Supporting information on "A global dust emission dataset for estimating dust radiative forcings in climate models"

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Table S1. Models from the Couple Model Intercomparison Project Phase 6 (CMIP6) used in this study.

Model name	Institute
CNRM-ESM2-1	Centre National de Recherches Météorologiques / Centre Européen de Recherche et Formation Avanwcée en Calcul Scientifique
CESM2-WACCM	NSF National Center for Atmospheric Research
CESM2	NSF National Center for Atmospheric Research
CanESM5	Canadian Centre for Climate Modelling and Analysis
GFDL-ESM4	NOAA Geophysical Fluid Dynamics Laboratory
GISS-E2-1-G	NASA Goddard Institute for Space Studies
GISS-E2-2-G	NASA Goddard Institute for Space Studies
HadGEM3-GC31-LL	Met Office Hadley Centre
INM-CM5-0	Institute for Numerical Mathematics
IPSL-CM6A-LR	Institut Pierre-Simon Laplace
MIROC-ES2H	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MIROC-ES2L	Japan Agency for Marine-Earth Science and Technology, Atmosphere and Ocean Research Institute (The University of Tokyo), and National Institute for Environmental Studies
MPI-ESM-1-2-HAM	Max Planck Institute
MRI-ESM2-0	Meteorological Research Institute
NorESM2-LM	Norwegian Climate Centre
TaiESM1	Academia Sinica
UKESM1-0-LL	Natural Environment Research Council, and Met Office

Table S2. Default and modified dust refractive indices for shortwave (SW) bands in the RRTMG radiative transfer model in the CESM2. The modified dust refractive indices are from Di Biagio et al. (2020).

Wavenumber (cm^{-1})	Wavelength (nm)	Default CAM6 dust real refractive index	Modified dust real refractive index in this study	Default CAM6 dust imaginary refractive index	Modified dust imaginary refractive index in this study
820–2600	3846–12195	1.18		–0.101	
2600–3250	3076–3846	1.51		–0.0184	
3250–4000	2500–3076	1.52		–0.0284	
4000–4650	2150–2500	1.54		–0.00736	
4650–5150	1942–2150	1.56		–0.0007	
5150–6150	1626–1942	1.56		–0.0007	
6150–7700	1298–1626	1.56		–0.000771	
7700–8050	1242–1298	1.56		–0.000870	
8050–12850	778–1242	1.56	1.52	–0.001	–0.0006
12850–16000	625–778	1.56	1.52	–0.00125	–0.0006
16000–22650	442–625	1.56	1.52	–0.00195	–0.0014
22650–29000	345–442	1.56	1.52	–0.00415	–0.0019
29000–38000	263–345	1.56	1.52	–0.0055	–0.0026
38000–50000	200–263	1.56	1.52	–0.0055	–0.0026

Table S3. Pearson correlation coefficients between the decadal dust depositions fluxes from the sedimentary and ice core records and from the CESM2–L23 and the CESM2–DustCOMM runs.

	CESM2–L23	CESM2–DustCOMM
NEGIS	0.12	–0.24
GISP2	0.20	–0.20
X20D	–0.22	0.61
Mount Logan	0.03	0.22
Motianling	–0.37	0.80
Pt. d Escuminac	0.19	0.91
Dasuopo	–0.20	0.28
Mt. Everest 1	–0.15	0.81
Mt. Everest 2	–0.11	0.68
Mauritania Canyon	–0.14	0.79
Snowy Mountains	–0.15	0.85
Law. Dome	–0.06	–0.17
Siple Station	0.04	–0.07
James Ross Island	–0.09	0.66
San Juan Lakes	0.35	–0.52
Andros Island	–0.09	–0.13
Colle Gnifetti	0.08	0.68
Lake Bastani	–0.15	–0.46
Sal. Island	–0.33	0.97
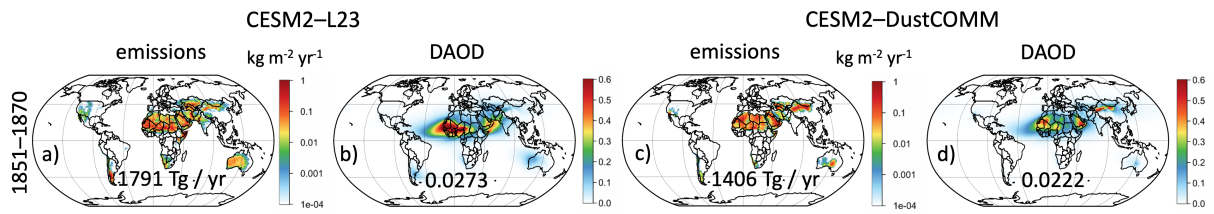
Figure S1. The CESM2 dust cycle simulation using the Leung et al. (2023; L23) dust emission scheme and the DustCOMMv1 emission dataset derived in this study. (a-b) The CESM2–L23 simulated emissions and DAOD maps averaged across 1851–1870, and (c-d) same maps but for the CESM2–DustCOMM run.