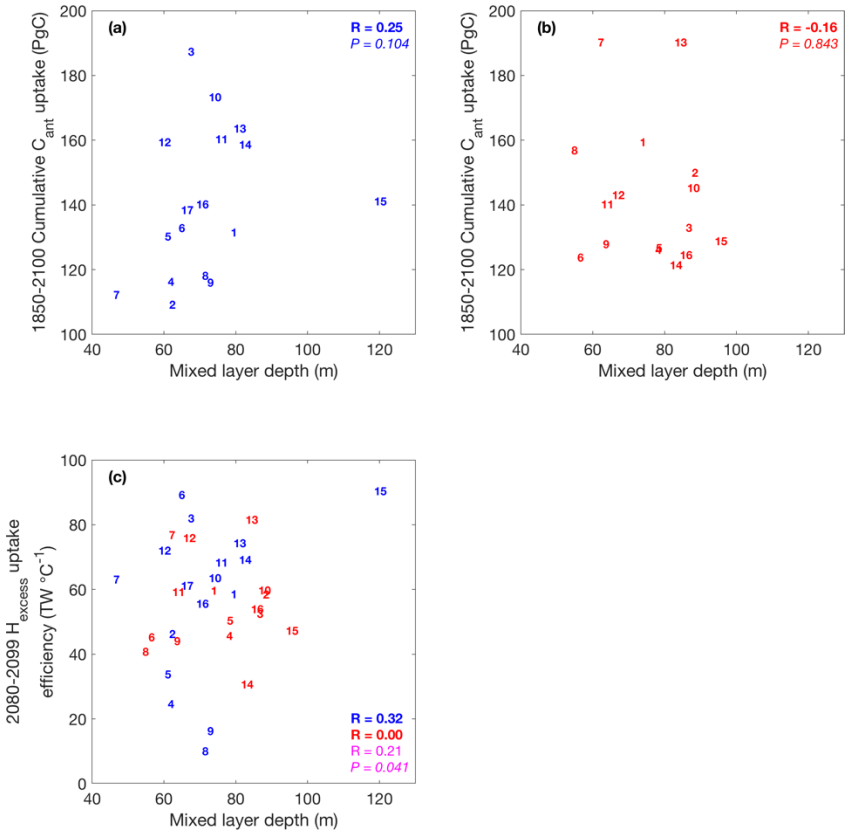
Supplementary Figure 4: CMIP5 and CMIP6 present (Historical 1986-2005) versus future (RCP8.5 / SSP5-8.5 2080-2099) stratification index. See Article Figure 4 for the legend.



Supplementary Figure 5: Equivalent of (a) Article Figure 2 and (b-d) Article Figure 4 using 2080-2099 H_{excess} uptake.

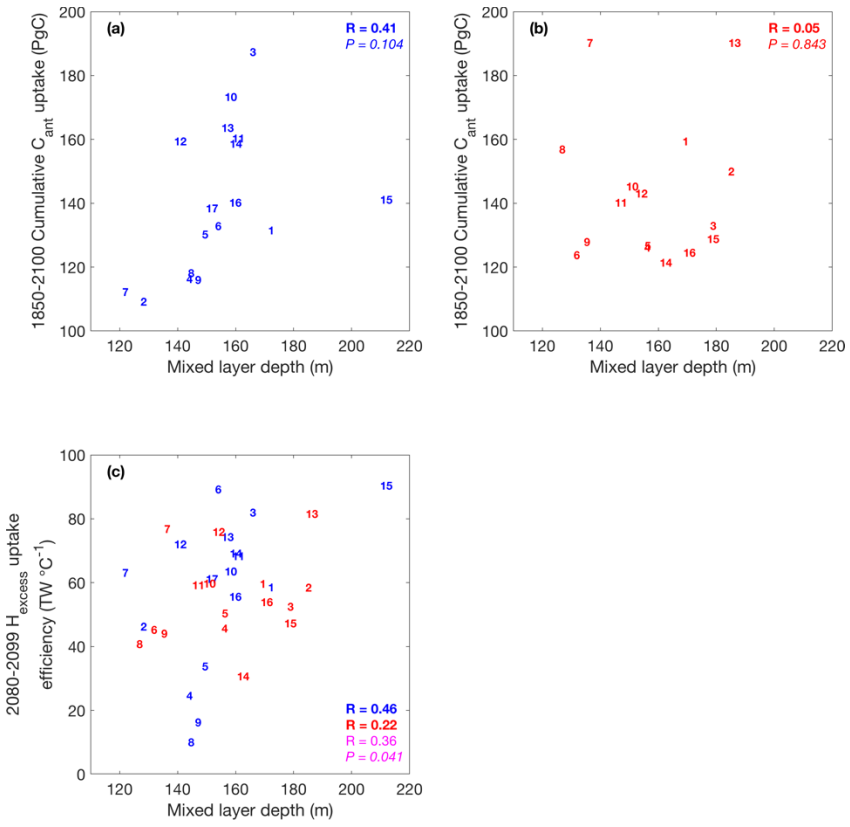


Supplementary Figure 6: Sensitivity analysis of the correlation in the emergent constraint to the position of the southern boundary. Each line represents the correlation coefficient of the emergent constraint as also shown in Figure 4 but using a fixed 30°S northern boundary and a southern boundary moving southwards at 5° intervals.

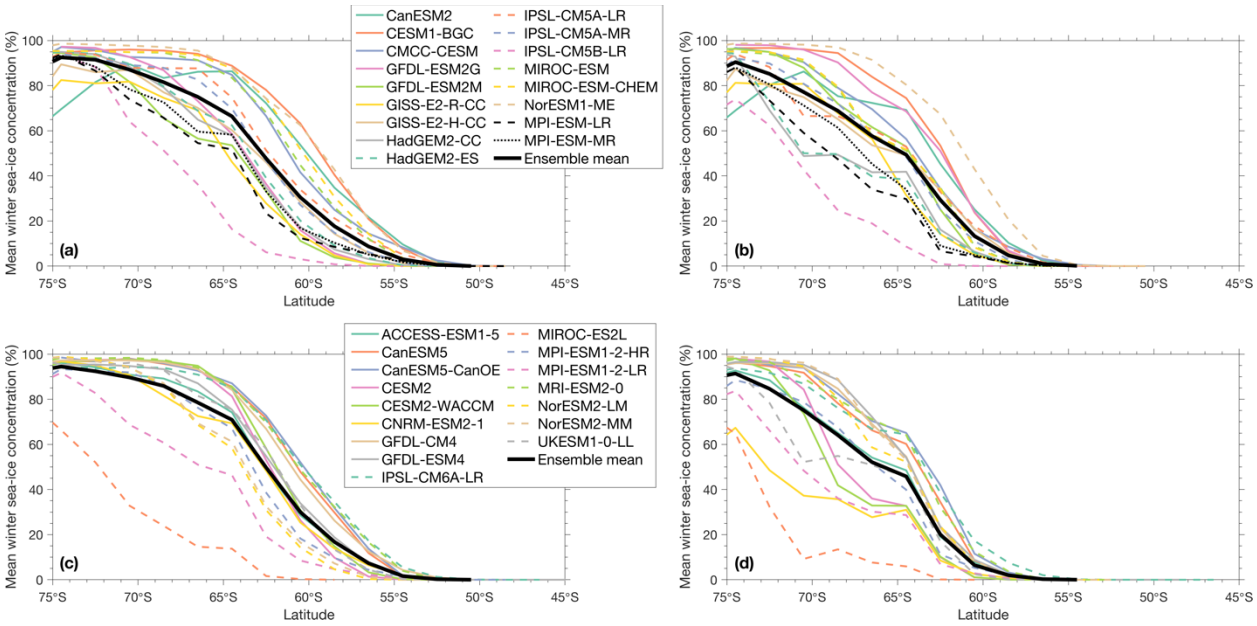


Supplementary Figure 7: Same as Article Figure 4 (a-c) but using contemporary annual mean mixed layer depth. The mixed layer depth is defined using a surface-density difference criterion of

0.03 kg m^{-3} (ref. [31]).



Supplementary Figure 8: Same as Article Figure 4 (a-c) but using contemporary mean winter mixed layer depth, defined as the average of monthly maximum mixed layer depths over 20 years.



Supplementary Figure 9: Mean longitudinally-averaged winter (July-August-September) sea-ice concentration for **(a, b)** CMIP5 and **(c, d)** CMIP6 from **(a, c)** the historical 1986-2005 period and **(b, d)** the RCP8.5 / SSP5-8.5 2080-2099 projections.

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