

Table 3. Global dust budgets in CMIP5 models. The models are classified into three groups according to the dust size range considered. Also included for comparison is the MERRA-2 reanalysis.

Model	Size (diameter, μm)	Emission ^a (Tg yr^{-1})	Wet deposition ^b (Tg yr^{-1})	Burden (Tg)	Lifetime (day)
ACCESS1-0		2218 (13 %)	261 (12 %)	8.1	1.3
HadGEM2-CC	0.06–63	8186 (11 %)	1521 (19 %)	41.9	1.9
HadGEM2-ES		7972 (10 %)	1429 (18 %)	41.4	1.9
GFDL-CM3		1246 (10 %)	210 (17 %)	13.5	4.0
MIROC4h		735 (2.9 %)	179 (24 %)	2.5	1.4
MIROC5		2716 (6.1 %)	668 (25 %)	19.0	3.0
MIROC-ESM	0.2–20	3339 (5.2 %)	540 (16 %)	15.5	2.0
MIROC-ESM-CHEM		3598 (5.2 %)	591 (16 %)	16.7	2.0
MRI-CGCM3		2107 (5.9 % TS2)	819 (39 %)	14.3	2.5
MRI-ESM1		2052 (6.1 %)	801 (39 %)	13.9	2.5
CanESM2 ^c	Median (0.78, 3.8)	2964 (18 %)	882 (30 %)	35.8	4.4
CESM1-CAM5	0.1–10	3454 (2.0 %)	1243 (36 %)	24.9	2.6
CSIRO-Mk3-6-0	0.2–12	3698 (8.9 %)	1024 (28 %)	36.1	3.6
GISS-E2-H	<2 to 16	1699 (8.2 %)	641 (38 %)	17.5	3.8
GISS-E2-R	<2 to 16	1677 (8.2 % TS3)	625 (37 %)	16.9	3.7
MERRA-2 ^d	0.2–20	1620 (7.4 %)	692 (38.6 %)	20.3	4.1

^a The global dust emission area fraction is given in parentheses next to the global dust emission. The dust emission area is defined as the region with an annual mean dust emission flux larger than 1 % of the global mean annual dust emission flux. ^b The ratio of wet deposition to total deposition is given in parentheses next to wet deposition. ^c Using two modes, CanESM2 represents more than 97 % of dust mass for particles smaller than 16 μm (in diameter). Therefore, CanESM2 is put into the third group. ^d The global dust deposition is **TS4** 1692 Tg, which is larger than dust emission because no adjustment was done with dust emission after aerosol assimilation (Sect. 2).

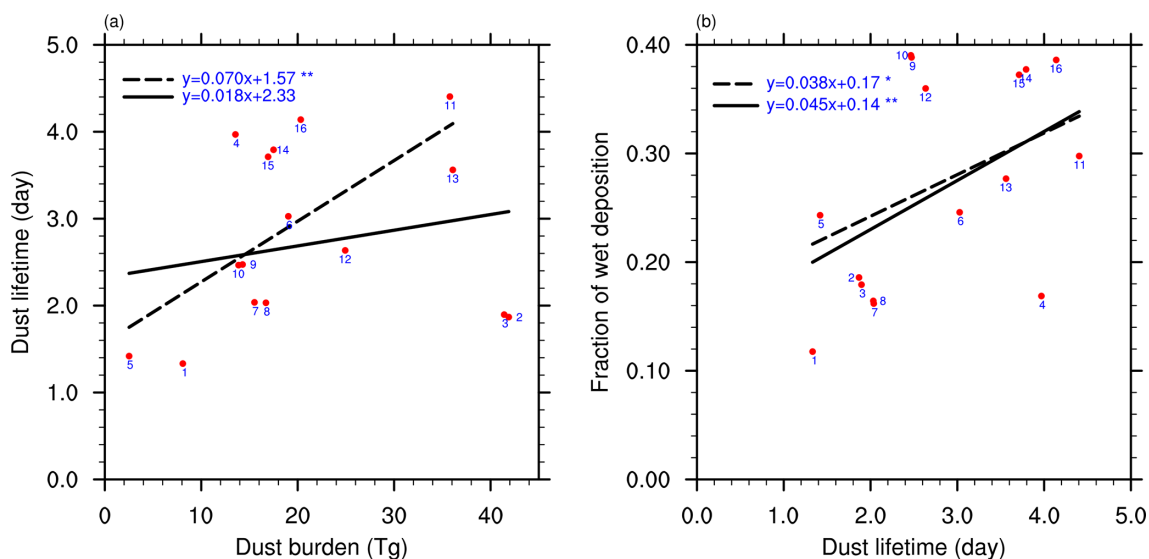


Figure 2. Scatter plot of (a) dust burden versus dust lifetime and (b) dust lifetime versus the fraction of wet deposition to total deposition in 15 CMIP5 models and in the MERRA-2 reanalysis. The models are indexed in Table 1. The regression lines from all the CMIP5 models (solid) and the CMIP5 models excluding HadGEM2-CC and HadGEM2-ES (dashed) are also shown with the slopes and intercepts for the regression equation. The significance test for each regression is denoted by one asterisk (*; above significant level of 0.1) or two asterisks (**; above significant level of 0.05) after each regression equation.

Table 4. Dust emission amount (Tg) in nine dust source regions. The contribution of each source region to global total dust emission is given in the parentheses next to the dust emission amount.

No.	Models	Global	North Africa	Middle East	Central Asia	South Asia	East Asia	Australia	North America	South America	Southern Africa
1	ACCESS1-0	2218	1097 (49.5 %)	356 (16.1 %)	95 (4.3 %)	159 (7.2 %)	132 (6.0 %)	254 (11.4 %)	49 (2.2 %)	46 (2.1 %)	21 (1.0 %)
2	HadGEM2-CC	8186	3124 (38.2 %)	593 (7.2 %)	403 (4.9 %)	826 (10.1 %)	359 (4.4 %)	2278 (27.8 %)	264 (3.2 %)	196 (2.4 %)	142 (1.7 %)
3	HadGEM2-ES	7973	3221 (40.4 %)	579 (7.3 %)	418 (5.2 %)	820 (10.3 %)	321 (4.0 %)	1988 (24.9 %)	340 (4.3 %)	144 (1.8 %)	139 (1.7 %)
4	GFDL-CM3	1246	749 (60.1 %)	150 (12.1 %)	68 (5.4 %)	41 (3.3 %)	113 (9.1 %)	52 (4.2 %)	5 (0.4 %)	44 (3.6 %)	19 (1.5 %)
5	MIROC4h	735	437 (59.4 %)	71 (9.7 %)	81 (11.1 %)	45 (6.1 %)	64 (8.8 %)	9 (1.2 %)	0.1 (0.02 %)	3 (0.5 %)	24 (3.2 %)
6	MIROC5	2716	1762 (64.9 %)	269 (9.9 %)	175 (6.5 %)	96 (3.5 %)	243 (8.9 %)	26 (1.0 %)	4 (0.2 %)	79 (2.9 %)	61 (2.2 %)
7	MIROC-ESM	3339	627 (78.7 %)	244 (7.3 %)	72 (2.2 %)	30 (0.9 %)	273 (8.2 %)	0.6 (0.02 %)	0.3 (0.008 %)	89 (2.6 %)	6 (0.2 %)
8	MIROC-ESM-CHEM	3598	2719 (75.6 %)	274 (7.6 %)	84 (2.3 %)	44 (1.2 %)	362 (10.1 %)	1 (0.03 %)	0.4 (0.01 %)	100 (2.8 %)	13 (0.4 %)
9	MRI-CGCM3	2107	1146 (54.4 %)	258 (12.2 %)	22 (1.1 %)	174 (8.3 %)	390 (18.5 %)	55 (2.6 %)	2 (0.09 %)	49 (2.3 %)	11 (0.5 %)
10	MRI-ESM1	2052	1108 (54.0 %)	246 (12.0 %)	21 (1.0 %)	167 (8.1 %)	392 (19.1 %)	57 (2.8 %)	2 (0.09 %)	48 (2.3 %)	10 (0.5 %)
11	CanESM2	2964	1053 (35.5 %)	415 (14.0 %)	323 (10.9 %)	99 (3.3 %)	151 (5.1 %)	218 (7.3 %)	133 (4.5 %)	365 (12.3 %)	96 (3.2 %)
12	CESM1-CAM5	3454	1609 (46.6 %)	698 (20.2 %)	495 (14.3 %)	122 (3.5 %)	329 (9.5 %)	38 (1.1 %)	35 (1.0 %)	26 (0.7 %)	101 (2.9 %)
13	CSIRO-Mk3-6-0	3698	1863 (50.4 %)	555 (15.0 %)	122 (3.3 %)	160 (4.3 %)	589 (15.9 %)	143 (3.9 %)	23 (0.6 %)	138 (3.7 %)	106 (2.9 %)
14	GISS-E2-H	1699	1045 (61.5 %)	252 (14.8 %)	109 (6.4 %)	96 (5.7 %)	94 (5.5 %)	71 (4.2 %)	4 (0.3 %)	22 (1.3 %)	5 (0.3 %)
15	GISS-E2-R	1678	1035 (61.7 %)	238 (14.2 %)	92 (5.5 %)	90 (5.4 %)	103 (6.1 %)	86 (5.1 %)	4 (0.2 %)	23 (1.4 %)	5 (0.3 %)
16	MERRA-2	1670	1104 (61.1 %)	182 (16.2 %)	56 (7.7 %)	55 (3.1 %)	162 (6.3 %)	59 (2.6 %)	8 (0.5 %)	30 (1.7 %)	15 (0.7 %)

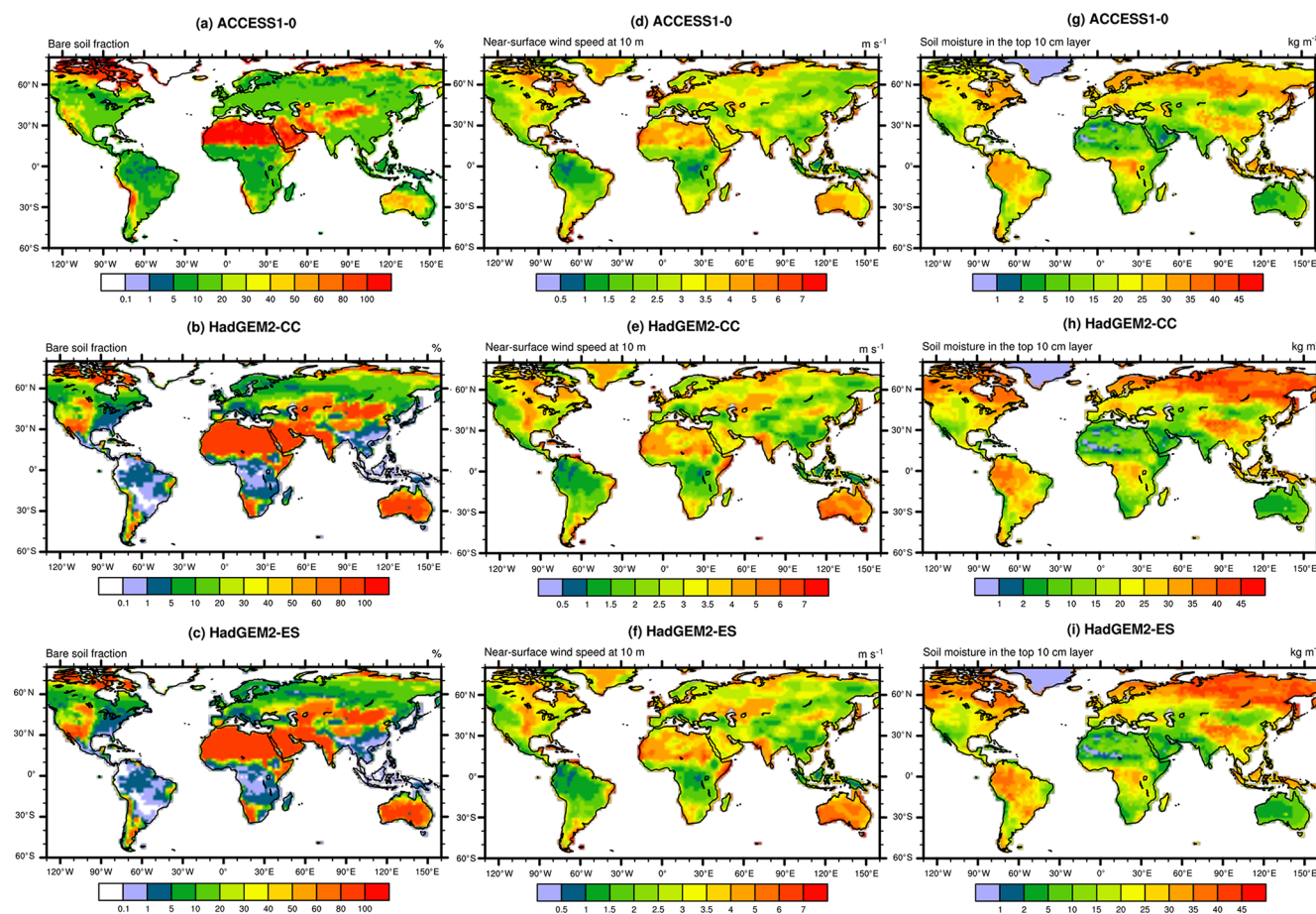


Figure 4. Bare-soil fraction (%), near-surface wind speed at 10 m over land (m s^{-1}), and soil moisture in the top 10 cm layer (kg m^{-2}) in ACCESS1-0, HadGEM2-CC, and HadGEM2-ES. Note that except for the bare-soil fraction in ACCESS1-0, which is prescribed and set constant for each year, the other results are all from model simulations during 1960–2005.