

Supporting Information for “Antarctic Sea Ice Area in CMIP6”

Lettie A. Roach¹, Jakob Dörr², Caroline R. Holmes³, François Massonnet⁴, Edward W. Blockley⁵, Dirk Notz^{6,2}, Thomas Rackow⁷, Marilyn N. Raphael⁸, Siobhan O’Farrell⁹, David A. Bailey¹⁰, Cecilia M. Bitz¹

¹Atmospheric Sciences, University of Washington, Seattle, WA, United States

²Max Planck Institute for Meteorology, Hamburg, Germany

³British Antarctic Survey, Cambridge, United Kingdom

⁴Georges Lemaitre Center for Earth and Climate Research, Earth and Life Institute, Université catholique de Louvain,

Louvain-la-Neuve, Belgium

⁵Met Office Hadley Centre, Exeter, United Kingdom

⁶Earth System Research and Sustainability (CEN), University of Hamburg, Hamburg, Germany

⁷Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Climate Dynamics, Bremerhaven, Germany

⁸Department of Geography, University of California Los Angeles, CA, United States

⁹CSIRO Oceans and Atmosphere, Aspendale, Victoria, Australia

¹⁰Climate and Global Dynamics Laboratory, National Center for Atmospheric Research, Boulder, CO, United States

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Table S1. CMIP6 models that have sea ice data concentration available at the time of writing from the historical simulations, label of ‘first’ ensemble member, number of ensemble members with sea ice data in historical and SSP2-4.5 experiments, and availability of pre-industrial control (piC) simulations, availability of variable ‘sivol’ for historical simulations, and DOI for historical simulations.

Expansions of institution acronyms are available at https://wcrp-cmip.github.io/CMIP6_CVs/docs/CMIP6_institution_id.html.

Model name	First variant	Historical	SSP2-4.5	pre-industrial control	sivol	URL/DOI
ACCESS-CM2	r1i1p1f1	2	1	yes	yes	10.22033/ESGF/CMIP6.4271
ACCESS-ESM1-5	r1i1p1f1	3	3	yes	yes	10.22033/ESGF/CMIP6.4272
AWI-CM-1-1-MR	r1i1p1f1	5	1	yes	no	10.22033/ESGF/CMIP6.359
BCC-CSM2-MR	r1i1p1f1	3	1	no	yes	10.22033/ESGF/CMIP6.2948
BCC-ESM1	r1i1p1f1	3	0	no	yes	10.22033/ESGF/CMIP6.2949
CAMS-CSM1-0	r1i1p1f1	3	2	yes	yes	10.22033/ESGF/CMIP6.9754
CESM2	r1i1p1f1	11	1	yes	yes	10.22033/ESGF/CMIP6.7627
CESM2-WACCM	r1i1p1f1	3	1	yes	yes	10.22033/ESGF/CMIP6.10071
CESM2-WACCM-FV2	r1i1p1f1	1	0	yes	yes	10.22033/ESGF/CMIP6.11298
CNRM-CM6-1	r1i1p1f2	10	1	no	yes	10.22033/ESGF/CMIP6.4066
CNRM-CM6-1-HR	r1i1p1f2	1	1	yes	no	10.22033/ESGF/CMIP6.4067
CNRM-ESM2-1	r1i1p1f2	5	1	yes	yes	10.22033/ESGF/CMIP6.4068
CanESM5	r1i1p1f1	25	10	yes	no	10.22033/ESGF/CMIP6.3610
E3SM-1-0	r1i1p1f1	5	0	yes	no	10.22033/ESGF/CMIP6.4497
EC-Earth3	r1i1p1f1	14	13	yes	yes	10.22033/ESGF/CMIP6.4700
EC-Earth3-Veg	r1i1p1f1	4	3	yes	yes	10.22033/ESGF/CMIP6.4706
FGOALS-f3-L	r1i1p1f1	1	1	no	yes	10.22033/ESGF/CMIP6.3355
FIO-ESM-2-0	r1i1p1f1	3	3	yes	yes	10.22033/ESGF/CMIP6.9199
GFDL-CM4	r1i1p1f1	1	1	yes	yes	10.22033/ESGF/CMIP6.8594
GFDL-ESM4	r1i1p1f1	1	1	yes	yes	10.22033/ESGF/CMIP6.8597
GISS-E2-1-G	r1i1p1f1	10	0	yes	yes	10.22033/ESGF/CMIP6.7127
GISS-E2-1-G-CC	r1i1p1f1	1	0	yes	yes	10.22033/ESGF/CMIP6.11762
GISS-E2-1-H	r1i1p1f1	10	0	yes	yes	10.22033/ESGF/CMIP6.7128
HadGEM3-GC31-L1	r1i1p1f3	4	1	no	yes	n/a
HadGEM3-GC31-MM	r1i1p1f3	4	0	no	no	n/a
INM-CM4-8	r1i1p1f1	1	1	yes	no	10.22033/ESGF/CMIP6.5069
INM-CM5-0	r1i1p1f1	10	1	yes	no	10.22033/ESGF/CMIP6.5070
IPSL-CM6A-LR	r1i1p1f1	32	2	yes	yes	10.22033/ESGF/CMIP6.5195
MIROC-ES2L	r1i1p1f2	3	1	yes	no	10.22033/ESGF/CMIP6.5602
MIROC6	r1i1p1f1	10	3	yes	no	10.22033/ESGF/CMIP6.5603
MPI-ESM-1-2-HAM	r1i1p1f1	2	0	yes	yes	n/a
MPI-ESM1-2-HR	r1i1p1f1	10	2	yes	yes	10.22033/ESGF/CMIP6.6594
MPI-ESM1-2-LR	r1i1p1f1	10	10	yes	yes	10.22033/ESGF/CMIP6.6595
MRI-ESM2-0	r1i1p1f1	5	1	yes	yes	n/a
NESM3	r1i1p1f1	5	2	yes	no	10.22033/ESGF/CMIP6.8769
NorCPM1	r1i1p1f1	30	0	yes	no	http://cera-www.dkrz.de/WDCC/meta/CMIP6/CMIP6.CMIP.NCC.NorCPM1.historical
NorESM2-LM	r1i1p1f1	1	0	yes	no	http://cera-www.dkrz.de/WDCC/meta/CMIP6/CMIP6.CMIP.NCC.NorESM2-LM.historical
NorESM2-MM	r1i1p1f1	1	0	no	no	http://cera-www.dkrz.de/WDCC/meta/CMIP6/CMIP6.CMIP.NCC.NorESM2-MM.historical
SAM0-UNICON	r1i1p1f1	1	0	yes	yes	10.22033/ESGF/CMIP6.7789
UKESM1-0-LL	r1i1p1f2	12	5	yes	yes	10.22033/ESGF/CMIP6.6113

Table S2. CMIP3 and CMIP5 models included in this study.

CMIP3 models	CMIP5 models
bccr-bcm2-0	ACCESS1-0
cccma-cgcm3-1	ACCESS1-3
cccma-cgcm3-1-t63	BNU-ESM
cnrm-cm3	CCSM4
csiro-mk3-5	CESM1-BGC
gfdl-cm2-0	CESM1-CAM5
gfdl-cm2-1	CMCC-CM
giss-aom	CMCC-CMS
giss-model-e-r	CNRM-CM5
inmcm3-0	CSIRO-Mk3-6-0
ipsl-cm4	CanESM2
miroc3-2-hires	EC-EARTH
miroc3-2-medres	FGOALS-g2
miub-echo-g	FIO-ESM
mpi-echam5	GFDL-CM3
mri-cgcm2-3-2a	GFDL-ESM2G
ncar-ccsm3-0	GFDL-ESM2M
ukmo-hadcm3	GISS-E2-H
ukmo-hadgem1	GISS-E2-H-CC GISS-E2-R GISS-E2-R-CC HadGEM2-AO HadGEM2-CC HadGEM2-ES IPSL-CM5A-LR IPSL-CM5A-MR IPSL-CM5B-LR MIROC-ESM MIROC-ESM-CHEM MIROC5 MPI-ESM-LR MPI-ESM-MR MRI-CGCM3 NorESM1-M NorESM1-ME bcc-csm1-1 bcc-csm1-1-m inmcm4

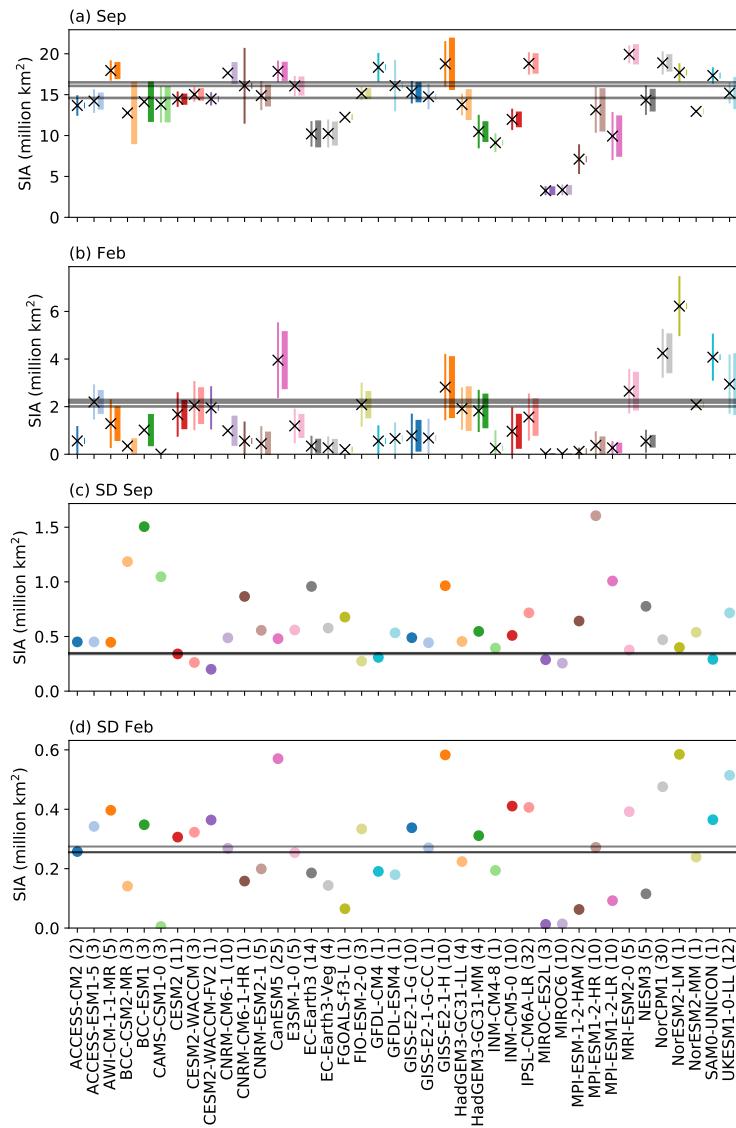


Figure S1. (a-b) 1979-2014 sea ice area in (a) September and (b) February for individual CMIP6 models. Crosses show the 1979-2014 mean; thin coloured vertical lines around the mean show two standard deviations from that model's control run; and thick coloured vertical boxes show two standard deviations across ensembles with three or more members, corrected for small sample size, for 1979-2014, if available. Horizontal grey lines show the 1979-2014 mean of each observational product. The number of ensemble members for each model is noted on the x-axis. (c-d) 1979-2014 sea ice area standard deviation in detrended sea ice area in (c) September and (d) February, representing inter-annual variability. Horizontal grey lines show the standard deviation across 1979-2014 from the three observational products.

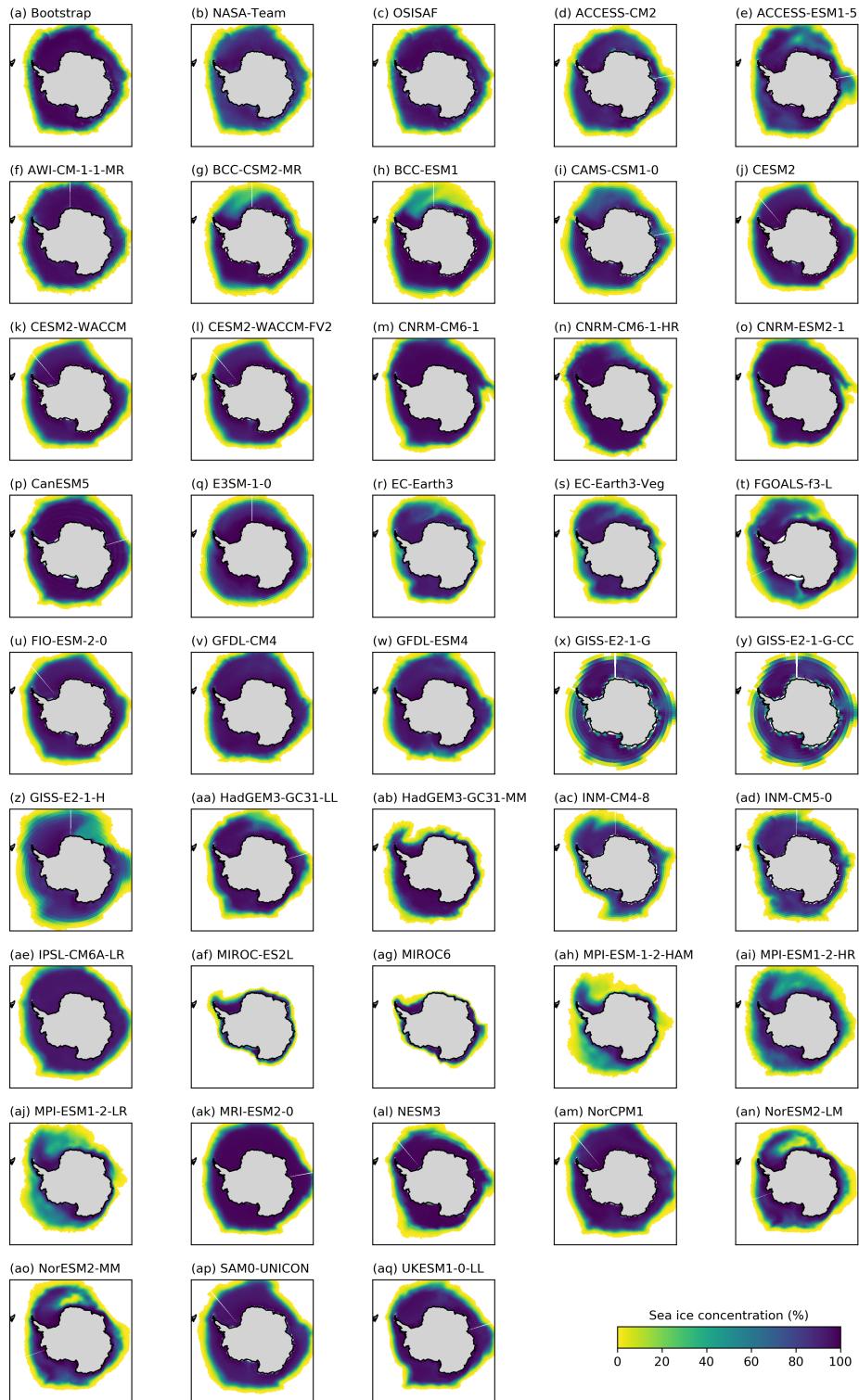


Figure S2. Mean 1979-2014 September sea ice concentration for CMIP6 r1 models and observations.

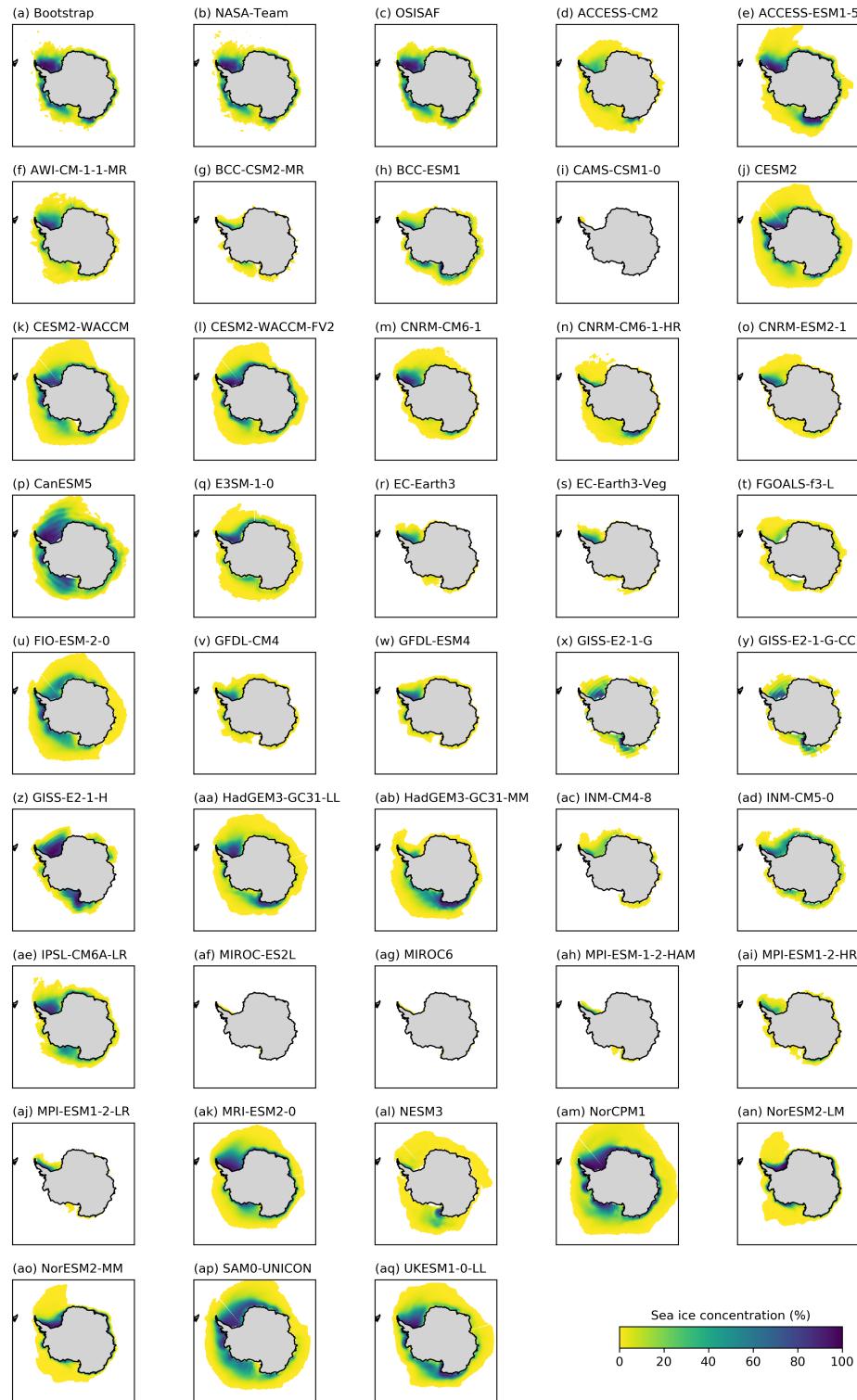


Figure S3. As Fig. S2 but for February.

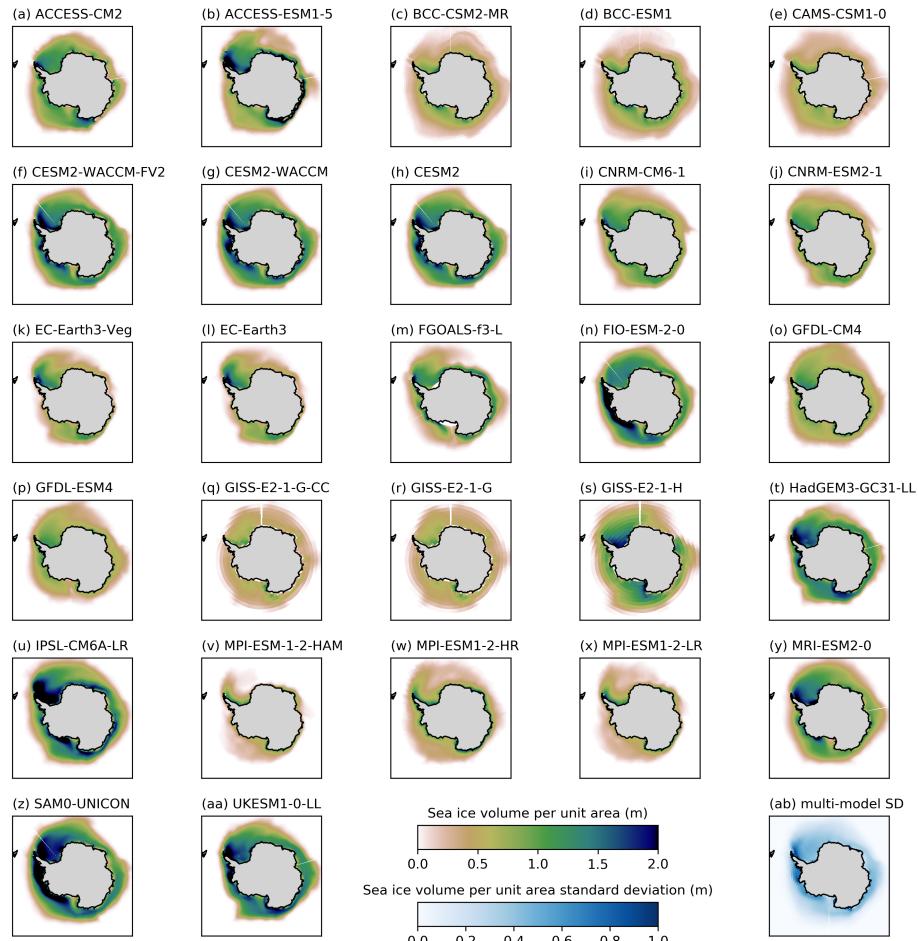


Figure S4. (a-aa) Mean 1979-2014 September sea ice volume per unit area for CMIP6 r1 models. (ab) The standard deviation of September sea ice volume per unit area across (a-aa).

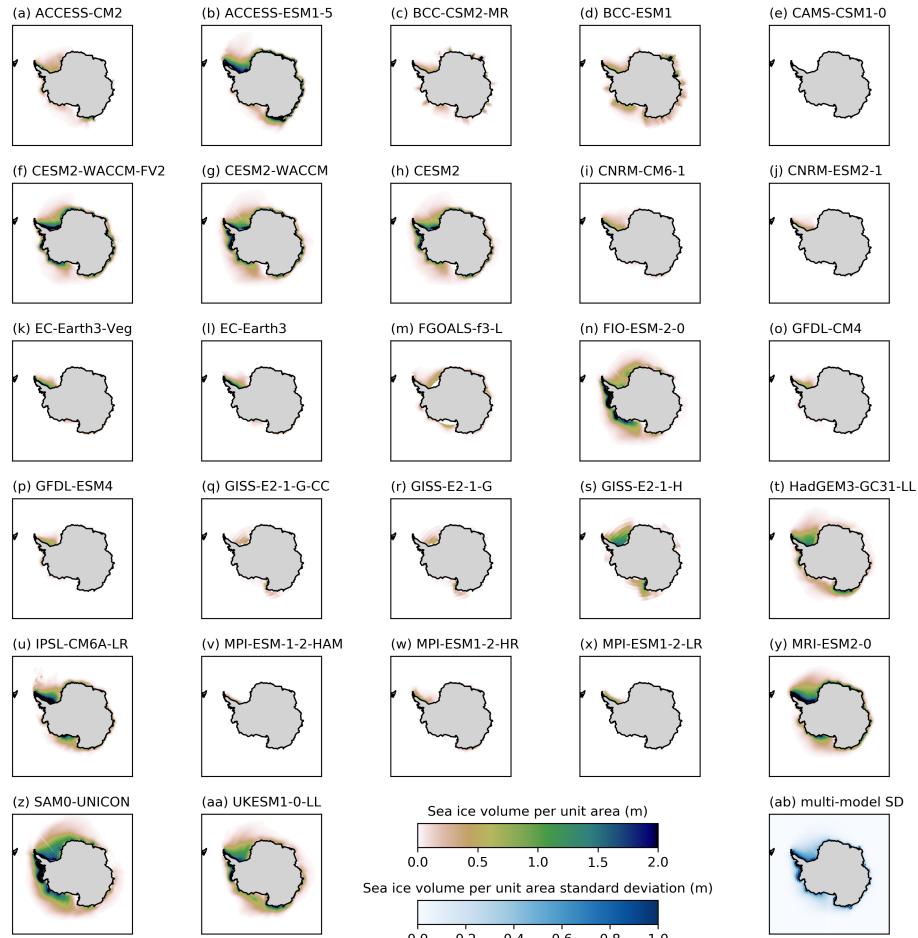


Figure S5. As Fig. S4 but for February.

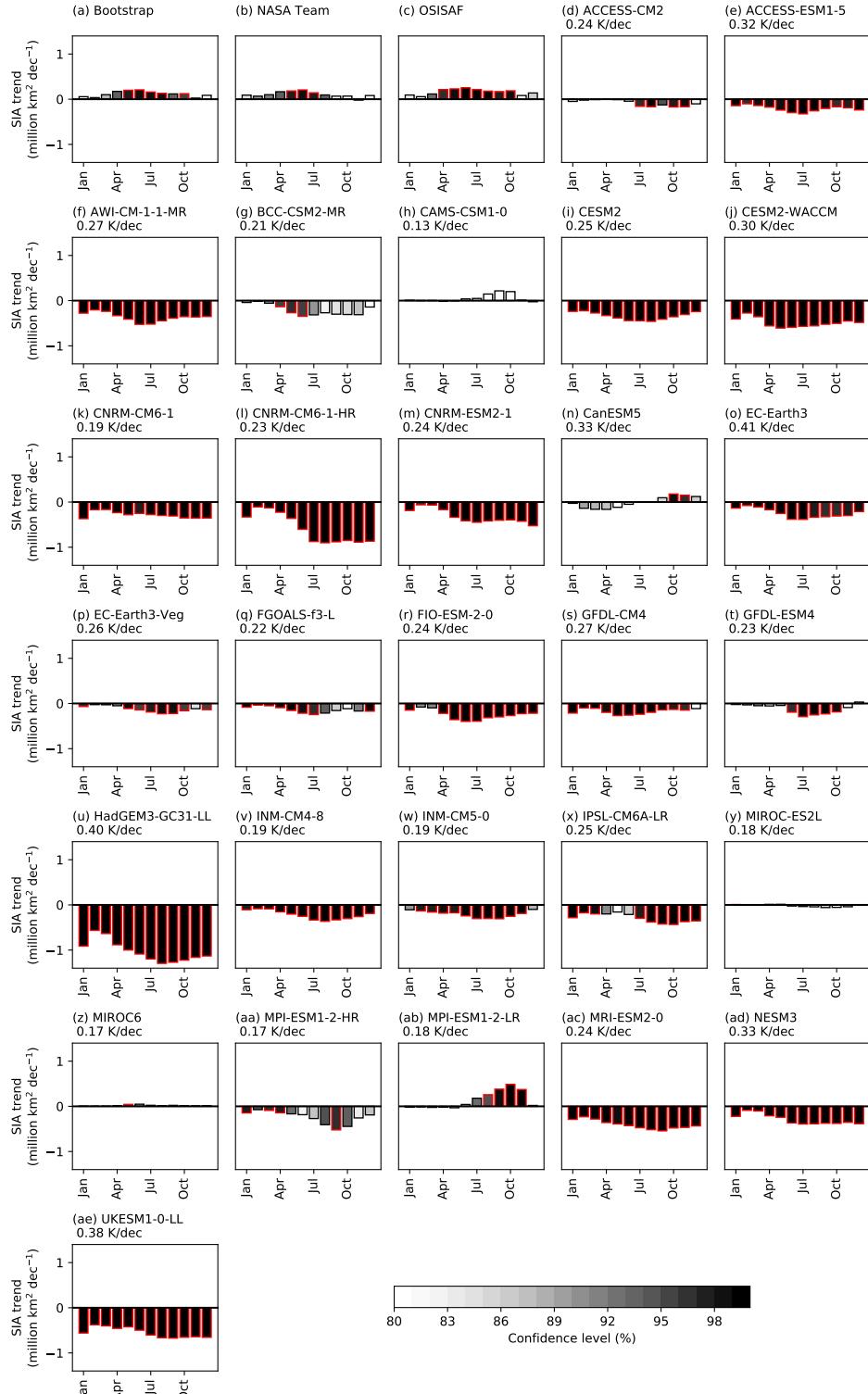


Figure S6. Trends in Antarctic sea ice area over 1979-2018 for each month for observations and CMIP6 r1 models as marked, calculated from a least-squares linear regression. The shading on the bars corresponds to the confidence level, from the two-sided p-value for a hypothesis test whose null hypothesis is that the slope is zero, with t-distribution of the test statistic. Linear regressions are outlined in red if they are statistically significant at the 95 % confidence level, black otherwise.

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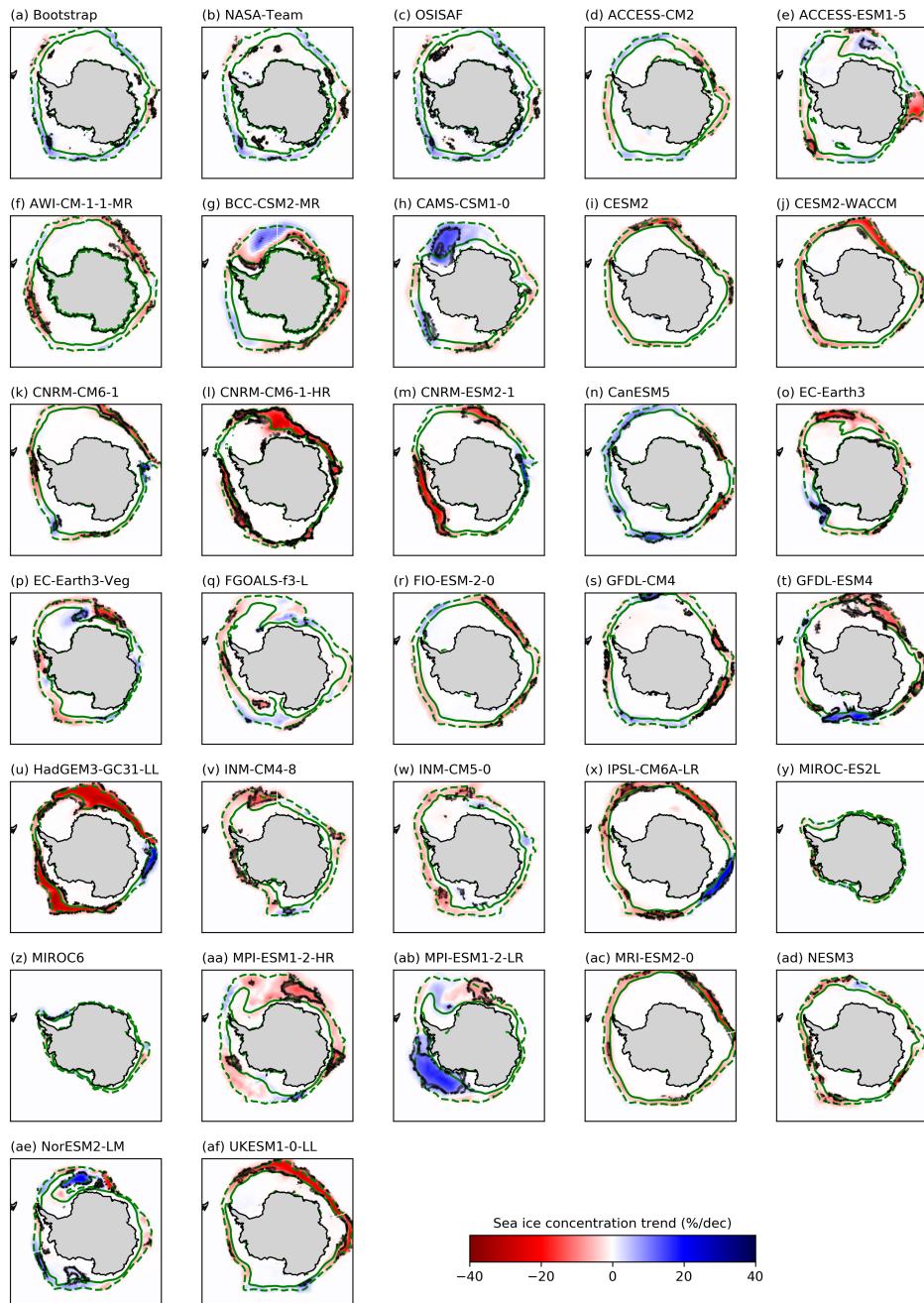


Figure S7. Linear trend in September sea ice concentration over 1979-2018 for CMIP6 models and observations, with trends significant at the 95 % confidence level contoured in black. Green contours show 15 and 80 % sea ice concentration.

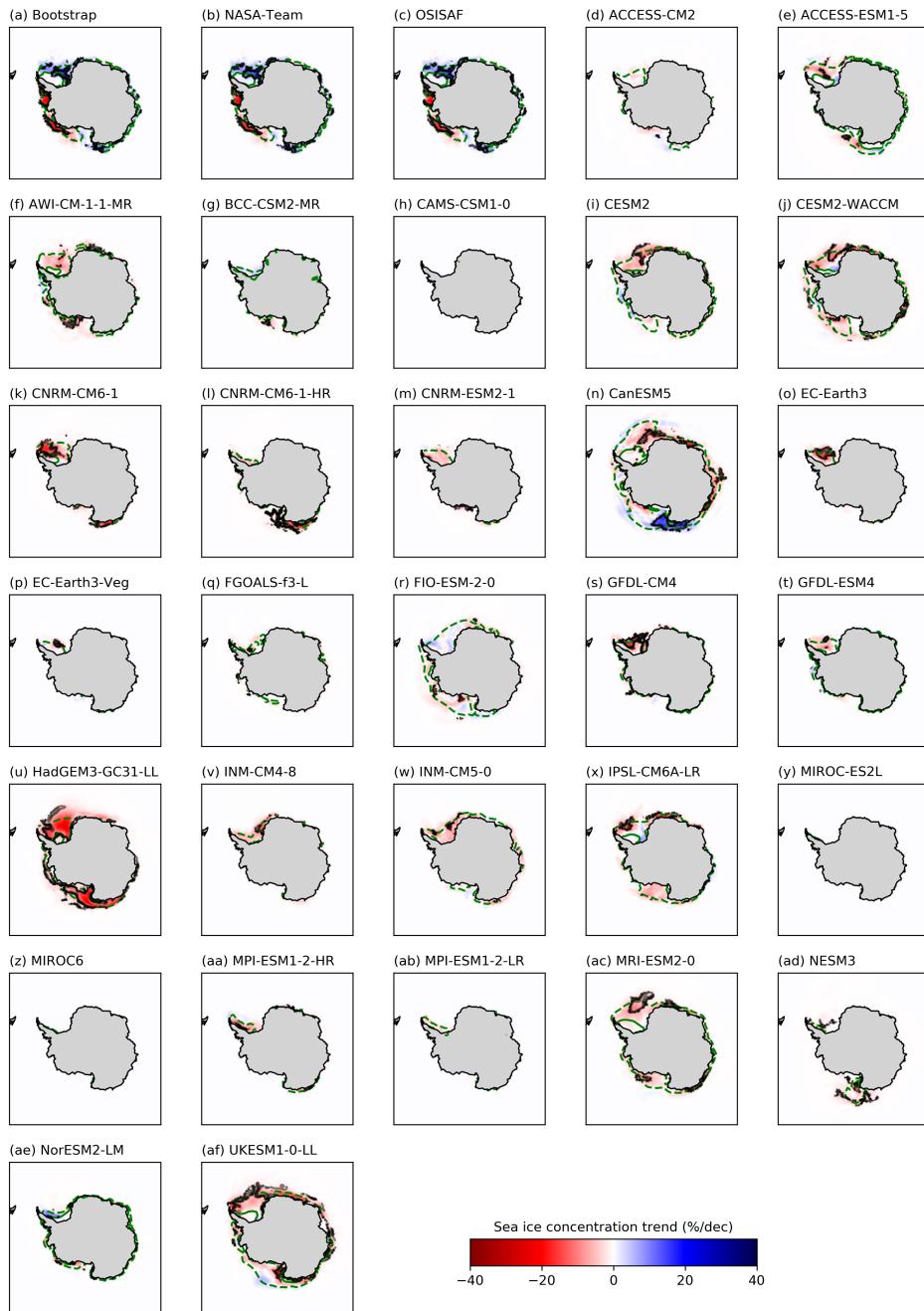


Figure S8. As Fig. S7 but for February.