Supplemental Material

Untangling the influence of Antarctic and Southern Ocean life on clouds.

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CMIP6 model methods and evaluation

We have used 22 CMIP6 model simulations (see Table S1) to produce the surface shortwave radiation bias map shown in Figure 2 (Eyring et al., 2016). We have selected these 22 models based on their equilibrium climate sensitivity (ECS), which fall within the considered 'likely' range of 2.5-4K (Hausfather et al., 2022). We have taken the ECS from Zelinka et al., 2020, which has been updated at the corresponding Github repository https://github.com/mzelinka/cmip56_forcing_feedback_ecs (accessed 1st June 2022). The CMIP6 data is available on the Australian National Computational Infrastructure (NCI) Earth System Grid Federation (ESGF) replica. We have used models from the CMIP historical experiment (atmosphere) and only considered one variant per model to avoid biassing a particular model/model family in the ensemble.

We have used the Clouds and the Earth's Radiant Energy System - Energy Balanced and Filled (CERES-EBAF) Level 3b incoming shortwave radiation product at the surface (Loeb et al., 2018). The CERES-EBAF data was obtained using the NCI ESGF replica of the Obs4MIPs collection (https://esgf-node.llnl.gov/projects/obs4mips/, accessed 30th May 2022).

We have averaged austral summers (December, January, February) over the time period of March 2000 to November 2013 to align the model data with the satellite product. All models and observational data have been regridded to a standard 1x1 degree grid using bilinear interpolation with xESMF (Zhuang et al., 2020).

Table S1. List of CMIP6 models, model variant, the model reference, and the model equilibrium climate sensitivity (taken from Zelinka et al., 2020)

Model	**Variant**	**DOI**	**ECS (K)** (Zelinka et al. 2020)
ACCESS-ESM1-5	r1i1p1f1	doi:10.22033/ESGF/CMIP6.2288	3.88
AWI-CM-1-1-MR	r1i1p1f1	doi:10.22033/ESGF/CMIP6.359	3.16
BCC-CSM2-MR	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1725	3.02
BCC-ESM1	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1733	3.25
CMCC-CM2-SR5	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1362	3.55
CMCC-ESM2	r1i1p1f1	doi:10.22033/ESGF/CMIP6.13165	3.58
EC-Earth3-AerChem	r1i1p1f1	doi:10.22033/ESGF/CMIP6.639	3.87
FGOALS-f3-L	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1782	2.98
FGOALS-g3	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1783	2.87

GFDL-ESM4	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1407	2.65
GISS-E2-1-G	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1400	2.71
GISS-E2-1-H	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1421	3.12
IPSL-CM5A2-INCA	r1i1p1f1	doi:10.22033/ESGF/CMIP6.13642	3.82
MIROC-ES2L	r1i1p1f2	doi:10.22033/ESGF/CMIP6.5602	2.66
MIROC6	r1i1p1f1	doi:10.22033/ESGF/CMIP6.881	2.6
MPI-ESM-1-2-HAM	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1622	2.95
MPI-ESM1-2-HR	r1i1p1f1	doi:10.22033/ESGF/CMIP6.741	2.98
MPI-ESM1-2-LR	r1i1p1f1	doi:10.22033/ESGF/CMIP6.6595	3.03
MRI-ESM2-0	r1i1p1f1	doi:10.22033/ESGF/CMIP6.621	3.13
NorCPM1	r1i1p1f1	doi:10.22033/ESGF/CMIP6.10843	3.03
NorESM2-LM	r1i1p1f1	doi:10.22033/ESGF/CMIP6.502	2.56
SAM0-UNICON	r1i1p1f1	doi:10.22033/ESGF/CMIP6.1489	3.72

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