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Environmental Chemistry

Supplementary Material

$PM_{2.5}$ acidity during haze episodes in Shanghai, China

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This document contains the following supporting information:

Haze episodes

Fig. S1 showed time series of meteorological conditions and $PM_{2.5}$ and PM_{10} levels. To be specific, Case 1 lasted from 0:00 local time (LT) on 25 November to 4:00 LT on 27 November 2013. During this episode, the average levels of $PM_{2.5}$ and PM_{10} was 82.8 μg/m^3 and 248.5 μg/m^3, respectively. The average ratio of $PM_{2.5}$ /PM_{10} was 0.34, with the maximum value of 0.47, while the average relative humidity (RH) in Case 1 was 59.1%, suggesting this process was floating dust pollution. Meanwhile, another possible explanation was associated with changes in long-range transport, which brings air pollutants from nonlocal sources and thus contributes to the increase in $PM_{2.5}$ in Shanghai. The back trajectory results (Fig. S2) showed the observed $PM_{2.5}$ concentrations during Case1 were usually accompanied by remarkable transport processes affected by the northwesterly winds. The northwesterly winds tended to bring high levels of pollutants from other provinces in the YRD region, which could contribute about 30% to the $PM_{2.5}$ in Shanghai.

Case 2 lasted from 16:00 LT on 29 November to 23:00 LT on 3 December, which was longer than Case 1 and 3. Descending wind speed (from 8 m/s to 1 m/s) and low relative humidity (57.2% ± 12.78%) and occurred during Case 2 and caused stagnant weather (Fig. S1), which indicated and local formation maintained the $PM_{2.5}$ pollution events until the improvement of the meteorological parameters. Case 2 (haze days with low relative humidity) was characterized by high ratio of $PM_{2.5}$/ PM_{10} with a mean value of 0.63, while the levels of $PM_{2.5}$ was 143.6 μg/m^3. Since high concentration of particulate matter the scattering and absorption of solar radiation by gaseous pollutants, the visibility less than 10.0km was up to 43 hours in Case 2.

Case 3 was the most severe haze event of the three cases which lasted from 19:00 LT on 4 December to 5:00 LT on 7 December, the levels of $PM_{2.5}$ and PM_{10} on average were 309.4 μg/m^3 and 403.4μg/m^3. Simultaneously, the $PM_{2.5}$/PM_{10} ratio was 0.78 and the average RH (76.7%) was larger than that in Case 2, illustrating haze days with high relative humidity. It is noted that concentrations of secondary inorganic ion such as NO_3^-, SO_4^{2-} and NH_4^+ increased significantly which is attributed to the conditions of high temperature, high relative humidity and stagnant weather in Case 3, indicated the enhancement of the secondary formation.

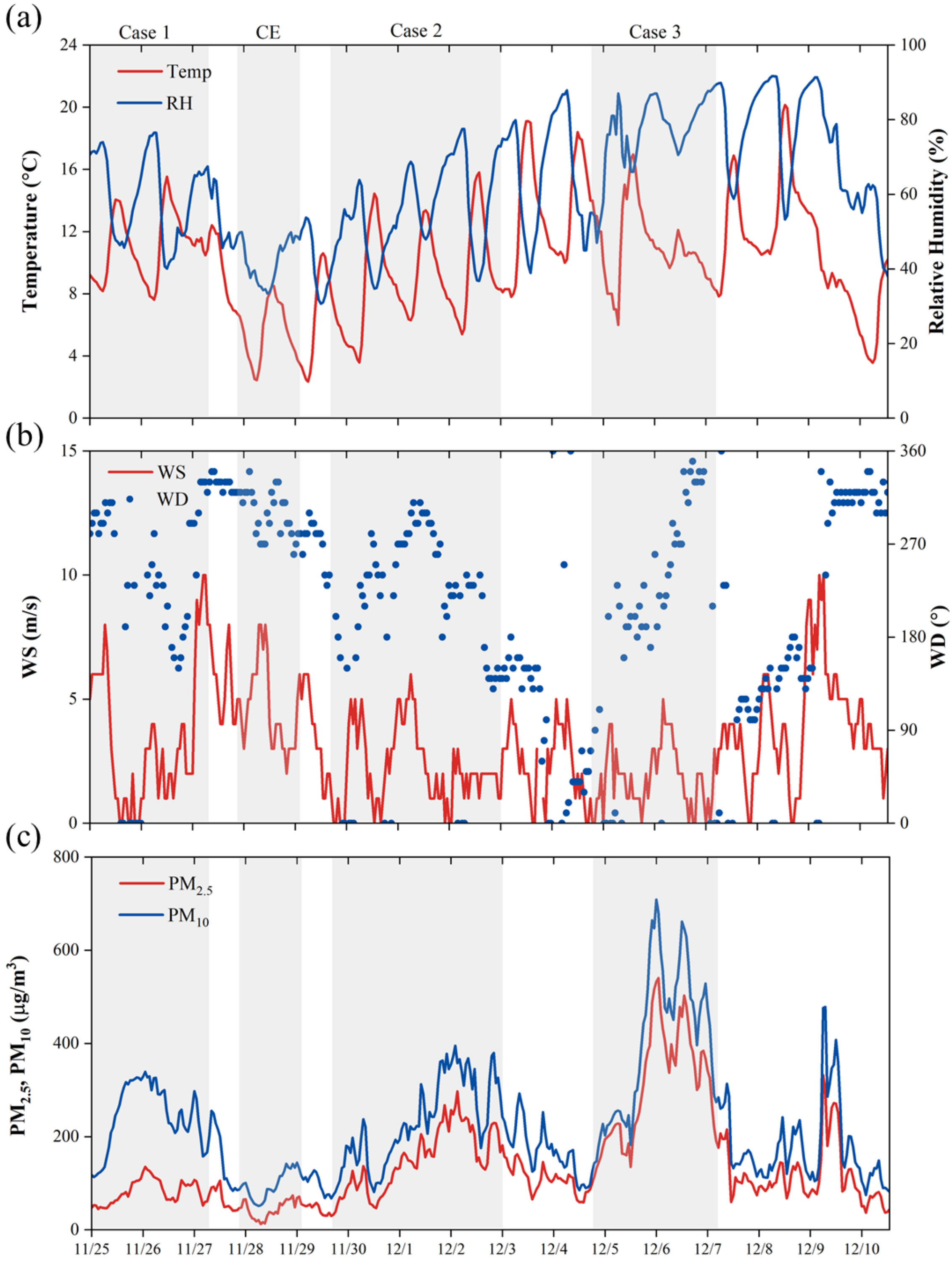

Fig. S1. Time series of (a) temperature (temp) and relative humidity (%) levels; (b) wind speed (WS) and wind direction (WD) levels; (c) $PM_{2.5}$ and PM_{10} concentrations.

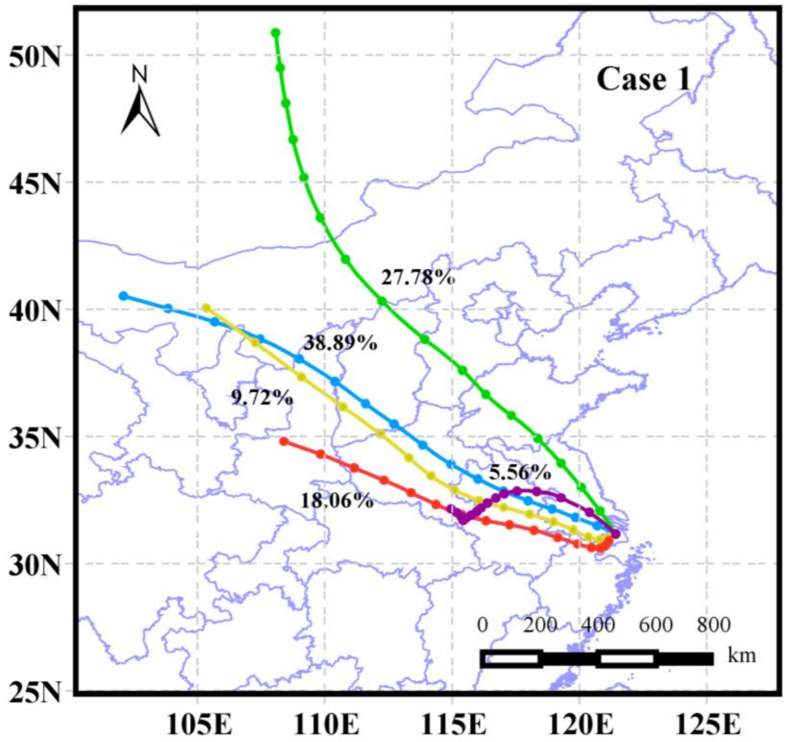

Fig. S2 The 48-h backward trajectory cluster results for the $PM_{2.5}$ concentration period in Case 1.

Table S1. Time series of PM_{10}, $PM_{2.5}$ concentrations and $PM_{2.5}/PM_{10}$

Time	$PM_{2.5}/PM_{10}$	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/ m^3)	Time	$PM_{2.5}/PM_{10}$	PM_{10} (μg/ m^3)	$PM_{2.5}$ (μg/m^3)	Time	$PM_{2.5}/PM_{10}$	PM_{10} (μg/ m^3)	$PM_{2.5}$ (μg/ m^3)
2013-11-25 00:00	0.40	117.42	47.34	2013-11-28 00:00	0.65	100.80	65.34	2013-12-01 00:00	0.68	193.55	132.22
2013-11-25 01:00	0.47	113.29	52.93	2013-11-28 01:00	0.53	86.72	45.94	2013-12-01 01:00	0.73	216.50	157.62
2013-11-25 02:00	0.45	116.57	52.16	2013-11-28 02:00	0.46	71.23	32.58	2013-12-01 02:00	0.72	228.75	165.24
2013-11-25 03:00	0.37	121.22	44.71	2013-11-28 03:00	0.39	63.05	24.81	2013-12-01 03:00	0.70	226.58	159.22
2013-11-25 04:00	0.39	123.82	48.73	2013-11-28 04:00	0.41	56.21	23.06	2013-12-01 04:00	0.77	192.60	148.81
2013-11-25 05:00	0.37	128.20	47.37	2013-11-28 05:00	0.34	53.46	18.19	2013-12-01 05:00	0.67	221.83	147.71
2013-11-25 06:00	0.35	134.72	46.56	2013-11-28 06:00	0.41	51.20	20.95	2013-12-01 06:00	0.67	216.05	143.81
2013-11-25 07:00	0.30	155.42	46.31	2013-11-28 07:00	0.23	52.44	12.30	2013-12-01 07:00	0.62	215.95	133.88
2013-11-25 08:00	0.29	176.67	51.29	2013-11-28 08:00	0.29	56.38	16.32	2013-12-01 08:00	0.59	222.90	131.49
2013-11-25 09:00	0.28	208.51	57.98	2013-11-28 09:00	0.21	63.58	13.51	2013-12-01 09:00	0.80	221.63	176.43
2013-11-25 10:00	0.26	219.55	57.18	2013-11-28 10:00	0.34	87.33	29.72	2013-12-01 10:00	0.66	312.43	205.03
2013-11-25 11:00	0.26	244.66	62.70	2013-11-28 11:00	0.44	87.21	38.20	2013-12-01 11:00	0.66	292.54	194.28
2013-11-25 12:00	0.25	254.71	63.82	2013-11-28 12:00	0.43	85.51	36.71	2013-12-01 12:00	0.64	243.79	155.64
2013-11-25 13:00	0.26	267.41	69.90	2013-11-28 13:00	0.41	81.66	33.42	2013-12-01 13:00	0.82	206.12	169.74
2013-11-25 14:00	0.26	289.68	76.27	2013-11-28 14:00	0.44	87.71	38.46	2013-12-01 14:00	0.68	252.76	173.04
2013-11-25 15:00	0.25	305.24	77.12	2013-11-28 15:00	0.35	100.17	34.80	2013-12-01 15:00	0.65	242.74	158.15
2013-11-25 16:00	0.26	316.98	81.05	2013-11-28 16:00	0.50	115.25	57.25	2013-12-01 16:00	0.65	242.38	156.78
2013-11-25 17:00	0.23	311.89	71.32	2013-11-28 17:00	0.45	115.95	52.67	2013-12-01 17:00	0.75	256.88	192.98
2013-11-25 18:00	0.26	320.67	84.94	2013-11-28 18:00	0.47	125.64	58.52	2013-12-01 18:00	0.69	315.99	217.59
2013-11-25 19:00	0.32	320.57	101.68	2013-11-28 19:00	0.46	141.82	65.78	2013-12-01 19:00	0.64	360.75	229.25
2013-11-25 20:00	0.32	323.09	102.65	2013-11-28 20:00	0.48	133.94	64.68	2013-12-01 20:00	0.64	363.38	231.84
2013-11-25 21:00	0.32	326.78	105.25	2013-11-28 21:00	0.51	131.26	67.06	2013-12-01 21:00	0.79	337.02	267.33

Continue the **Table S1**

Time	$PM_{2.5}$/ PM_{10}	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)	Time	$PM_{2.5}$/ PM_{10}	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)	Time	$PM_{2.5}$/ PM_{10}	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)
2013-11-25 22:00	0.32	325.94	105.75	2013-11-28 22:00	0.52	141.42	73.79	2013-12-01 22:00	0.63	377.81	237.15
2013-11-25 23:00	0.34	321.42	109.75	2013-11-28 23:00	0.36	133.25	48.12	2013-12-01 23:00	0.61	344.81	210.94
2013-11-26 00:00	0.38	328.13	124.42	2013-11-29 00:00	0.47	144.11	68.28	2013-12-02 00:00	0.72	355.12	256.89
2013-11-26 01:00	0.40	339.21	135.17	2013-11-29 01:00	0.54	131.44	71.36	2013-12-02 01:00	0.67	372.07	247.58
2013-11-26 02:00	0.39	327.06	129.00	2013-11-29 02:00	0.48	115.39	54.99	2013-12-02 02:00	0.67	395.02	263.42
2013-11-26 03:00	0.38	329.27	126.33	2013-11-29 03:00	0.49	107.67	52.92	2013-12-02 03:00	0.83	357.73	296.90
2013-11-26 04:00	0.40	299.59	120.98	2013-11-29 04:00	0.45	112.96	50.73	2013-12-02 04:00	0.68	365.99	248.02
2013-11-26 05:00	0.35	325.25	113.31	2013-11-29 05:00	0.50	103.19	51.74	2013-12-02 05:00	0.69	340.18	233.70
2013-11-26 06:00	0.34	326.14	111.14	2013-11-29 06:00	0.48	113.50	54.49	2013-12-02 06:00	0.76	309.26	234.82
2013-11-26 07:00	0.37	291.09	108.80	2013-11-29 07:00	0.40	119.88	48.13	2013-12-02 07:00	0.68	355.92	241.02
2013-11-26 08:00	0.36	290.27	105.53	2013-11-29 08:00	0.42	127.62	53.08	2013-12-02 08:00	0.64	368.12	236.50
2013-11-26 09:00	0.30	296.45	88.98	2013-11-29 09:00	0.47	123.28	57.73	2013-12-02 09:00	0.62	340.78	210.28
2013-11-26 10:00	0.26	299.97	77.63	2013-11-29 10:00	0.47	111.98	52.70	2013-12-02 10:00	0.74	301.62	224.70
2013-11-26 11:00	0.25	256.43	64.71	2013-11-29 11:00	0.40	92.50	37.31	2013-12-02 11:00	0.59	345.00	204.43
2013-11-26 12:00	0.28	228.95	64.91	2013-11-29 12:00	0.39	82.15	31.76	2013-12-02 12:00	0.56	261.07	146.72
2013-11-26 13:00	0.28	228.18	64.57	2013-11-29 13:00	0.45	68.20	30.64	2013-12-02 13:00	0.70	223.12	155.19
2013-11-26 14:00	0.31	219.24	68.73	2013-11-29 14:00	0.40	75.39	30.29	2013-12-02 14:00	0.80	175.43	139.52
2013-11-26 15:00	0.29	207.73	59.82	2013-11-29 15:00	0.48	75.78	36.43	2013-12-02 15:00	0.64	206.26	132.86
2013-11-26 16:00	0.30	214.77	63.82	2013-11-29 16:00	0.44	67.56	29.75	2013-12-02 16:00	0.60	214.48	129.25
2013-11-26 17:00	0.33	251.70	83.65	2013-11-29 17:00	0.43	74.95	32.58	2013-12-02 17:00	0.63	225.01	141.51
2013-11-26 18:00	0.41	257.79	106.36	2013-11-29 18:00	0.47	81.95	38.78	2013-12-02 18:00	0.66	319.02	209.56
2013-11-26 19:00	0.44	225.01	99.75	2013-11-29 19:00	0.60	94.39	56.83	2013-12-02 19:00	0.61	373.10	225.84
2013-11-26 20:00	0.44	215.18	94.38	2013-11-29 20:00	0.66	105.43	69.90	2013-12-02 20:00	0.60	379.57	229.37

Continue the **Table S1**

Time	$PM_{2.5}$/ PM_{10}	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)	Time	$PM_{2.5}$/ PM_{10}	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)	Time	$PM_{2.5}$/ PM_{10}	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)
2013-11-27 19:00	0.46	89.44	41.31	2013-11-30 19:00	0.61	161.72	99.24	2013-12-03 19:00	0.58	252.42	145.31
2013-11-27 20:00	0.49	85.03	42.07	2013-11-30 20:00	0.59	169.92	100.58	2013-12-03 20:00	0.60	209.06	125.43
2013-11-27 21:00	0.54	86.16	46.39	2013-11-30 21:00	0.68	180.79	123.07	2013-12-03 21:00	0.64	177.66	113.03
2013-11-27 22:00	0.51	93.69	48.07	2013-11-30 22:00	0.69	193.38	133.40	2013-12-03 22:00	0.61	173.70	105.91
2013-11-27 23:00	0.66	98.94	64.99	2013-11-30 23:00	0.70	186.53	130.30	2013-12-03 23:00	0.56	184.23	102.60

Table S2. Relationship between Rc/a values and concentration of $PM_{2.5}$ (Case 1).

Rc/a	NO_3^- (μg/m³)	SO_4^{2-} (μg/m³)	NH_4^+ (μg/m³)	Rc/a	NO_3^- (μg/m³)	SO_4^{2-} (μg/m³)	NH_4^+ (μg/m³)	Rc/a	NO_3^- (μg/m³)	SO_4^{2-} (μg/m³)	NH_4^+ (μg/m³)
1.41	112	35	145	1.08	791	254	1273	1.35	304	103	568
1.46	102	33	131	1.07	802	254	1263	1.31	297	110	557
1.43	100	34	126	1.08	790	258	1273	1.27	300	113	542
1.43	106	40	143	1.09	776	262	1283	1.27	314	122	580
1.48	117	40	167	1.12	771	266	1324	1.24	343	129	621
1.43	124	43	179	1.66	769	267	2046	1.25	375	138	672
1.41	127	44	184	1.19	759	270	1451	1.25	413	155	744
1.68	128	48	223	1.12	743	267	1311	1.21	487	184	882
1.85	126	48	256	1.11	735	268	1287	1.17	568	204	998
1.55	130	64	277	1.09	714	270	1246	1.11	604	197	983
1.53	136	85	305	1.10	707	275	1250	1.09	589	184	922
1.53	135	72	277	1.07	749	293	1288	1.06	598	185	916
1.59	132	67	275	1.06	781	289	1293	1.05	608	192	937
1.62	130	74	297	1.04	765	268	1218	1.04	583	185	888
1.45	129	75	284	1.05	743	249	1173	1.03	652	213	1011
1.73	140	72	315	1.04	658	206	985	1.04	686	216	1071
1.65	177	77	388	1.04	580	185	856	1.06	706	223	1105
1.26	204	67	316	1.04	523	170	765	1.12	523	188	896
1.36	204	70	316	1.06	513	163	751	1.06	497	180	788
1.26	182	76	297	1.05	519	164	754	1.06	528	182	820
1.08	180	70	266	1.07	547	174	805	1.10	523	173	799
1.07	184	70	266	1.04	632	208	970	1.09	488	155	740
1.07	192	66	268	1.15	656	221	1146	1.12	405	136	629
1.07	187	63	256	1.20	619	214	1085	1.04	317	115	495
1.04	218	76	303	1.20	618	215	1099	1.07	261	99	414
1.05	216	76	293	1.21	600	205	1087	1.08	305	106	471
1.06	221	75	296	1.14	570	190	948	1.34	305	114	482
1.07	236	78	322	1.10	541	181	863	1.17	318	119	515
1.06	237	75	320	1.08	560	189	897	1.19	361	134	612
1.28	242	75	369	1.10	555	184	920	1.09	398	155	680
1.38	255	75	426	1.09	507	167	824	1.13	392	152	668
1.37	256	77	430	1.06	507	168	811	1.11	382	149	655
1.36	259	76	427	1.06	511	173	824	1.07	379	147	643
1.38	300	87	528	1.07	516	182	853	1.08	402	147	664

Table S3. Relationship between Rc/a values and concentration of $PM_{2.5}$ (CE).

Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)	Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)	Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)
1.17	162	60	256	1.88	40	19	63	1.15	172	65	256
1.17	178	66	289	1.85	34	20	59	1.35	170	69	263
1.15	190	71	313	1.58	35	19	54	1.44	169	70	293
1.24	189	79	334	1.52	48	22	66	1.37	178	77	304
1.36	152	64	284	1.47	67	31	104	1.21	192	79	328
1.34	73	33	130	1.34	94	43	156	1.30	197	73	349
1.49	66	26	109	1.35	115	48	202	1.63	174	69	360
1.63	47	21	81	1.28	115	41	174	1.77	130	52	284
1.97	41	20	76	1.30	133	44	199	1.87	123	53	299
1.88	40	19	63	1.27	154	49	228	1.91	117	49	287
1.85	34	20	59	1.21	159	55	233	1.65	111	46	217

Table S4. Relationship between Rc/a values and concentration of $PM_{2.5}$ (Case 2).

Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)	Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)	Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)
1.41	112	35	145	1.35	304	103	568	1.04	580	185	856
1.46	102	33	131	1.31	297	110	557	1.04	523	170	765
1.43	100	34	126	1.27	300	113	542	1.06	513	163	751
1.43	106	40	143	1.27	314	122	580	1.05	519	164	754
1.48	117	40	167	1.24	343	129	621	1.07	547	174	805
1.43	124	43	179	1.25	375	138	672	1.04	632	208	970
1.41	127	44	184	1.25	413	155	744	1.15	656	221	1146
1.68	128	48	223	1.21	487	184	882	1.20	619	214	1085
1.85	126	48	256	1.17	568	204	998	1.20	618	215	1099
1.55	130	64	277	1.11	604	197	983	1.21	600	205	1087
1.53	136	85	305	1.09	589	184	922	1.14	570	190	948
1.53	135	72	277	1.06	598	185	916	1.10	541	181	863
1.59	132	67	275	1.05	608	192	937	1.08	560	189	897
1.62	130	74	297	1.04	583	185	888	1.10	555	184	920
1.45	129	75	284	1.03	652	213	1011	1.09	507	167	824
1.73	140	72	315	1.04	686	216	1071	1.06	507	168	811
1.65	177	77	388	1.06	706	223	1105	1.06	511	173	824
1.26	204	67	316	1.08	780	243	1234	1.07	516	182	853
1.36	204	70	316	1.09	789	253	1274	1.12	523	188	896
1.26	182	76	297	1.08	791	254	1273	1.06	497	180	788
1.08	180	70	266	1.07	802	254	1263	1.06	528	182	820
1.07	184	70	266	1.08	790	258	1273	1.10	523	173	799
1.07	192	66	268	1.09	776	262	1283	1.09	488	155	740
1.07	187	63	256	1.12	771	266	1324	1.12	405	136	629
1.04	218	76	303	1.66	769	267	2046	1.04	317	115	495
1.05	216	76	293	1.19	759	270	1451	1.07	261	99	414
1.06	221	75	296	1.12	743	267	1311	1.08	305	106	471
1.07	236	78	322	1.11	735	268	1287	1.34	305	114	482
1.06	237	75	320	1.09	714	270	1246	1.17	318	119	515
1.28	242	75	369	1.10	707	275	1250	1.19	361	134	612
1.38	255	75	426	1.07	749	293	1288	1.09	398	155	680
1.37	256	77	430	1.06	781	289	1293	1.13	392	152	668
1.36	259	76	427	1.04	765	268	1218	1.11	382	149	655
1.38	300	87	528	1.05	743	249	1173	1.07	379	147	643

Table S5. Relationship between Rc/a values and concentration of $PM_{2.5}$ (Case 3).

Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)	Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)	Rc/a	NO_3^- (μg/m^3)	SO_4^{2-} (μg/m^3)	NH_4^+ (μg/m^3)
1.06	388	166	667	1.00	1800	744	3236	0.97	983	344	1546
1.06	450	171	740	1.02	1719	672	3075	0.98	1090	356	1696
1.04	553	178	857	1.03	1564	578	2740	1.00	1160	368	1770
1.01	707	196	1030	1.05	1376	503	2437	1.03	1280	399	2004
1.02	761	204	1097	1.09	1188	451	2182	1.00	1351	418	2123
1.02	770	205	1113	1.09	1127	441	2107	1.02	1336	419	2127
1.02	759	207	1106	1.07	1092	446	2032	1.05	1301	433	2144
1.03	778	211	1141	1.09	1033	438	1980	1.09	1403	527	2559
1.02	796	219	1174	1.07	1028	442	1948	1.07	1543	627	2882
1.01	872	228	1260	1.07	1007	427	1872	1.02	1697	666	3003
1.02	854	226	1246	1.03	1318	558	2412	1.00	1138	523	2134
1.05	719	216	1119	1.02	1414	644	2659	1.03	1155	549	2253
1.09	554	194	947	1.03	1463	731	2913	1.04	1184	585	2380
1.11	585	201	995	0.97	1480	808	2939	1.08	1177	595	2469
1.10	656	242	1146	0.96	1434	846	2937	1.10	1059	551	2295
1.06	879	254	1339	0.93	1256	717	2439	1.13	919	475	2033
1.00	815	289	1307	0.92	1321	682	2404	1.13	812	435	1812
0.97	762	296	1266	0.95	1334	631	2412	1.19	619	351	1491
0.98	892	314	1417	0.98	1234	566	2265	1.22	504	302	1288

Table S6. Relationship between $[NH_4^+]_{Excess}$ and NO_3^-(nmol/m^3) in the (a) Case 1, (b) CE, (c) Case 2 and (d) Case 3.

$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^--
Case 3		**Case 2**				**CE**		**Case 1**	
335	388	75	112	908	759	135	162	67	133
396	450	65	102	775	743	157	178	73	136
499	553	57	100	749	735	171	190	75	137
637	707	62	106	703	714	175	189	68	126
687	761	86	117	697	707	156	152	65	126
702	770	92	124	700	749	64	73	66	127
690	759	96	127	713	781	56	66	56	115
716	778	128	128	680	765	39	47	46	108
734	796	160	126	672	743	36	41	8	102
801	872	149	130	570	658	25	40	5	120
792	854	134	136	484	580	18	34	17	125
685	719	133	135	425	523	17	35	31	136
557	554	141	132	424	513	22	48	30	138
591	585	147	130	424	519	42	67	23	135
660	656	134	129	455	547	70	94	12	126
828	879	170	140	553	632	105	115	2	104
725	815	234	177	702	656	92	115	2	95
671	762	181	204	656	619	110	133	50	104
786	892	176	204	667	618	129	154	92	112
855	983	143	182	676	600	123	159	105	116
980	1090	125	180	566	570	125	172	101	120
1030	1160	126	184	498	541	125	170	88	118
1203	1280	137	192	516	560	152	169	38	121
1284	1351	128	187	549	555	150	178	44	116
1284	1336	151	218	487	507	169	192	35	109
1274	1301	141	216	473	507	201	197	36	107
1499	1403	146	221	477	511	222	174	49	102
1622	1543	166	236	488	516	179	130	169	101
1665	1697	170	237	519	523	192	123	171	100
1740	1800	218	242	426	497	189	117	15	101
1724	1719	275	255	453	528	125	111	7	123
1579	1564	275	256	450	523			64	150
1425	1376	274	259	428	488			28	130
1276	1188	353	300	356	405			18	113
1219	1127	361	304	263	317			23	120
1137	1092	335	297	215	261			20	120
1100	1033	314	300	258	305			20	111
1059	1028	336	314	252	305			32	117
1013	1007	362	343	275	318			24	128
1291	1318	395	375	344	361			91	178
1366	1414	432	413	368	398			97	164
1443	1463	512	487	362	392			72	131
1315	1480	588	568	356	382			85	131

Continue the **Table S6**

$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^-	$[NH_4^+]_{Excess}$	NO_3^--
Case 3		**Case 2**				**CE**		**Case 1**	
1236	1434	587	604	347	379			97	128
1236	1434	587	604	347	379			97	128
997	1256	551	589	369	402			132	133
1032	1321	544	598					106	130
1144	1334	552	608					79	128
1128	1234	517	583					60	124
1083	1138	582	652					64	116
1150	1155	636	686					23	101
1204	1184	656	706					21	90
1273	1177	745	780						
1188	1059	765	789						
1078	919	763	791						
939	812	753	802						
785	619	755	790						
681	504	757	776						
612	470	789	771						
603	470	1509	769						

Table S7. Concentration of inorganic particles in the (a) Case 1, (b) CE, (c) Case 2 and (d) Case 3.

	NO_3^- (ueq/m^3)	SO_4^{2-} (ueq/m^3)	NH_4^+ (ueq/m^3)	Cl^- (ueq/m^3)	Ca^{2+} (ueq/m^3)	K^+ (ueq/m^3)	Mg^{2+} (ueq/m^3)
Case 1	0.12	0.08	0.22	0.08	0.10	0.03	0.01
CE	0.12	0.05	0.21	0.08	0.05	0.03	0.01
Case 2	0.43	0.15	0.72	0.14	0.06	0.05	0.01
Case 3	1.04	0.42	1.87	0.23	0.04	0.06	0.01

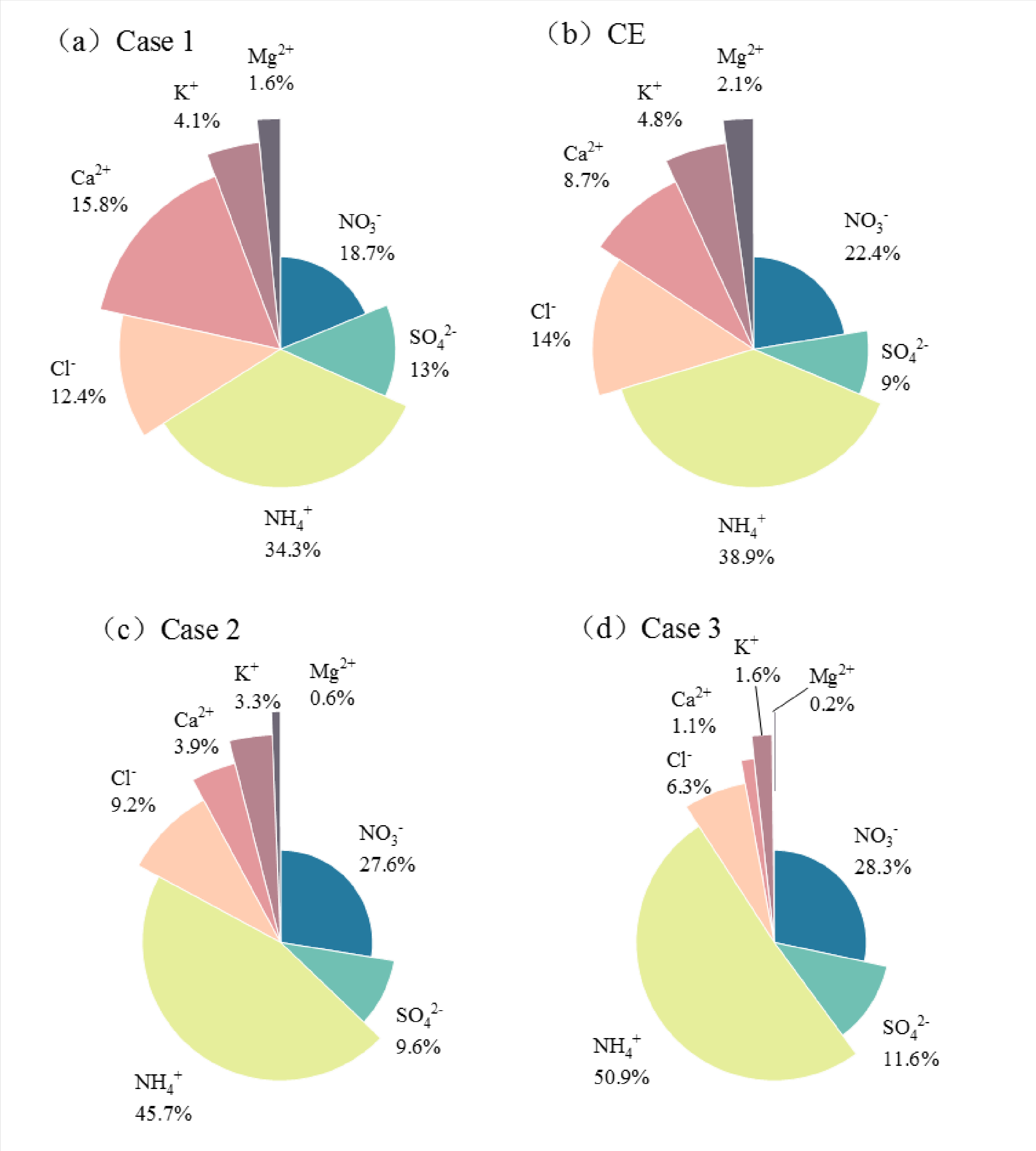

Fig. S3. Equivalent contributions of observed particle inorganic species in the (a) Case 1, (b) CE, (c) Case 2 and (d) Case 3 (Table S7).