

JAMES

Supporting Information for

Influence of more mechanistic representation of particle dry deposition on 1850-to-2000 changes in global aerosol burdens and radiative forcing

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Introduction

The supporting information includes figures providing information on model performance for aerosol deposition velocities for the OMA configuration of ModelE, how aerosol deposition velocities change from 1850 to 2000 for different aerosol species, aerosol dry deposition schemes, and aerosol configurations of ModelE, and how 1850-to-2000 changes in Aitken mode particles and deposition velocities change with the dry deposition scheme in the MATRIX configuration of ModelE. The supporting information also includes tables providing information on direct and indirect effect changes in MATRIX and OMA for 1850 and 2000 and the new vs. old dry deposition scheme.

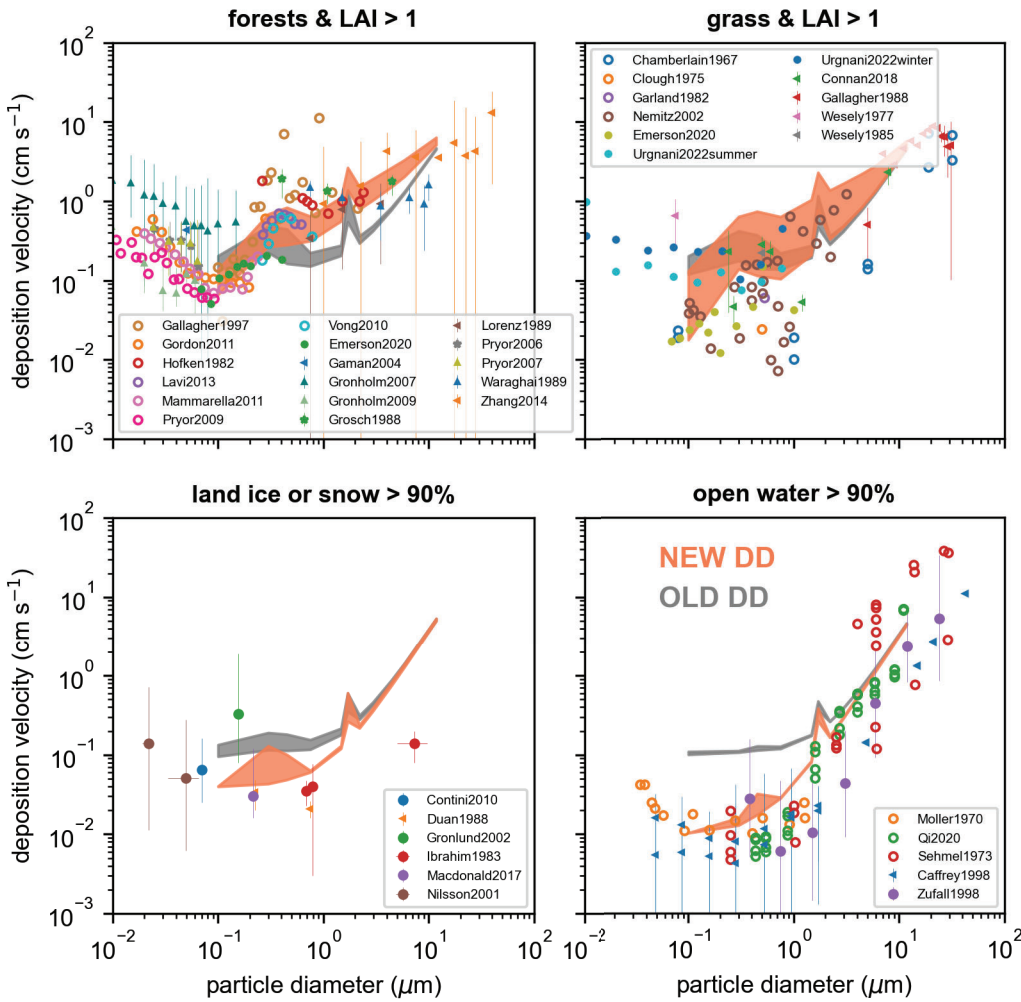


Figure S1. Deposition velocity as a function of particle diameter for observations and ModelE (both old and new DD). For ModelE, the interquartile spread of multiyear monthly averages across all particles binned over geometric space are shown from 2000 OMA simulations. All global values for a given condition (indicated on subpanel title) are included. For the top two panels, the deposition velocities specific to forests or grasslands in the grid box are used. The observations (symbols) are collated from the peer-reviewed literature by Farmer et al. (2021).

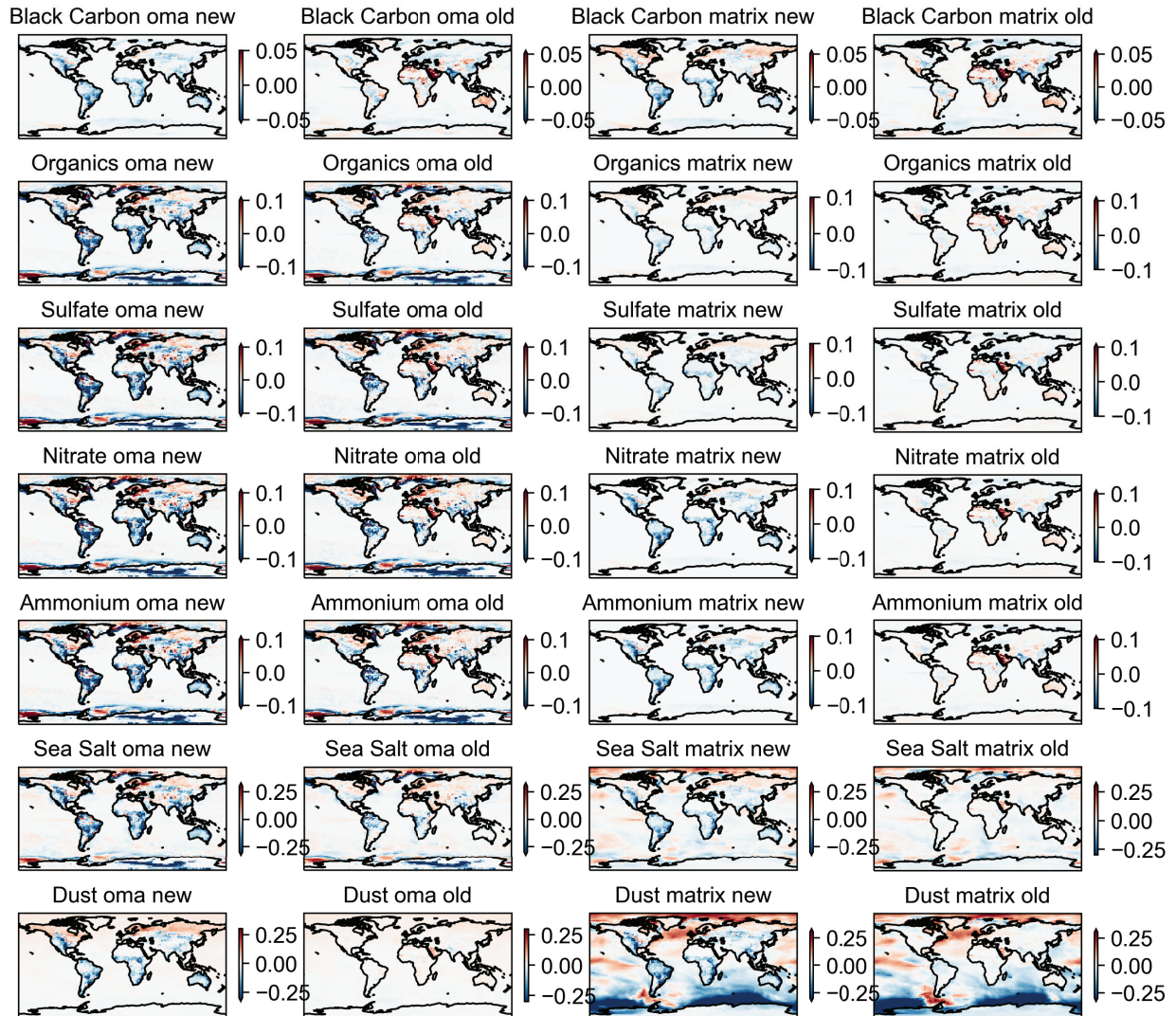


Figure S2. Species-specific deposition velocity (cm s^{-1}) changes from 1850 to 2000 for OMA (columns 1-2) and MATRIX (columns 3 and 4) for old DD (columns 2 and 4) and the new DD (columns 1 and 3). Species-specific deposition velocities are weighted by surface concentrations of the individual components of each species, so that they emphasize the components with the largest ambient concentrations.

[new DD matrix 2000-1850] - [old DD matrix 2000-1850]

$1e-6$

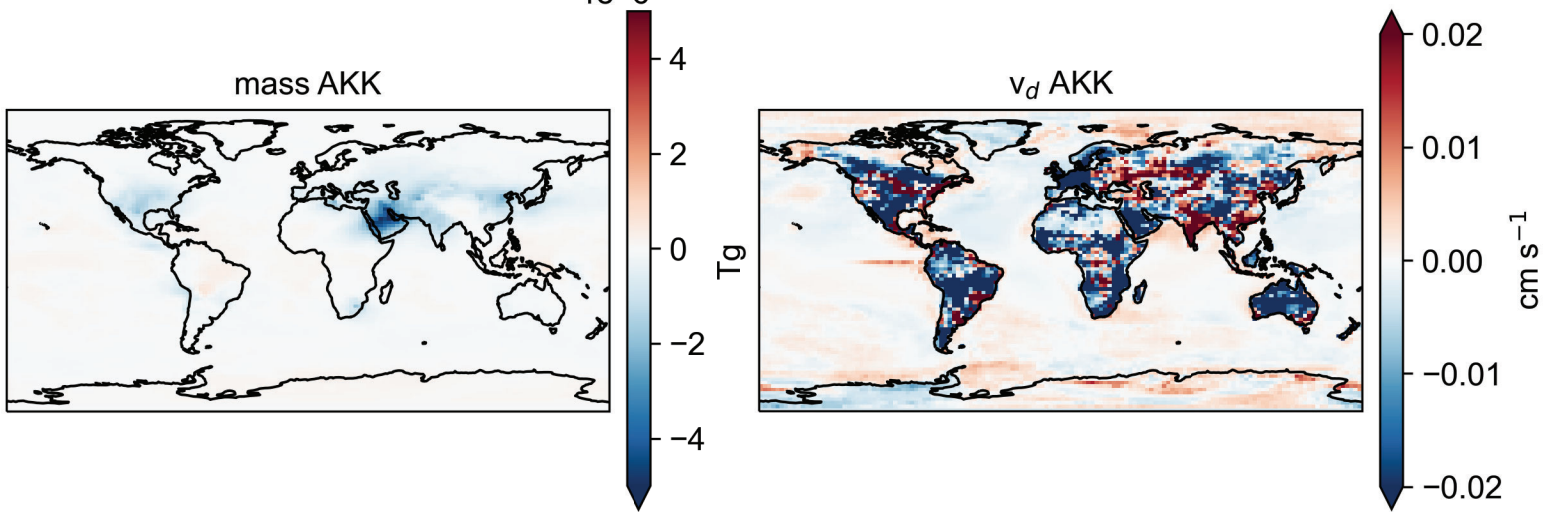


Figure S3. Changes in 1850-to-2000 annual mean mass concentrations and deposition velocities (v_d) with new DD for the Aitken mode (AKK) MATRIX aerosol populations.

		aerosol direct iRF	SW component	LW component
MATRIX	old dd 2000	-1.05	-1.30	0.25
	old dd 1850	-0.73	-0.94	0.22
	new dd 2000	-1.04	-1.33	0.30
	new dd 1850	-0.75	-1.00	0.25
	new-old, 2000	0.01	-0.03	0.05
	new-old, 1850	-0.03	-0.06	0.03
OMA	old dd 2000	-2.07	-2.35	0.28
	old dd 1850	-1.50	-1.78	0.27
	new dd 1850	-1.68	-2.00	0.33
	new dd 2000	-2.28	-2.61	0.33
	new-old, 2000	-0.21	-0.26	0.05
	new-old, 1850	-0.17	-0.23	0.05

Table S1. The shortwave (SW) and longwave (LW) components of the instantaneous radiative forcing (iRF) corresponding to the aerosol direct effect at 2000 and 1850 for OMA and MATRIX old and new dry deposition schemes. Changes between the old and new dry deposition schemes at 1850 and 2000 are also shown. All variables in $W\ m^{-2}$.

		CDNC (cm ⁻³)	Cloud optical depth (unitless)	Liquid water path (g m ⁻²)	Total cloud cover (%)
MATRIX	old dd 2000	54.19	21.29	137.19	66.10
	old dd 1850	42.42	20.28	133.86	66.08
	new dd 2000	59.37	21.59	137.12	66.19
	new dd 1850	46.53	20.56	133.63	66.12
	new-old, 2000	5.18	0.31	-0.07	0.09
	new-old, 1850	4.11	0.28	-0.24	0.04
	2000-1850, old	11.76	1.01	3.33	0.02
	2000-1850, new	12.84	1.03	3.50	0.08
OMA	old dd 2000	69.57	20.76	130.73	64.11
	old dd 1850	47.14	19.63	127.69	64.04
	new dd 2000	74.41	20.93	130.51	63.99
	new dd 1850	50.16	19.74	127.38	63.87
	new-old, 2000	4.84	0.16	-0.22	-0.12
	new-old, 1850	3.02	0.11	-0.30	-0.17
	2000-1850, old	22.43	1.13	3.04	0.07
	2000-1850, new	24.25	1.19	3.12	0.12

Table S2. Variables related to clouds at 2000 and 1850 for OMA and MATRIX old and new dry deposition schemes. Changes from 1850 to 2000 as well as differences between the old and new dry deposition schemes at 1850 and 2000 are also shown.