Supplement of

Impact of Topographic Wind Conditions on Dust Particle Size Distribution: Insights from a Regional Dust Reanalysis Dataset

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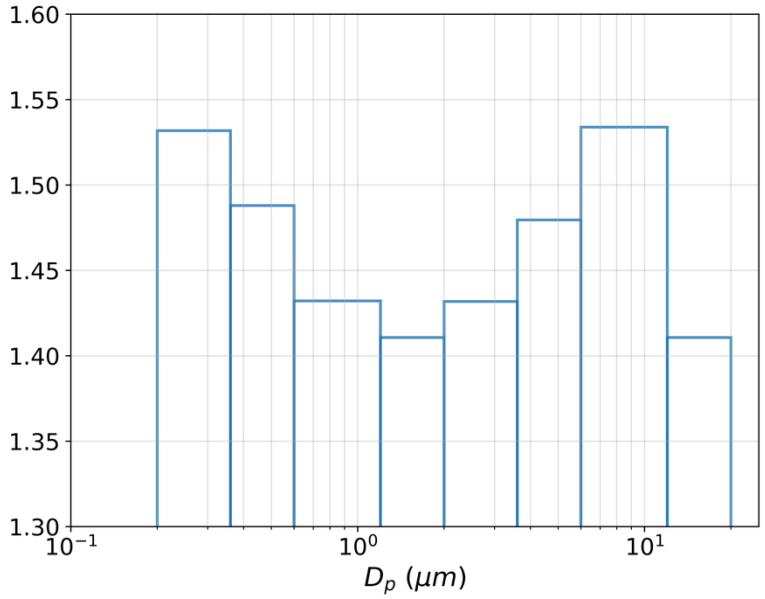

Figure S1. Ratio of first-guess dust concentration to its reanalysis across eight size bins. The average of dust concentrations in grids that contain any portion of selected Fennec segments were used as an example (see Section 2.2 for more details).

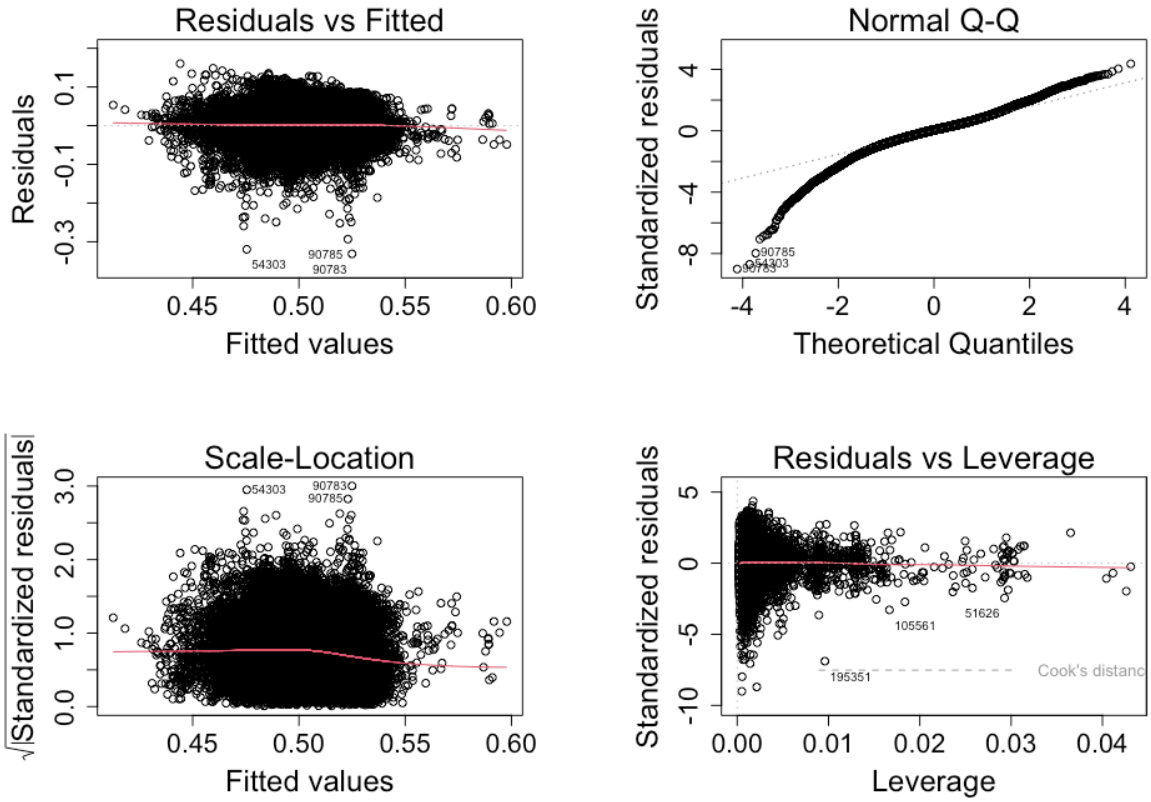

Figure S2. Diagnostic plots for the residuals of the linear model with only significant interactions (Eq. (4)). The "Residual vs Fitted" and "Scale-Location" panels indicate that the residuals exhibit uneven variances. The "Normal Q-Q" panel shows the deviation of data points from the dotted line, indicating that the residuals do not conform to a normal distribution.

Table S1. Estimates, standard errors, and p-values of all coefficients for the multiple linear model of dust coarse fraction. The model includes the independent variables of wind conditions (i.e., wind speed and slope under three wind direction types), time of day, season, year, soil moisture, and soil texture. The symbols of coefficients are defined in Eq. (3). The significantly positive, significantly negative, and insignificant coefficients at a confidence level of 95% (p-value > 0.05) are marked with orange, blue, and grey backgrounds, respectively.

Terms and coefficients	Estimates	Standard errors	p-values
Intercept (β_0)	0.0753	0.1574	0.6323
wind speed (β_1)	0.0075	0.0002	<0.0001
slope with uphill winds (β_2)	0.0175	0.0013	<0.0001
slope with tangential winds (β_3)	0.0081	0.0015	<0.0001
slope with downhill winds (β_4)	0.0076	0.0016	<0.0001
time of day ("afternoon" as reference) (β_5)			
evening	-0.0339	0.0006	<0.0001
morning	-0.0253	0.0006	<0.0001
season ("DJF" as reference) (β_6)			
JJA	0.0139	0.0008	<0.0001
MAM	0.0184	0.0007	<0.0001
SON	0.0124	0.0008	<0.0001
year (β_7)	0.0002	0.0001	0.0180
soil moisture (β_8)	-0.0742	0.0030	<0.0001
soil texture ("sand" as reference) (β_9)			
loamy sand	-0.0064	0.0014	<0.0001
sandy loam	0.0106	0.0013	<0.0001
loam	0.0151	0.0011	<0.0001
sandy clay loam	0.0204	0.0025	<0.0001
clay loam	0.0393	0.0036	<0.0001
clay	0.0841	0.0064	<0.0001
organic materials	-0.0019	0.0042	0.6570
bedrock	0.0179	0.0019	<0.0001

Table S2. Estimates, standard errors, and p-values of all coefficients for the multiple linear model of dust coarse fraction. The model includes the independent variables of wind conditions (i.e, wind speed and slope under three wind direction types), time of day, season, year, soil moisture, and soil texture, as well as significant interaction terms between wind conditions and other independent variables. The interaction coefficients represent wind conditions (speed and direction) under various situation of time of day, season, and soil moisture. The symbols of coefficients are defined in Eq. (3) and (4). The significantly positive, significantly negative, and insignificant coefficients at a confidence level of 95% (p-value > 0.05) are marked with orange, blue, and grey backgrounds, respectively.

Multiple linear model coefficients for wind speed under various conditions			
	Estimates	Standard errors	p-values
Afternoon, DJF, and soil moisture of 0 (reference levels; β_1)	0.0076	0.0007	<0.0001
Adjustments with time of day (β_{15})			
evening	0.0122	0.0006	<0.0001
morning	0.0016	0.0006	0.0058
Adjustments with season (β_{16})			
JJA	-0.0028	0.0007	<0.0001
MAM	-0.0023	0.0006	0.0003
SON	-0.0003	0.0007	0.6500
Adjustments with soil moisture (β_{18})	-0.0154	0.0029	<0.0001
Multiple linear model coefficients for slope with uphill winds under various conditions			
	Estimates	Standard errors	p-values
Afternoon, DJF, and soil moisture of 0 (reference levels; β_2)	0.0135	0.0030	<0.0001
Adjustments with time of day (β_{25})			
evening	0.0061	0.0024	0.0118
morning	0.0159	0.0026	<0.0001
Adjustments with season (β_{26})			
JJA	-0.0098	0.0028	0.0005
MAM	-0.0138	0.0029	<0.0001
SON	-0.0056	0.0031	0.0672
Adjustments with soil moisture (β_{28})	0.0521	0.0107	<0.0001
Multiple linear model coefficients for slope with tangential winds under various conditions			
	Estimates	Standard errors	p-values
Afternoon, soil moisture of 0 (reference levels; β_3)	-0.0038	0.0025	0.1261
Adjustments with time of day (β_{35})			
evening	0.0134	0.0024	<0.0001
morning	0.0110	0.0027	<0.0001
Adjustments with soil moisture (β_{38})	0.0351	0.0115	0.0022
Multiple linear model coefficients for slope with downhill winds under various conditions			
	Estimates	Standard errors	p-values
DJF (reference level; β_4)	0.0148	0.0026	<0.0001
Adjustments with season (β_{46})			
JJA	-0.0101	0.0031	0.0011

MAM	-0.0105	0.0032	0.0011
SON	-0.0090	0.0036	0.0116
Other coefficients			
	Estimates	Standard errors	p-values
Intercept (β_0)	0.0703	0.1560	0.6522
time of day ("afternoon" as reference) (β_5)			
evening	-0.1210	0.0044	<0.0001
morning	-0.0415	0.0042	<0.0001
season ("DJF" as reference) (β_6)			
JJA	0.0360	0.0047	<0.0001
MAM	0.0370	0.0045	<0.0001
SON	0.0166	0.0053	0.0018
year (β_7)	0.0002	0.0001	0.0149
soil moisture (β_8)	0.0156	0.0208	0.4528
soil texture ("sand" as reference) (β_9)			
loamy sand	-0.0061	0.0014	<0.0001
sandy loam	0.0108	0.0013	<0.0001
loam	0.0149	0.0011	<0.0001
sandy clay loam	0.0203	0.0025	<0.0001
clay loam	0.0391	0.0035	<0.0001
clay	0.0846	0.0063	<0.0001
organic materials	-0.0024	0.0042	0.5634
bedrock	0.0165	0.0019	<0.0001