
Supplementary information

**Projected ocean warming constrained by
the ocean observational record**

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Supplementary Information contains:

3 Tables

Supplementary Table 1 | CMIP6 and CMIP5 models used in this study and their Equilibrium Climate Sensitivity (ECS) values²⁵.

CMIP6			CMIP5		
No.	Model Name	ECS (K)	No.	Model Name	ECS (K)
A	ACCESS-CM2	4.66	1	ACCESS1-0	3.85
B	ACCESS-ESM1-5	3.88	2	ACCESS1-3	3.55
C	BCC-CSM2-MR	3.02	3	bcc-csm1-1	2.82
D	CAMS-CSM1-0	2.29	4	bcc-csm1-1-m	2.89
E	CanESM5	5.64	5	CanESM2	3.7
F	CESM2	5.15	6	CNRM-CM5	3.25
G	CESM2-WACCM	4.68	7	CSIRO-MK3-6-0	4.09
H	CIESM	5.67	8	EC-EARTH	
I	CMCC-CM2-SR5	3.55	9	GFDL-CM3	3.96
J	CNRM-CM6-1	4.90	10	GFDL-ESM2G	2.43
K	CNRM-ESM2-1	4.79	11	GFDL-ESM2M	2.44
L	EC-Earth3	4.26	12	GISS-E2-H	2.31
M	EC-Earth3-Veg	4.33	13	GISS-E2-H-CC	
N	FGOALS-f3-L	2.98	14	GISS-E2-R	2.12
O	FGOALS-g3	2.87	15	GISS-E2-R-CC	
P	FIO-ESM-2-0		16	IPSL-CM5A-LR	4.13
Q	GFDL-CM4	3.89	17	IPSL-CM5A-MR	4.11
R	GISS-E2-1-G	2.71	18	IPSL-CM5B-LR	2.61
S	HadGEM3-GC31-LL	5.55	19	MIROC5	2.71
T	IPSL-CM6A-LR	4.7	20	MIROC-ESM	4.65
U	MIROC6	2.6	21	MIROC-ESM-CHEM	
V	MIROC-ES2L	2.66	22	MRI-CGCM3	2.61
W	MPI-ESM1-2-HR	2.98	23	NorESM1-M	2.87
X	MPI-ESM1-2-LR	3.03			
Y	MRI-ESM2-0	3.13			
Z	NorESM2-LM	2.56			
a	NorESM2-MM	2.49			
b	UKESM1-0-LL	5.36			

Supplementary Table 2 | Eight observational datasets used in this study.

Name	Link	Institute
BOA_Argo ⁵²	ftp://data.argo.org.cn/pub/ARGO/BOA_Argo/	China Argo Real-time Data Center
IPRC	http://apdrc.soest.hawaii.edu/projects/Argo/data/gridded/On_stand_levels/index-1.html	International Pacific Research Center (IPRC)
ISAS ⁵³	https://www.seanoe.org/data/00412/52367/ https://resources.marine.copernicus.eu/?option=com_csw&view=details&product_id=INSITU_GLO_TS_OA_NRT_OBSERVATIONS_013_002_a	French Service National d'Observation Argo, Laboratory for Ocean Physics and remote Sensing
JAMSTEC ⁵⁴	http://www.jamstec.go.jp/ARGO/argo_web/argo/?page_id=83&lang=en	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Scripps ⁵⁵	http://sio-argo.ucsd.edu/RG_Climatology.html	Scripps Institution of Oceanography
IAP/CAS ⁵⁷	http://159.226.119.60/cheng/	Institute of Atmospheric Physics, Chinese Academy of Sciences
MRI/JMA ⁵⁸	https://www.data.jma.go.jp/gmd/kaiyou/english/ohc/ohc_global_en.html	Meteorological Research Institute, Japan Meteorological Agency
NCEI/NOAA ⁵⁹	https://www.nodc.noaa.gov/OC5/3M_HEAT_CONTENT/	National Centers for Environmental Information, NOAA

Supplementary Table 3 | Comparison between the likely ranges (17–83%) from original and constrained projections (2081–2100 relative to 2005–2019) of the global OHC increase (ZJ) and thermosteric sea level rise (cm) for the upper 2000 m of the ocean.

	SSP5-8.5/RCP8.5	SSP2-4.5/RCP4.5	SSP1-2.6/RCP2.6
CMIP6	1695–2417 (21.4–30.4)	1165–1651 (14.2–20.0)	849–1291 (9.9–15.6)
CMIP6 (constrained)	1546–2170 (17.4–25.9)	1045–1537 (11.3–18.0)	757–1209 (7.8–13.8)
CMIP6 (constrained without ENSO correction)	1591–2210 (18.1–26.6)	1076–1566 (11.7–18.5)	789–1240 (8.1–14.2)
CMIP5	1550–2110 (18.6–26.5)	965–1436 (11.1–17.2)	704–1168 (7.9–13.6)