Supplementary Materials

Table S1. Timing of haze episodes during the winter of 2011–2017 (Hong Kong) and 2016–2019 (Beijing).

Area	Increasing					Decreasing				
	Sequence Number	Year	Month	Day	Start Hour–End Hour	Sequence number	Year	Month	Day	Start Hour–End Hour
Sham Shui Po in Hong Kong	1	2011	1	14	14–24	1	2011	1	11	9–23
	2	2011	1	20	3–19	2	2011	1	19	16–3 next day
	3	2011	1	23	24–19 next day	3	2011	1	20	14–5
	4	2011	2	8	16–23	4	2011	2	8	21–7 next day
	5	2011	2	9	18–01 next day	5	2011	2	17	15–24
	6	2011	2	17	7–17	6	2011	12	7	19–1 next day
	7	2011	12	29	24–9 next day	7	2011	12	17	12–5 next day
	8	2012	1	9	11–23	8	2011	12	30	8–23
	9	2013	1	12	13–20	9	2012	1	9	20–2 next day
	10	2013	12	4	5–11	10	2012	2	19	17–4 next day
	11	2013	12	7	15–22	11	2012	12	27	17–23
	12	2013	12	21	6–21	12	2013	1	24	19–10 next day
	13	2013	12	24	14–21	13	2013	12	4	10–17
	14	2014	1	3	3–11	14	2013	12	14	8–4 next day
	15	2014	1	8	10–18	15	2013	12	23	18–17 next day
	16	2014	1	17	8–17	16	2014	1	6	9–10 next day
	17	2014	2	18	5–13	17	2014	1	8	17–7 next day
	18	2014	12	10	11–22					
	19	2015	2	7	12–20					
	20	2015	2	15	15–24					
	21	2015	12	23	12–1 next day					
Guanxiangtai and Haidian in Beijing	1	2016	12	1	14–2 next day	1	2016	12	4	19–17 next day
	2	2016	12	5	17–3 three days later	2	2016	12	8	5–17
	3	2016	12	23	12–8 next day	3	2016	12	12	18–11 next day
	4	2016	12	27	15–6 next day	4	2016	12	22	0–10
	5	2016	12	29	8–3 next day	5	2016	12	25	19–14 next day
	6	2017	1	9	7–1 next day	6	2016	12	28	5–15
	7	2017	1	10	19–6 next day	7	2017	1	7	22–7 next day
	8	2017	1	12	9–20	8	2017	1	9	22–7 next day
	9	2017	1	18	14–10 next day	9	2017	1	12	17–7 next day
	10	2017	1	20	14–6 next day	10	2017	1	17	22–14 next day
	11	2017	1	23	6–2 next day	11	2017	1	19	4–1 next day

12	2017	1	27	6–1 next day	12	2017	1	21	4–13
13	2017	2	1	3–3 next day	13	2017	1	26	5–0 next day
14	2017	2	11	15–3 next day	14	2017	1	29	1–11
15	2017	2	13	19–3 next day	15	2017	1	31	7–4 next day
16	2017	2	17	13–5 next day	16	2017	2	4	19–1 next day
17	2017	2	26	12–6 next day	17	2017	2	7	22–18 next day
18	2018	1	12	10–1 next day	18	2017	2	13	2–18
19	2018	1	18	7–1 next day	19	2017	2	16	6–18
20	2018	1	19	15–22	20	2017	2	19	2–4 next day
21	2018	2	6	0–4 next day	21	2017	2	22	12–22
22	2018	2	7	23–12 next day	22	2017	12	3	0–18
23	2018	2	13	8–21	23	2017	12	15	1–16
24	2018	2	15	11–0 next day	24	2017	12	21	21–16 next day
25	2018	2	25	0–23 next day	25	2017	12	30	9–4 next day
26	2018	12	9	12–21	26	2018	1	18	21–15 next day
27	2018	12	24	10–2 next day	27	2018	1	19	20–6 next day
28	2019	1	2	9–4 next day	28	2018	1	27	18–5 next day
29	2019	1	13	15–3 next day	29	2018	2	7	3–10
30	2019	1	17	12–1 next day	30	2018	2	9	0–14
31	2019	1	26	10–2 next day	31	2018	2	13	20–10 next day
32	2019	1	28	12–4 next day	32	2018	2	16	3–18
33	2019	2	18	9–4 next day	33	2018	2	20	3–12
34	2019	2	20	10–3 next day	34	2018	2	21	8–23 next day
35	2019	2	21	9–3 next day	35	2018	12	2	23–6 three days later
36	2019	2	24	17–1 next day	36	2018	12	16	6–23
37	2019	12	6	8–22	37	2018	12	22	0–17
38	2019	12	23	12–22	38	2018	12	25	1–18
					39	2019	1	3	23–10 next day
					40	2019	1	6	23–14 next day
					41	2019	1	12	23–15 next day
					42	2019	1	14	16–2 next day
					43	2019	1	27	11–4 next day
					44	2019	1	29	21–14 next day
					45	2019	2	2	16–10 next day

						46	2019	2	19	18–9 next day
						47	2019	2	21	0–10
						48	2019	2	24	2–20
						49	2019	2	25	0–13
						50	2019	12	10	11–19
						51	2019	12	25	4–16
						52	2019	12	29	13–23
Yanqing in Beijing	1	2016	12	14	14–20	1	2016	12	28	9–18
	2	2017	1	16	13–14	2	2017	1	8	9–17
	3	2017	1	20	13–22	3	2017	1	11	9–17
	4	2017	1	30	16–22	4	2017	1	21	0–10
	5	2017	2	4	17–0	5	2017	1	31	8–17
	6	2017	2	7	14–2	6	2017	2	1	8–15
	7	2017	2	13	15–0	7	2017	2	4	8–19
	8	2017	2	18	13–22	8	2017	2	11	8–14
	9	2017	2	20	11–20	9	2017	2	13	8–15
	10	2017	2	26	16–1	10	2017	2	15	20–16
	11	2017	12	1	12–1	11	2017	2	17	5–12
	12	2017	12	31	15–21	12	2017	2	22	9–16
	13	2018	1	4	13–23	13	2017	2	26	11–17
	14	2018	1	6	13–3	14	2017	12	1	8–14
	15	2018	1	15	11–21	15	2017	12	3	8–17
	16	2018	1	18	15–23	16	2017	12	9	20–2
	17	2018	1	20	12–18	17	2017	12	22	9–15
	18	2018	1	26	11–2	18	2017	12	23	21–3
	19	2018	1	31	12–3	19	2017	12	25	21–3
	20	2018	2	6	15–0	20	2017	12	31	9–15
	21	2018	2	15	15–2	21	2018	1	2	9–20
	22	2018	2	16	15–23	22	2018	1	6	9–17
	23	2018	2	28	18–23	23	2018	1	7	8–16
	24	2018	12	8	17–1	24	2018	1	14	9–18
	25	2018	12	11	17–0	25	2018	1	18	9–15
	26	2018	12	13	11–21	26	2018	1	22	1–7
	27	2019	1	1	17–3	27	2018	2	1	9–17
	28	2019	1	5	14–23	28	2018	2	7	3–9
	29	2019	1	7	17–23	29	2018	2	16	8–15
	30	2019	1	8	16–0	30	2018	2	23	8–20
	31	2019	1	13	16–0	31	2018	12	10	20–4
	32	2019	2	9	14–23	32	2018	12	22	3–15
	33	2019	2	14	4–11	33	2018	12	25	9–16
	34	2019	2	25	13–23	34	2019	1	1	1–17
	35	2019	12	23	17–10	35	2019	1	7	7–17
	36	2019	12	31	14–21	36	2019	1	13	9–16
						37	2019	1	14	10–20
						38	2019	1	27	9–16
						39	2019	1	29	9–17
						40	2019	2	2	20–7
						41	2019	2	11	8–16
						42	2019	2	14	21–3
						43	2019	2	19	9–18
						44	2019	12	13	9–17
						45	2019	12	18	19–7
						46	2019	12	22	17–23
						47	2019	12	25	8–16
						48	2019	12	29	11–18

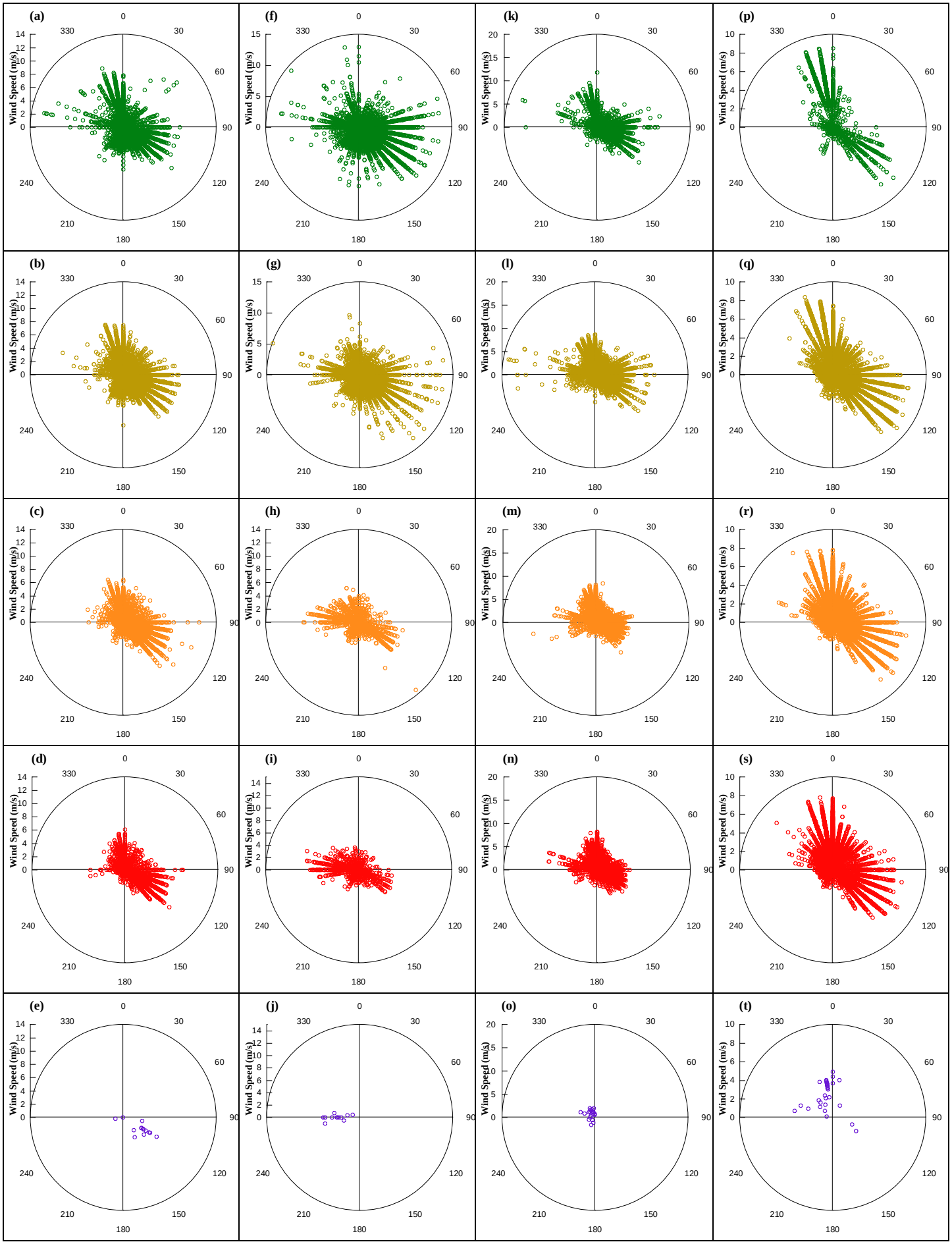

Figure S1. Surface wind distribution under the five pollution scenarios during 1999–2017 for Tam Mun in Hong Kong. Panels (**a**–**e**), (**f**–**j**), (**k**–**o**), and (**p**–**t**) show the results for spring, summer, autumn, and winter, respectively. Green, dark yellow, orange, red, and purple denote the five pollution scenarios, with corresponding $PM_{2.5}$ concentration (μg/m^3) thresholds of 0.0–12.0,

12.1–35.4, 35.5–55.4, 55.5–150.4, and 150.5–250.4, respectively. Spring is March–April–May, summer is June–July–August, autumn is September–October–November, and winter is December–January–February.

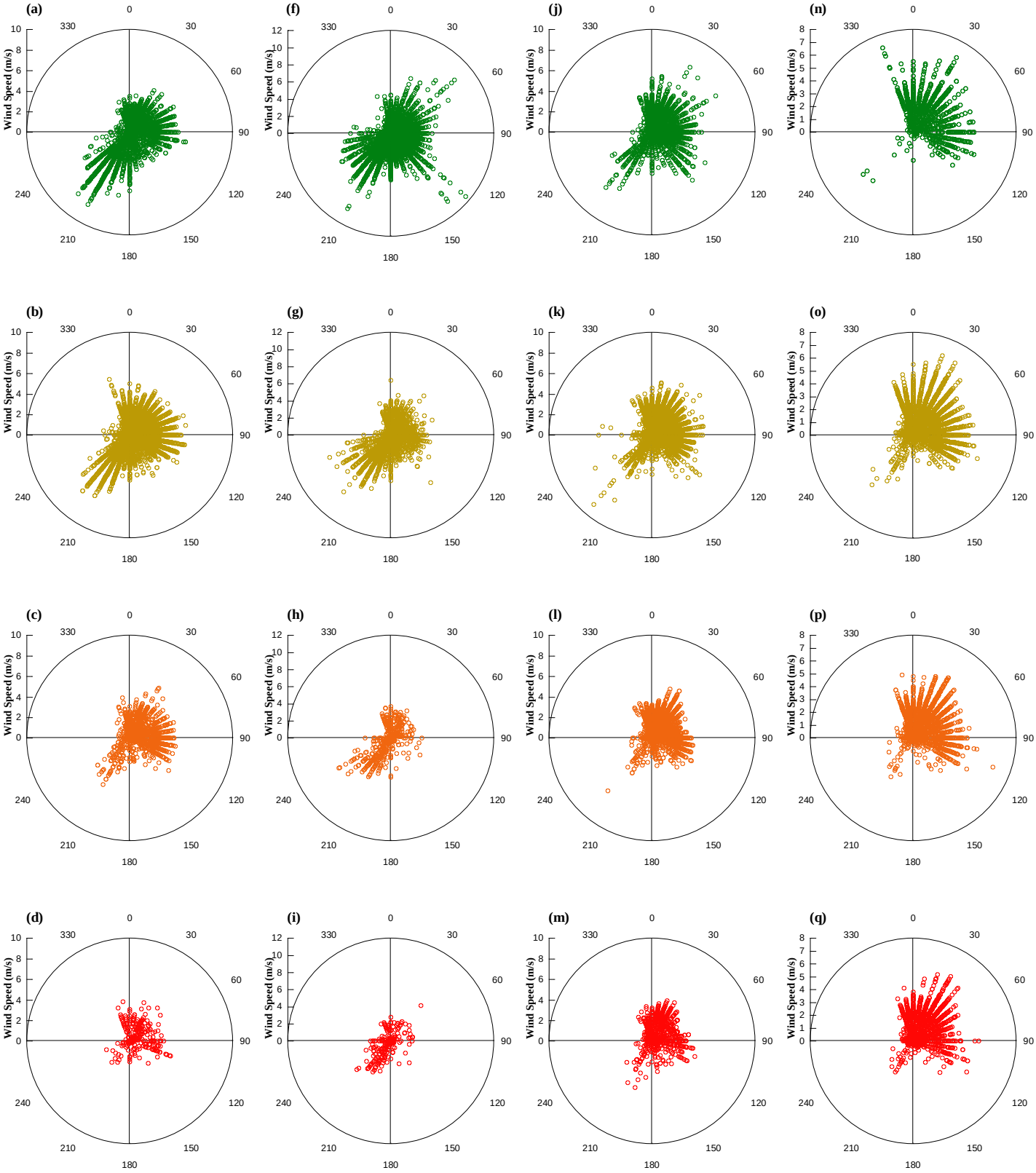

Figure S2. Surface wind distribution under the five pollution scenarios during 2012–2017 for Sha Tin Hong Kong. Panels (**a**–**e**), (**f**–**i**), (**j**–**m**), and (**n**–**r**) show the results for spring, summer, autumn, and winter, respectively. Green, dark yellow, orange, red, and purple denote the five pollution scenarios, with corresponding $PM_{2.5}$ concentration (μg/m^3) thresholds of 0.0–12.0, 12.1–35.4, 35.5–55.4, 55.5–150.4, and 150.5–250.4, respectively. For each panel, the four rows from top to bottom are spring, summer, autumn, and winter, respectively.

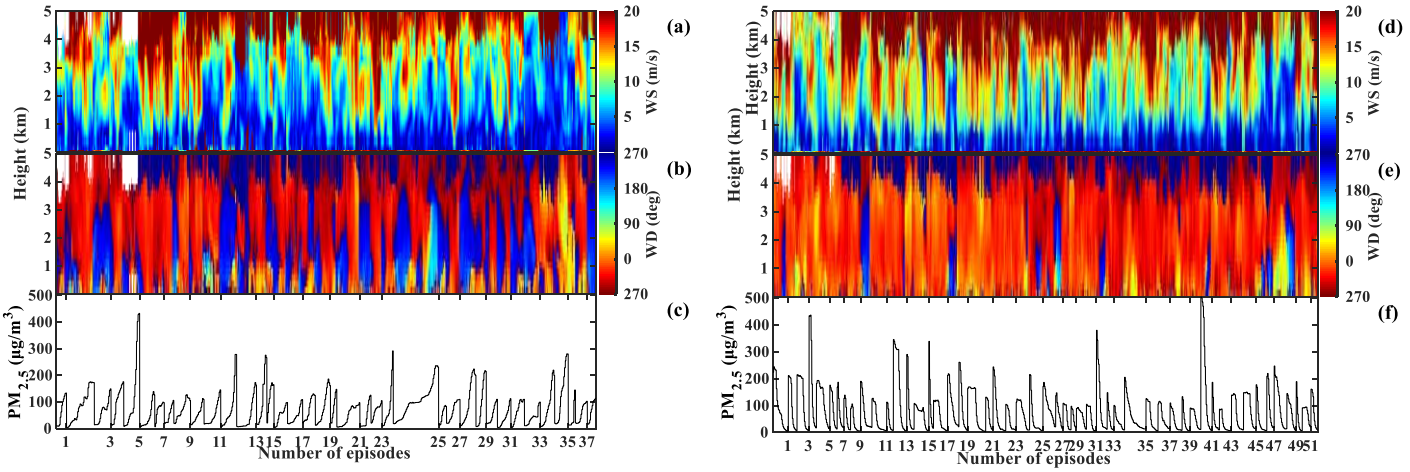

Figure S3. Vertical evolution of wind during the haze episodes in winter at Haidian in Beijing. (**a**–**c**) are episodes of increasing $PM_{2.5}$ concentration and (**d**–**f**) are episodes of decreasing $PM_{2.5}$ concentration. Upper, middle, and lower panels indicate wind speed, wind direction, and $PM_{2.5}$ mass concentrations, respectively. Note that wind direction centered on the east to display continuously for direction of the emission source (south) and of the clear air mass (northwest).

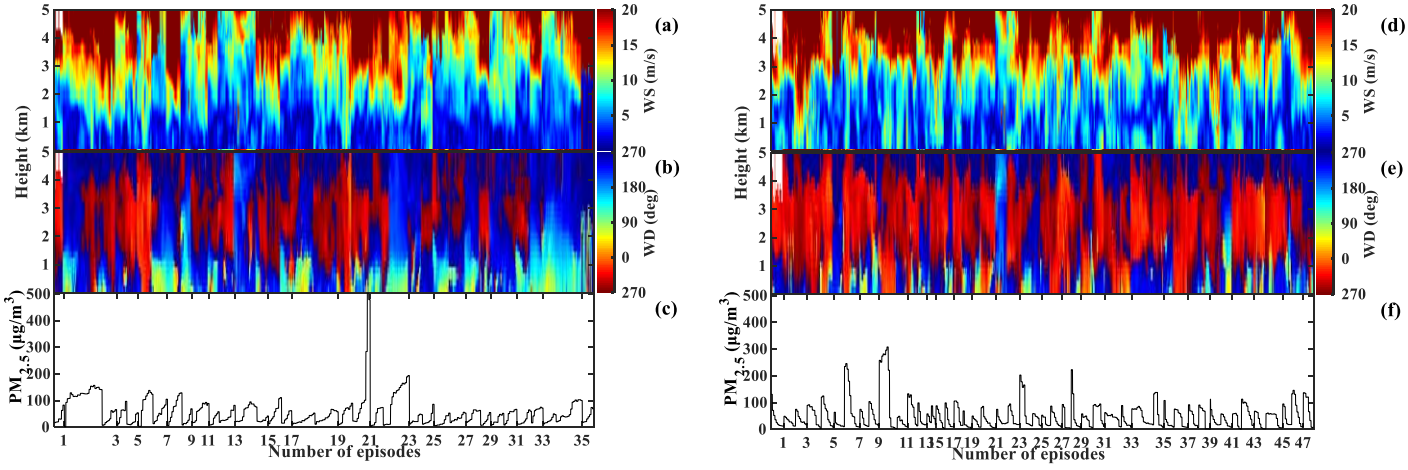

Figure S4. Vertical evolution of wind during the haze episodes in winter at Yanqing in Beijing. (**a**–**c**) are episodes of increasing $PM_{2.5}$ concentration and (**d**–**f**) are episodes of decreasing $PM_{2.5}$ concentration. Upper, middle, and lower panels indicate wind speed, wind direction, and $PM_{2.5}$ mass concentrations, respectively. Note that wind direction centered on the east to display continuously for direction of the emission source (south) and of the clear air mass (northwest).