



Supplement of

What controls the vertical distribution of aerosol? Relationships between process sensitivity in HadGEM3–UKCA and inter-model variation from AeroCom Phase II

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Table S1: Annual and global mean mass mixing ratio of sulphate (in ng kg^{-1}) at 200, 300, 500, 700 and 800 hPa, and at the closest model level to the surface, from the AeroCom models.

$\text{SO}_4 / \text{ng kg}^{-1}$	200 hPa	300 hPa	500 hPa	700 hPa	800 hPa	surf.
CAM4–Oslo	356	348	339	423	528	725
CAM5.1	150	156	153	296	431	686
CanAM4–PAM	105	140	244	493	669	1077
EMAC	76	116	233	481	585	696
ECHAM5–SALSA	104	74	165	540	808	618
GEOS–Chem–APM	151	211	314	608	726	1410
GISS–MATRIX	123	154	226	379	537	868
GISS–modelE	152	151	198	281	357	612
GLOMAP–bin	154	187	268	741	1059	1116
GLOMAP–mode	141	138	207	660	993	1068
GOCART	92	129	239	498	704	839
HadGEM2	34	53	166	454	597	772
HadGEM3–UKCA	341	344	338	300	286	264
INCA	345	212	210	384	521	692
ECHAM5–HAM	413	172	217	696	1117	1182
OsloCTM2	261	307	438	523	534	507
SPRINTARS	314	125	102	272	462	1228
TM5	59	148	288	465	568	690
Multi-model mean	187	176	241	472	638	836
st. dev.	118	83	80	142	231	290

Table S2: Annual and global mean mass mixing ratio of sea-salt (in ng kg^{-1}) at 200, 300, 500, 700 and 800 hPa, and at the closest model level to the surface, from the AeroCom models. Due to outliers and the skewed distribution, the standard deviation is larger than the mean in some cases despite all values being positive.

SS / ng kg^{-1}	200 hPa	300 hPa	500 hPa	700 hPa	800 hPa	surf.
CAM4-Oslo	58	107	303	722	1344	11610
CAM5.1	173	229	344	1001	3266	12092
CanAM4-PAM	2	12	52	229	880	9540
EMAC	22	48	159	480	1134	8821
ECHAM5-SALSA	12	18	84	1382	5452	13243
GEOS-Chem-APM	2	12	59	242	720	9101
GISS-MATRIX	1	14	119	436	1550	10611
GISS-modelE	1	24	223	740	2627	18239
GLOMAP-bin	0	5	36	924	2052	7266
GLOMAP-mode	8	18	103	990	2062	6338
GOCART	8	63	333	1232	3320	15341
HadGEM2	—	—	—	—	—	—
HadGEM3-UKCA	112	153	158	247	396	5963
INCA	356	848	1508	2493	4203	34275
ECHAM5-HAM	78	71	133	1143	5692	14530
OsloCTM2	56	117	403	1902	3685	9037
SPRINTARS	32	19	21	63	268	5959
TM5	18	152	415	1112	2441	7516
Multi-model mean	55	112	262	902	2417	11734
st. dev.	91	200	346	636	1660	6782

Table S3: Annual and global mean mass mixing ratio of black carbon (in ng kg^{-1}) at 200, 300, 500, 700 and 800 hPa, and at the closest model level to the surface, from the AeroCom models.

BC / ng kg^{-1}	200 hPa	300 hPa	500 hPa	700 hPa	800 hPa	surf.
CAM4–Oslo	48.0	44.3	38.9	46.5	57.1	86.0
CAM5.1	6.4	6.0	6.1	21.5	34.0	75.3
CanAM4–PAM	2.7	8.4	15.4	46.1	69.1	128.4
EMAC	10.9	17.1	31.0	54.8	64.2	143.9
ECHAM5–SALSA	1.8	3.5	11.4	29.6	35.7	75.1
GEOS–Chem–APM	13.8	14.2	14.5	27.9	42.2	72.2
GISS–MATRIX	0.5	2.0	4.9	18.5	32.3	81.6
GISS–modelE	21.1	13.9	11.9	22.6	37.1	90.0
GLOMAP-bin	6.6	7.4	10.5	36.3	50.1	88.4
GLOMAP-mode	5.6	7.1	9.9	33.1	45.5	74.9
GOCART	19.2	24.6	27.3	41.5	56.4	88.4
HadGEM2	30.7	38.1	43.7	57.0	68.9	118.8
HadGEM3–UKCA	12.6	14.1	12.3	18.0	27.7	91.0
INCA	27.2	17.5	14.3	30.3	46.8	79.6
ECHAM5–HAM	6.8	2.7	5.6	39.6	57.7	117.4
OsloCTM2	14.7	19.7	32.4	41.1	40.9	81.0
SPRINTARS	19.9	10.5	10.4	36.3	56.4	104.8
TM5	9.2	17.4	26.0	41.2	53.1	111.8
Multi-model mean	14.3	14.9	18.1	35.7	48.6	94.9
st. dev.	12.0	11.5	11.9	11.5	12.6	21.0

Table S4: Annual and global mean mass mixing ratio of organic aerosol (in ng kg^{-1}) at 200, 300, 500, 700 and 800 hPa, and at the closest model level to the surface, from the AeroCom models. Due to outliers and the skewed distribution, the standard deviation is larger than the mean in some cases despite all values being positive.

OA / ng kg^{-1}	200 hPa	300 hPa	500 hPa	700 hPa	800 hPa	surf.
CAM4-Oslo	779	716	629	754	944	1400
CAM5.1	204	186	174	411	611	1354
CanAM4-PAM	17	55	98	375	592	941
EMAC	105	156	271	479	545	1142
ECHAM5-SALSA	12	21	79	379	489	669
GEOS-Chem-APM	273	250	242	457	614	771
GISS-MATRIX	9	26	53	182	294	608
GISS-modelE	367	236	104	228	420	1278
GLOMAP-bin	35	53	91	305	413	692
GLOMAP-mode	33	42	69	264	360	551
GOCART	—	—	—	—	—	—
HadGEM2	5	8	18	49	70	158
HadGEM3-UKCA	125	137	112	146	218	521
INCA	333	211	157	305	471	614
ECHAM5-HAM	329	43	36	285	417	572
OsloCTM2	110	202	423	518	470	724
SPRINTARS	136	57	64	425	682	765
TM5	57	128	201	329	423	834
Multi-model mean	172	149	166	347	473	800
st. dev.	199	167	157	162	195	330

Table S5: Annual and global mean mass mixing ratio of mineral dust (in ng kg^{-1}) at 200, 300, 500, 700 and 800 hPa, and at the closest model level to the surface, from the AeroCom models.

DU / ng kg^{-1}	200 hPa	300 hPa	500 hPa	700 hPa	800 hPa	surf.
CAM4–Oslo	558	828	1152	3059	4520	14202
CAM5.1	324	553	1348	6954	11449	23022
CanAM4–PAM	389	1229	2431	7609	9992	26214
EMAC	198	490	1235	3621	4846	16840
ECHAM5–SALSA	182	273	1837	10405	13872	13518
GEOS–Chem–APM	114	629	1596	9645	13808	21597
GISS–MATRIX	80	571	2530	9545	12442	14503
GISS–modelE	467	775	1731	6640	9236	12761
GLOMAP-bin	—	—	—	—	—	—
GLOMAP-mode	14	75	431	4701	5936	10493
GOCART	241	1695	4983	13305	16530	23270
HadGEM2	1718	2317	2705	6937	9748	13342
HadGEM3–UKCA	589	1249	2112	8421	11232	22537
INCA	1200	1219	2632	7820	9953	15232
ECHAM5–HAM	162	147	574	3723	5065	7220
OsloCTM2	—	—	—	—	—	—
SPRINTARS	638	574	1253	4878	6133	7190
TM5	314	937	1722	4574	5594	13171
Multi-model mean	449	848	1892	6990	9397	15945
st. dev.	445	587	1071	2845	3727	5796