

Table S1. Fitted parameters of the exponential deposition model for each wind-speed-size combination.

Wind speed (m s <sup>-1</sup> )	Particle size (μm)	<i>a</i> (mg·cm <sup>-2</sup> )	<i>k</i> (h <sup>-1</sup> )	<i>τ</i> (h)	<i>J</i> <sub>0</sub> (mg·cm <sup>-2</sup> ·h <sup>-1</sup> )	95% CI of <i>J</i> <sub>0</sub>
0	2.5	95	0.24	4.180	22.7	[16.9, 28.5]
0	10	386	0.71	1.400	275	[192, 359]
0	20	598	0.90	1.110	540	[398, 681]
0	30	728	1.02	0.978	744	[588, 900]
0	40	760	1.24	0.807	942	[718, 1165]
0	63	755	1.52	0.656	1151	[842, 1460]
2	2.5	73	3.03	0.330	222	[162, 282]
2	10	349	3.34	0.300	1163	[521, 1806]
2	20	563	2.35	0.426	1321	[724, 1918]
2	30	649	2.16	0.463	1401	[543, 2260]
2	40	630	2.46	0.407	1546	[361, 2732]
2	63	640	2.33	0.430	1490	[411, 2569]
4	2.5	38	4.03	0.248	153	[102, 205]
4	10	286	2.96	0.338	847	[715, 978]
4	20	399	2.52	0.397	1005	[819, 1192]
4	30	471	2.68	0.373	1264	[1138, 1391]
4	40	496	3.53	0.283	1751	[1422, 2080]
4	63	538	3.66	0.274	1966	[1811, 2122]
6	2.5	3	3.61	0.277	11.5	[7.13, 15.9]
6	10	47	2.68	0.373	126	[87.6, 164]
6	20	120	3.62	0.276	434	[160, 709]
6	30	250	1.82	0.550	456	[265, 647]
6	40	819	0.91	1.100	746	[474, 1018]
6	63	756	1.63	0.612	1234	[868, 1600]

Table S2. Quadratic vertex of the  $J_0-U$  relationship and statistical support for non-monotonicity for each size class.

Particle size ( $\mu\text{m}$ )	$U_{opt}$ ( $\text{m s}^{-1}$ )	95% CI of $U_{opt}$	LRT $p$ -value	$\Delta\text{AIC}$ (linear vs quadratic)
2.5	2.88	[2.31, 3.34]	0.159	9.20
10	2.81	[2.33, 3.21]	0.139	10.20
20	2.81	[2.15, 3.33]	0.173	8.53
30	2.73	[2.66, 2.79]	0.024	24.20
40	2.90	[2.44, 3.31]	0.141	10.10
63	3.27	[1.86, 6.13]	0.326	3.71

Table S3 Deviation from a strictly monotonic wind-speed benchmark, expressed as  $R(U) = J_0/J_{0,mono}$ .

Particle size ( $\mu\text{m}$ )	$R(2 \text{ m s}^{-1})$	$R(4 \text{ m s}^{-1})$	$R(6 \text{ m s}^{-1})$
2.5	1.723	1.188	0.089
10	1.633	1.190	0.177
20	1.436	1.092	0.472
30	1.347	1.215	0.438
40	1.147	1.299	0.554
63	1.000	1.229	0.771

$J_0$  is the initial deposition flux derived from the kinetic fit ( $J_0 = ak$ ).

$R > 1$  indicates underprediction and  $R < 1$  indicates overprediction by a strictly monotonic scheme at that wind speed.