Table S1. ICP-MS instrumental parameters for analysis using Nexion™ 5000 ICP-MS and Syngistix™ Software

Instrumental Parameter	Standard Mode	Direct Reaction Cell (DRC) Mode
Gas Flow (*L min^{-1}*)		
Nebulizer	1.02	
Auxiliary	1.2	
Plasma	16	
DRC	0	0.8
ICP RF Power *(W)*	1600	
Voltages *(V)*		
QID Fixed	−12	
Hyperskimmer Park	3	
OmniRing Park	3	
Inner Target Lens	1.5	
Outer Target Lens	−8.5	
Deflector Exit	−9	
Differential Aperture	−2	
Cell Rod Offset	−33	−4
Axial Field	0	200
Q3 AC Rod Offset	−4.5	−8.5
Q3 Rod Offset	0	−12
Analog Stage	−1650 ± 50	
Pulse Stage	1200 ± 50	
Rejection Parameter a	0	
Rejection Parameter q	0.25	0.45
Acquisition Timing *(ms)*		
Dwell Time Per AMU	40	
Integration Time	640	

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Table S2. Information for total determination of metals in mineral dust using ICP-MS. CRM 2710a was used for estimation of recovery. LOD refers to analytes in the final prepared solution following digestion. Uncertainties presented at 95% confidence.

Element	Al	Ag	As	Ba	Ca	Cd	Co	Cu	Fe
Isotope used for detection	27	107	75	138	43	114	59	63	57/73
CRM Recovery (%)	30.5	106	115	69.3	15.7	108	70.9	108	81
Uncertainty (%)	6.3	16	22	8.7	3.6	11	8.3	15	16
LOD for total determination ($\mu g\ L^{-1}$)	13.5	0.0185	0.0452	1.76	128	0.00352	0.0366	0.486	6.67
Element	K	Mg	Mn	Ni	Pb	Rb	Tl	U	V
Isotope used for detection	39	26	55	60	208	85	205	238	51/67
CRM Recovery (%)	18.4	62.2	83	82	111	52.4	37.6	67.1	73
Uncertainty (%)	3.0	9.3	10	28	14	8.9	9.9	3.8	16
LOD for total determination ($\mu g\ L^{-1}$)	221	31.3	0.634	0.590	0.133	0.156	0.0119	0.00363	0.0823

Table S3. Detailed gravimetric PM concentration results at 3.3 and 6.3 m above ground at Down Valley site.

Sample Date	Size Class	PM Concentration in Air *(μg m^{-3})*	
		3.3 m	6.3 m
2021-06-04	TSP	10300	3640 20
2021-06-04	PM_{10}	29.8	12.7
2021-06-07	TSP	480	230
2021-06-07	PM_{10}	37.8	-
2021-06-08	TSP	1800	-
2021-06-08	PM_{10}	501	384
2021-06-08	PM_{10}	-	-
2021-06-09	TSP	5340	3540
2021-06-09	PM_{10}	-	701
2021-06-10	TSP	464	244
2021-06-10	$PM_{2.5}$	<LOD	<LOD
2021-06-11	TSP	230	248
2021-06-12	TSP	543	387
2021-06-12	$PM_{2.5}$	<LOD	<LOD
2021-06-14	TSP	128	193
2021-06-17	PM_{10}	19.1	-
2021-06-17	$PM_{2.5}$	19.7	9.6
2021-06-18	PM_{10}	310	192
2021-06-19	PM_{10}	488	275
2021-06-21	PM_{10}	840	613
2021-06-23	TSP	7200	4440
2021-06-23	PM_{10}	920	573
2021-06-26	TSP	2930	2730
2021-06-26	$PM_{2.5}$	65.5	31.7
2021-06-27	TSP	2100	1200
2021-06-29	PM_{10}	197	-
2021-06-16	PM_{10}	42.8	31.2
2021-06-19	PM_{10}	469	224
2021-06-21	PM_{10}	830	481
2021-06-22	TSP	104	57.3
2021-06-22	PM_{10}	56.2	29.3
2021-06-24	TSP	36900	17800
2021-06-24	$PM_{2.5}$	327	<LOD
2021-06-25	TSP	46100	30200
2021-07-01	PM_{10}	269	-
2021-07-02	PM_{10}	720	-
2021-07-02	PM_{10}	596	-

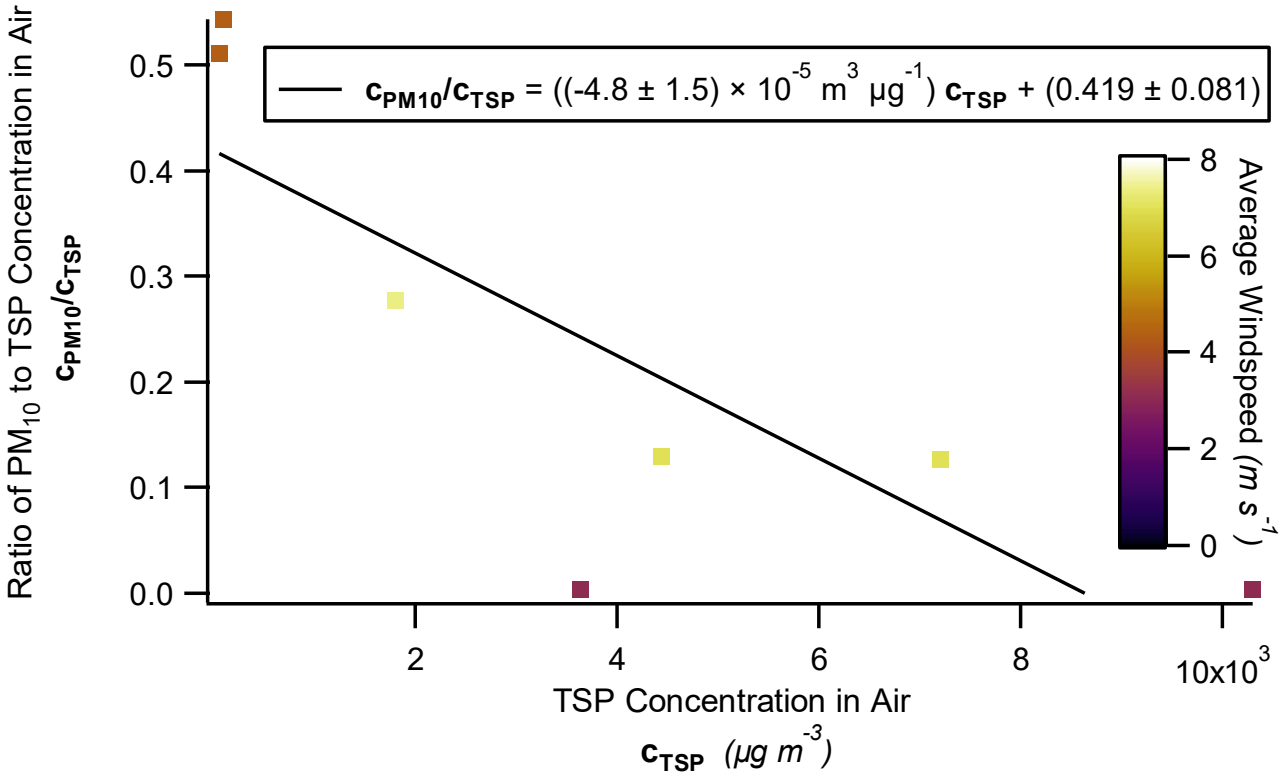

Figure S1. Ratio of PM_{10} concentration to TSP concentration with intensity of dust activity

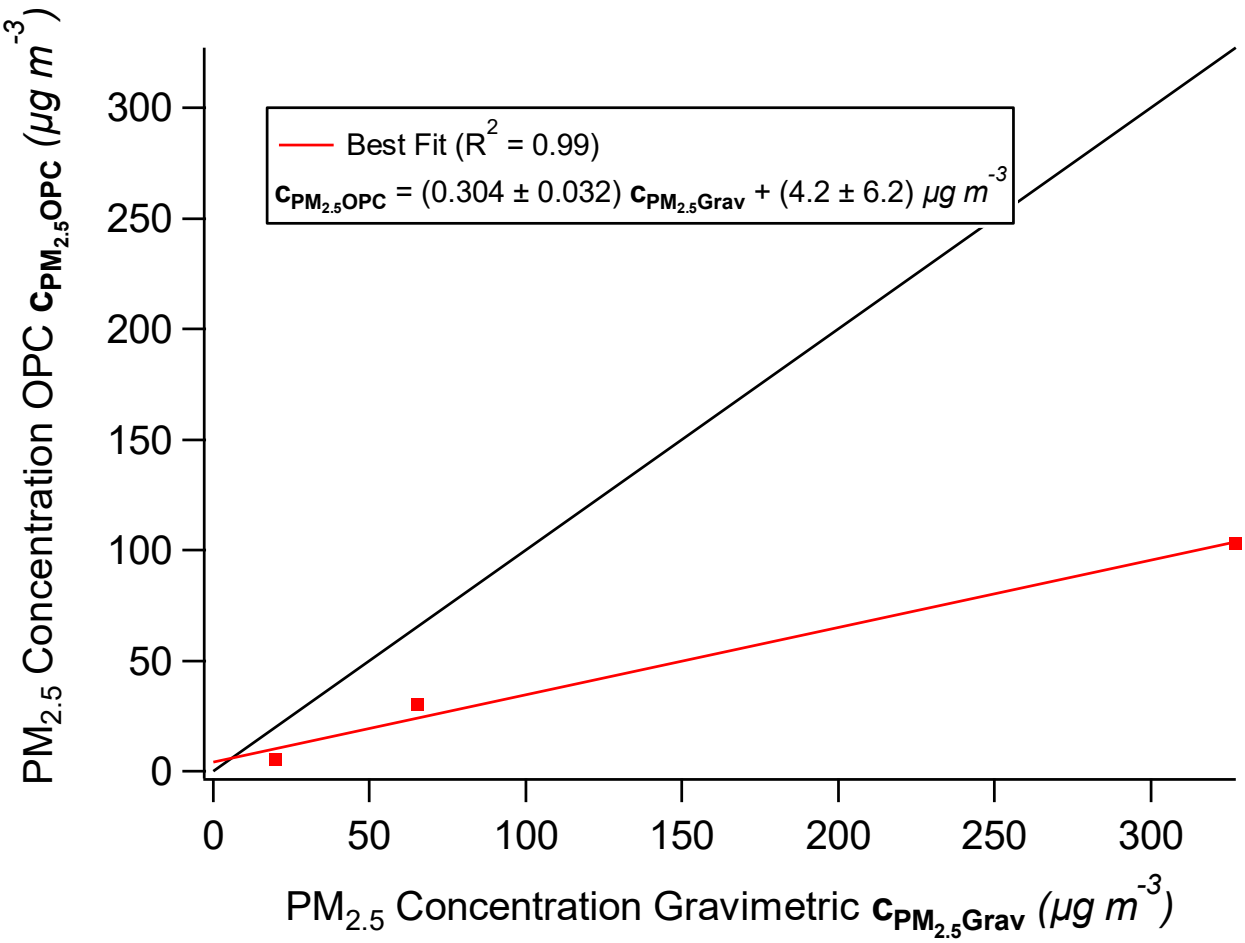

Figure S2. Comparison of $PM_{2.5}$ measurements at 3 m using OPC and Gravimetry. The black line represents the unity function. The linear function of best fit is presented along with associated standard errors.

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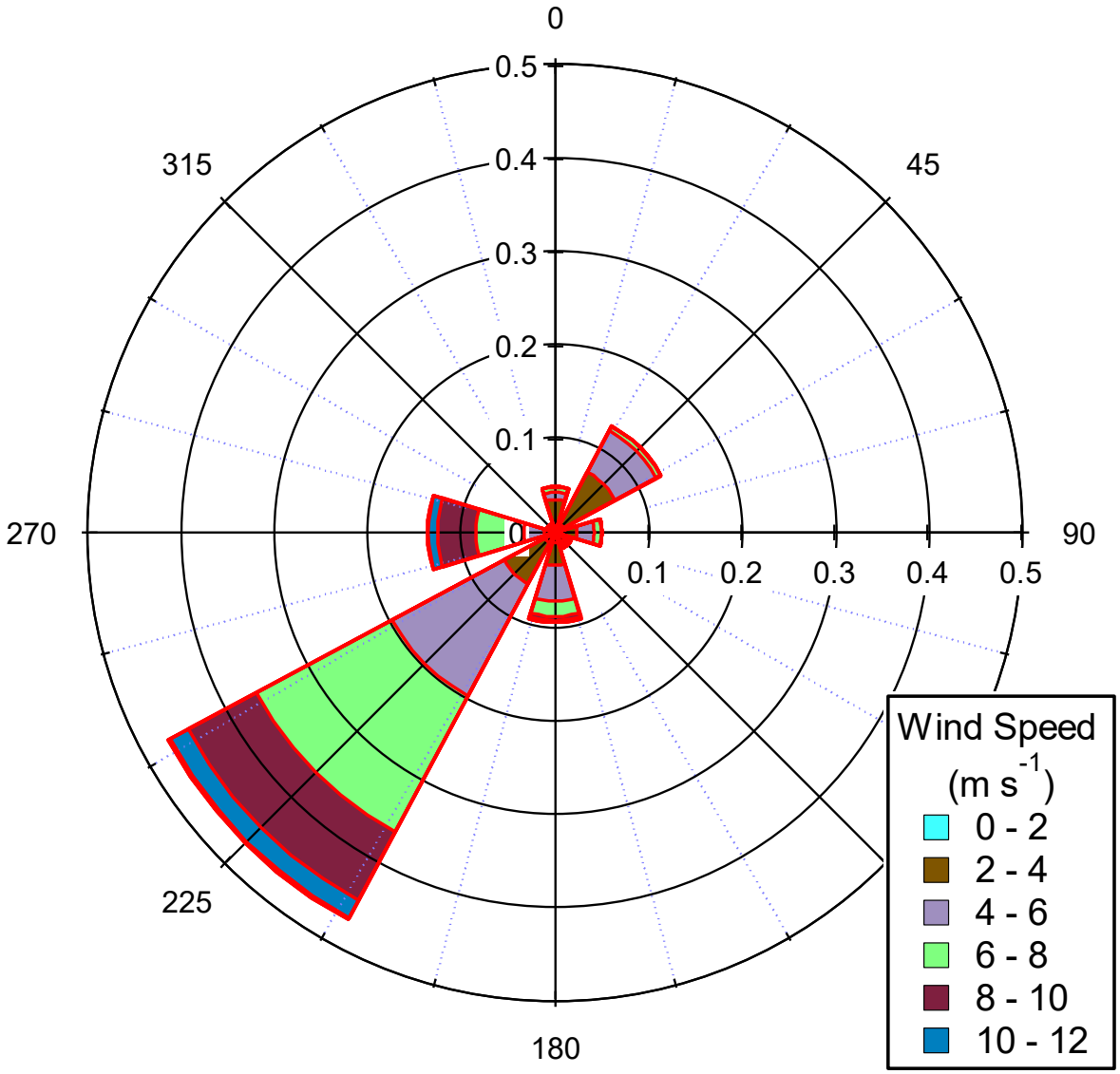

Figure S3. Wind rose for Down Valley site during sampling period, where 0° represents North

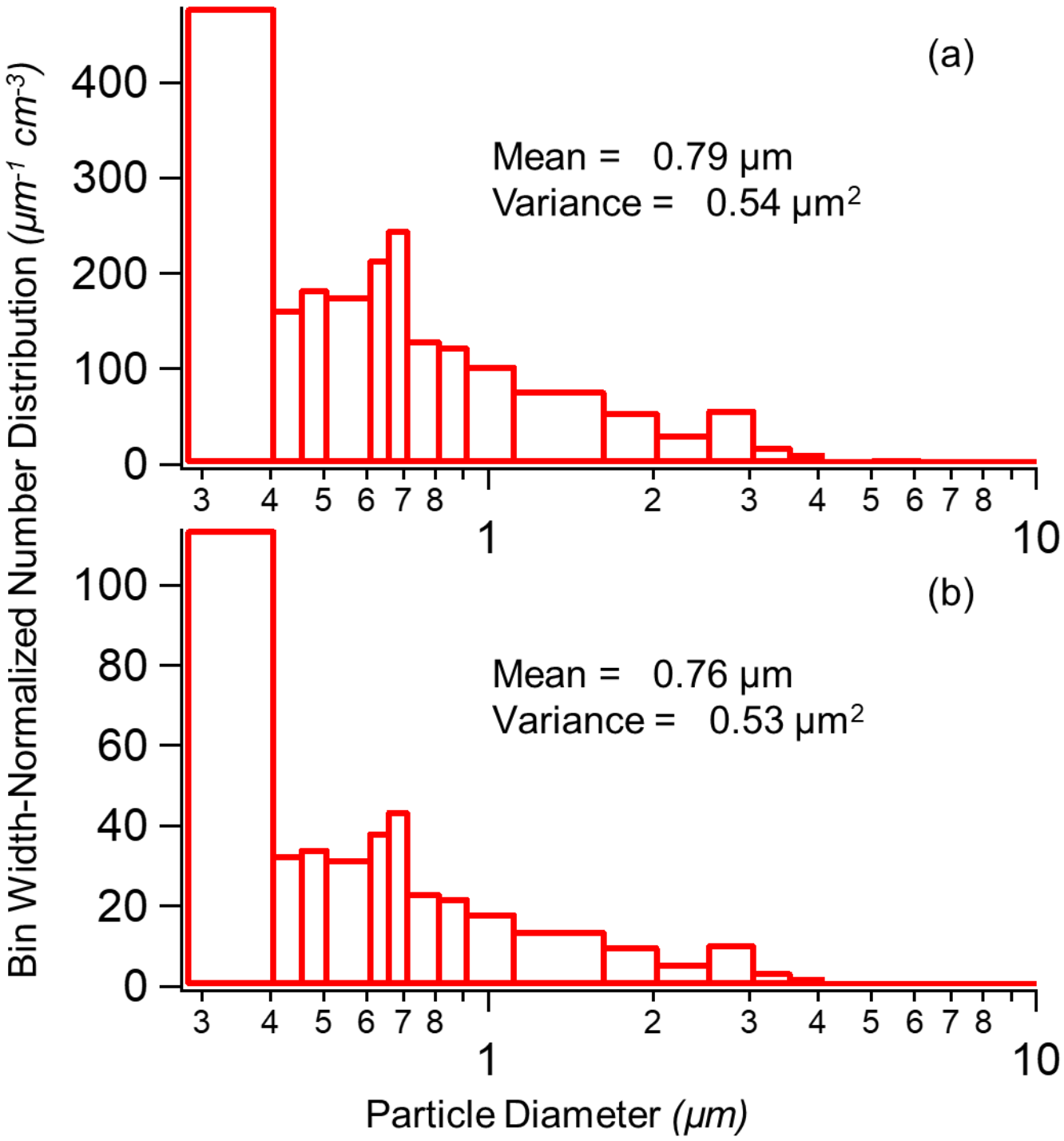

Figure S4. Comparison of size distribution for a) top 10 percentile of dust concentration and for b) whole campaign