



Supplement of

Non-monotonic response of net dust deposition kinetics to low wind speeds

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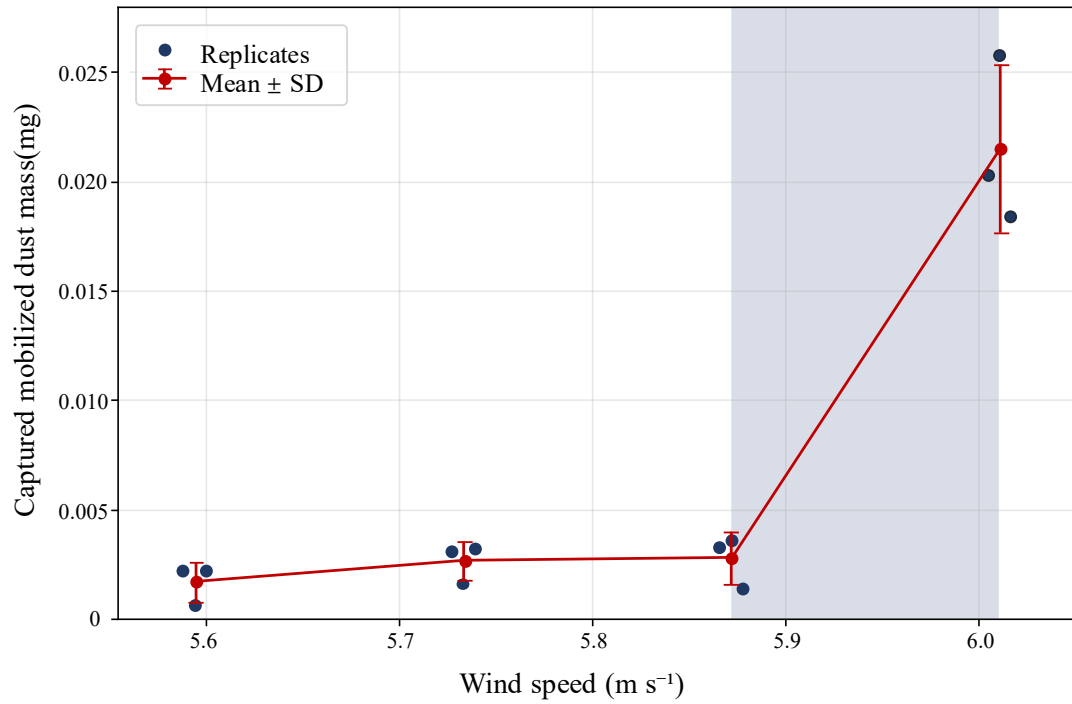


Figure S1. Auxiliary threshold-screening test for dust mobilization.

Mobilized particles were captured on double-sided adhesive tape fixed to inverted glass dishes positioned at the tray edge. Three replicate measurements were obtained at each tested wind speed. Points show individual captured masses, and red symbols and error bars show the mean $\pm$ SD ($n = 3$). The captured mobilized dust mass remained low at 5.59–5.87 m s⁻¹ and increased sharply at 6.01 m s⁻¹, indicating an apparent critical wind-speed range of 5.87–6.01 m s⁻¹ for marked particle mobilization under this tray configuration.

Table S1. Initial and late-stage airborne dust concentrations during the low-wind deposition phase.

Wind speed (m s ⁻¹)	Recorded C_0 (mg m ⁻³)	Normalization factor C_{ref} / C_0	C_{late} (mg m ⁻³)	C_{late} / C_0 (%)
0	191.35	0.97	10.18	5.32
2	178.20	1.05	0.27	0.15
4	186.36	1.00	17.27	9.27
6	189.44	0.98	8.03	4.24

C_0 was defined as the airborne dust concentration recorded at the start of the low-wind phase. C_{ref} is the mean recorded C_0 across the four wind-speed treatments, equal to 186.3 mg m⁻³. C_{late} represents the mean concentration during the final 20 min records of the low-wind phase, calculated from 20 one-minute records. The coefficient of variation of C_0 was 3.1%, indicating comparable initial suspended dust loading among treatments.

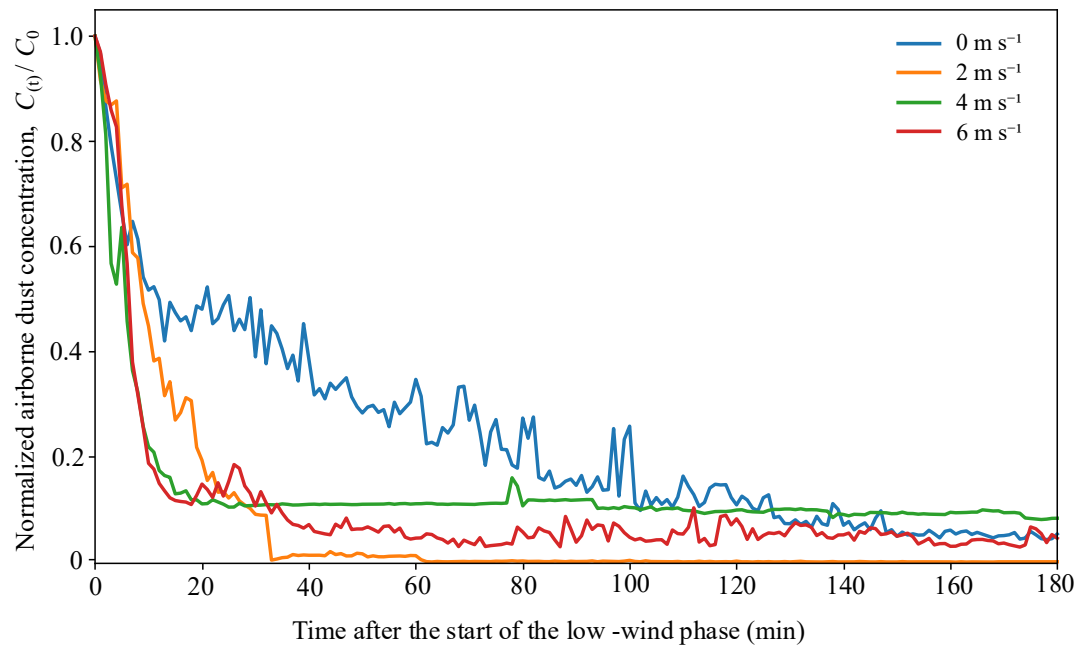


Figure S2. Normalized airborne dust concentration during the low-wind phase.

Table S2. Fitted parameters of the exponential net-accumulation model for each wind-speed-size combination.

Wind speed (m s ⁻¹)	Particle size (μm)	a (mg·m ⁻²)	k (h ⁻¹)	τ (h)	J_0 (mg·m ⁻² ·h ⁻¹)	95% CI of J_0
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 S3. Quadratic vertex of the J_o – U relationship and statistical support for non-monotonicity for each size class.

Particle size (μm)	U_{opt} (m s^{-1})	95% CI of U_{opt}	LRT p -value	ΔAIC (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 S4. Deviation from a non-decreasing wind-speed benchmark, expressed as $R(U) = J_0 / J_{0,mono}$.

Particle size (μm)	R (2 m s ⁻¹)	R (4 m s ⁻¹)	R (6 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 net accumulation flux derived from the kinetic fit ($J_0 = ak$). $J_{0,mono}$ is obtained by fitting a non-decreasing sequence to the J_0 values at 0, 2, 4, and 6 m s⁻¹. $R > 1$ indicates that the observed J_0 exceeds the benchmark, and $100(R - 1)\%$ gives the percentage by which the observation exceeds the benchmark. $R < 1$ indicates that the observed J_0 falls below the benchmark, and $1/R$ gives the benchmark-to-observation ratio.