

Spatio-Temporal Characteristics of Air Quality Index (AQI) over Northwest China

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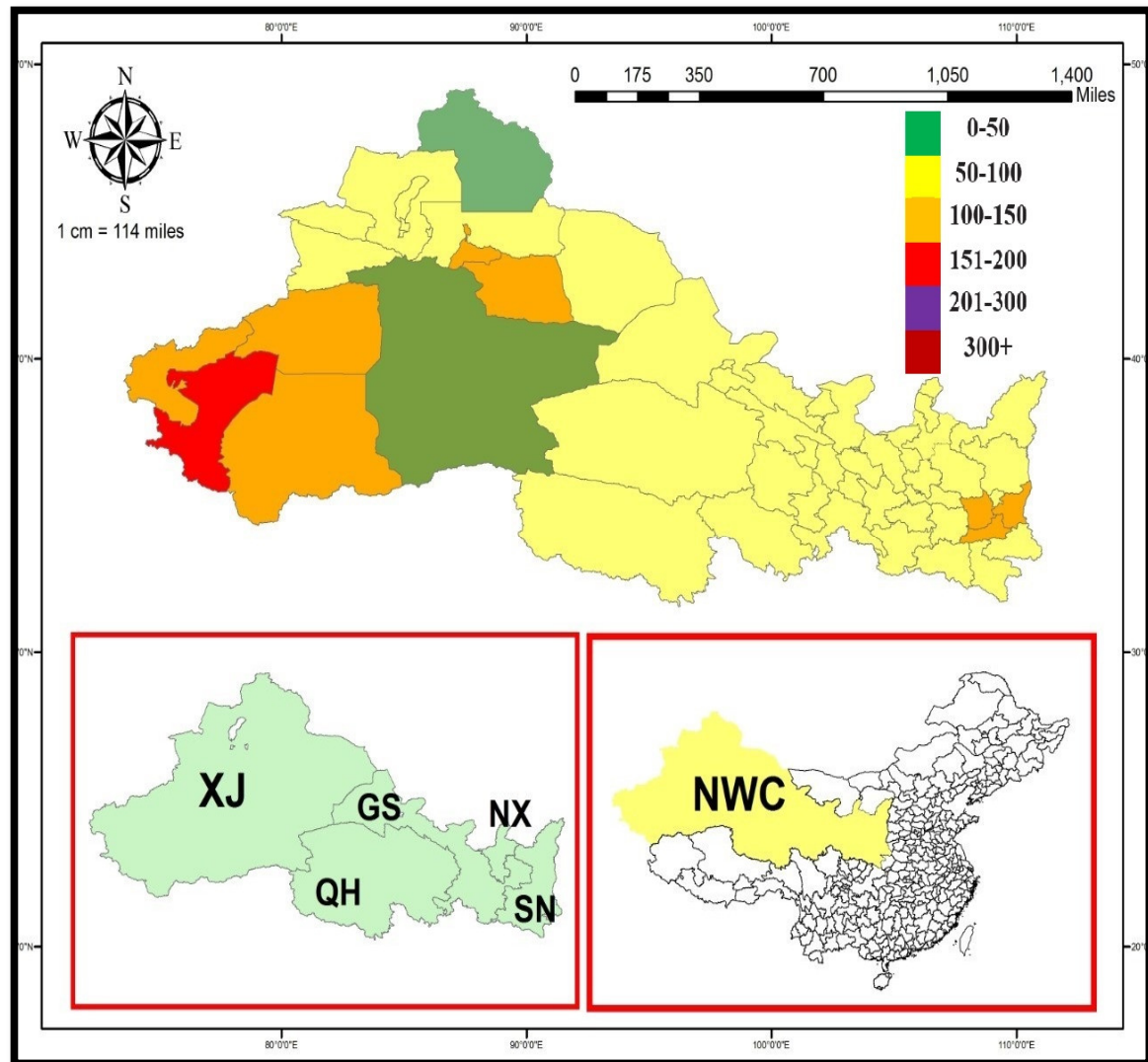


Figure. S1. The locations of 53 cities in five provinces (Shaanxi (SN), Xinjiang (XJ), Gansu (GS), Ningxia (NX), and Qinghai (QH)) northwest China (NWC). Color represents the different classes of air quality index e.g., green (0-50, good), yellow (51-100, moderate), orange (101-150, unhealthy for sensitive group), red (151-200, unhealthy for all), purple (201-300, very unhealthy), and maroon (300+, hazardous).

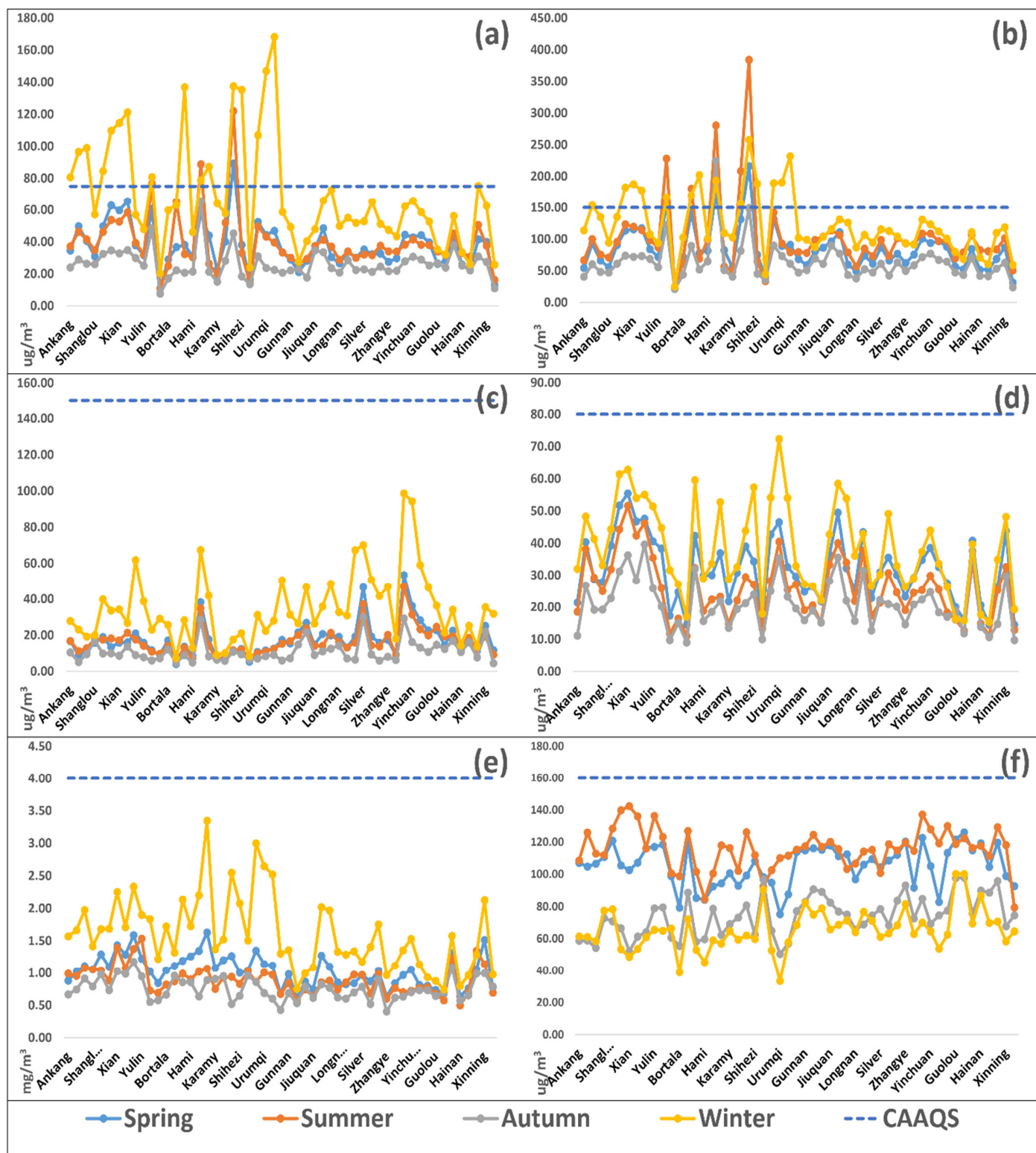


Figure. S2. The seasonal (spring, summer, autumn, and winter) spatial distribution of PM_{2.5} (a), PM₁₀ (b), SO₂ (c), NO₂ (d), CO (e), and O₃ (f) in 53 cities of northwest China during 2015-2018. Descriptions are as follow: light blue line with dots (spring), orange line with dots (summer), grey line with dots (autumn), yellow line with dots (winter), and blue line (Chinese ambient air quality standards (CAAQS), daily mean). The abbreviations are as follows: PM_{2.5} (fine particulate matter), PM₁₀ (coarse particulate matter), SO₂ (Sulfur dioxide), NO₂ (nitrogen dioxide), CO (carbon monoxide), and O₃ (ozone).

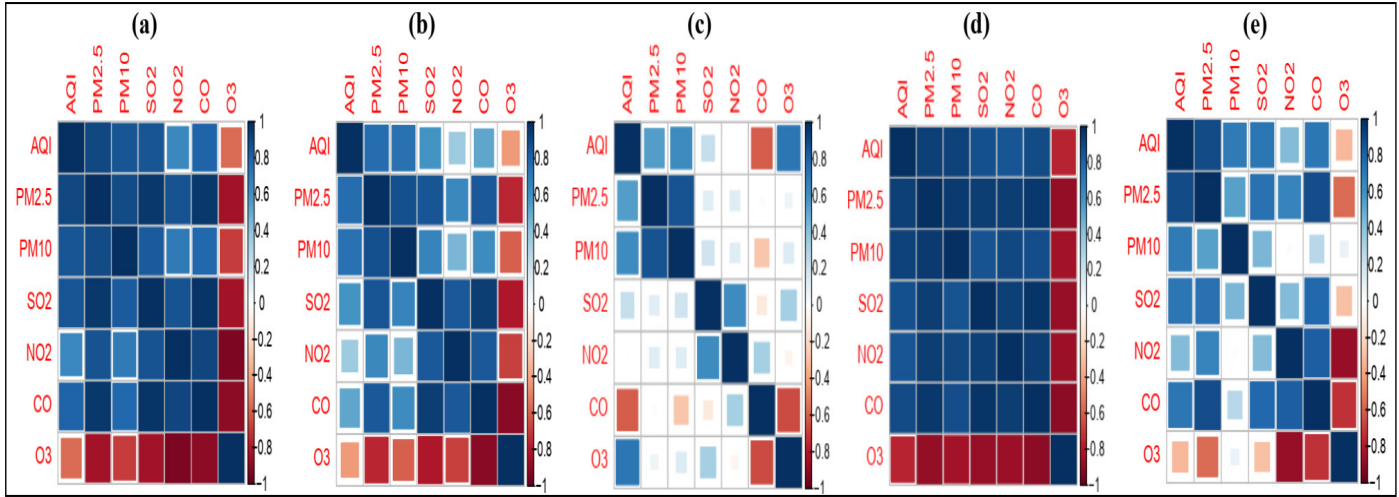


Figure. S3. Annual (a) and seasonal (spring (b), summer (c), autumn (d), winter (e)) relationship between air quality index (AQI) and criteria pollutants (PM_{2.5}, PM₁₀, SO₂, NO₂, CO, and O₃). The abbreviations are as follows: AQI (air quality index), PM_{2.5} (fine particulate matter), PM₁₀ (coarse particulate matter), SO₂ (sulfur dioxide), NO₂ (nitrogen dioxide), CO (carbon monoxide), and O₃ (ozone).

Table. S1. Lists of cities, and their ranking in five provinces (Shaanxi (SN), Xinjiang (XJ), Gansu (GS), Ningxia (NX), and Qinghai (QH)) of northwest China (NWC) during 2015-2018.

<i>Ran king</i>	<i>City</i>	<i>PM_{2.5}</i> ($\mu\text{g}/\text{m}^3$)	<i>City</i>	<i>PM₁₀</i> ($\mu\text{g}/\text{m}^3$)	<i>City</i>	<i>SO₂</i> ($\mu\text{g}/\text{m}^3$)	<i>City</i>	<i>NO₂</i> ($\mu\text{g}/\text{m}^3$)	<i>City</i>	<i>CO</i> (mg/m^3)	<i>City</i>	<i>O₃</i> ($\mu\text{g}/\text{m}^3$)	<i>City</i>	<i>AQ I</i>	<i>City</i>
1	Ankang	101.01	Kashgar	255.26	Kashgar	56.88	Shizuishan	51.47	Xian	1.73	Ili	114.11	Haibei	162.34	Kashgar
2	Baoji	76.39	Hotan	219.63	Hotan	45.82	Silver	48.55	Urumqi	1.61	Yannan	111.61	Guolu	123.54	Hotan
3	Hanzhong	69.69	Xianyang	167.11	Aksu	44.33	Yinchuan	47.10	Yannan	1.52	Xian	109.08	Zhangye	112.57	Aksu
4	Shanglu	69.26	Wujiaqu	145.26	Crete	42.39	Hotan	47.08	Weina	1.51	Turpan	108.01	Shizuishan	111.70	Xianyang
5	Tonchuan	66.76	Aksu	143.12	Korla	30.80	Wuzhong	45.80	Lanzhou	1.44	Xinnin	106.85	Hainan	111.08	Wujiaqu
6	Weinan	64.99	Weinan	138.34	Turpan	29.62	Jinchang	42.83	Xianyang	1.40	Yulin	106.69	Jiayuguan	109.98	Xian
7	Xian	64.58	Xian	123.08	Xian	27.21	Yannan	41.47	Changji	1.37	Urumqi	106.65	Crete	109.64	Crete
8	Xianyang	64.38	Urumqi	122.64	Weinan	27.03	Qinyang	38.85	Pingliang	1.32	Kashgar	104.32	Huanggan	109.14	Weinan
9	Yannan	60.52	Turpan	120.19	Xianyang	25.43	Linxia	38.48	Xinnin	1.30	Wujiaqu	103.94	Yulin	105.62	Urumqi
10	Yulin	56.82	Changji	115.37	Wujiaqu	25.41	Xinnin	38.33	Baoji	1.29	Hotan	102.44	Jinchang	102.48	Turpan
11	Aksu	55.73	Shihezi	111.44	Urumqi	24.80	Zhongwei	38.27	Yulin	1.29	Haidong	102.24	Gunna	98.00	Shihezi
12	Altay	55.11	Baoji	105.93	Lanzhou	24.58	Guolu	38.15	Haidong	1.29	Changji	101.19	Tonchuan	97.48	Korla
13	Bortala	52.98	Tonchuan	103.51	Jiuquan	23.30	Tianshui	37.46	Turpan	1.27	Hanzhong	100.87	Jiuquan	95.66	Changji
14	Crete	51.50	Hanzhong	102.45	Shizuishan	23.04	Zhangye	35.58	Shihezi	1.26	Xianyang	99.77		93.93	
15	Changji	49.44	Huanggan	101.28	Baoji	22.76	Haidong	35.44			Tonchuan	99.58	Aksu	92.13	Baoji
16	Hami	47.12	Lanzhou	100.18	Yinchuan	22.10		35.14	Linxia	1.25	Lanzhou	98.81	Haixi	88.18	Shizuishan
17	Hotan	46.97	Crete	100.06	Changji	21.48	Tonchuan	34.51	Tonchuan	1.18	Hami	98.66	Haidong	85.38	Yinchuan
18	Ili	45.20	Haidong	95.20	Tonchuan	20.71	Jiayuguan	34.21	Yinchuan	1.17	Linxia	98.12	Linxia	84.66	Lanzhou
19	Karamay	44.95	Yinchuan	92.89	Shihezi	20.54	Longnan	33.98	Tianshui	1.17	Huanggan	97.87	Zhongwei	83.90	Huanggan
20	Korla	44.55	Ili	92.72	Wuzhong	20.46		33.77	Wujiaqu	1.17	Wuwei	96.87	Qinyang	83.56	Jiuquan
21	Kashgar	44.23	Korla	91.66	Haidong	20.32	Lanzhou	33.58	Ili	1.15	Korla	96.87		83.33	Hanzhong
22	Shihezi	43.84	Ankang	91.24	Xinnin	19.43	Xianyang	33.40	Kashgar	1.13	Shihezi	96.10	Lanzhou	80.79	Wuzhong
23	Tachen	42.88	Shizuishan	90.08	Silver	19.23		32.15	Aksu	1.13	Tachen	96.02	Weinan	79.81	Haidong
24	Turpan	42.29	Wuzhong	89.25	Yannan	19.06	Haixi	29.90	Shizuishan	1.10	Weinan	95.73	Shanglu	79.46	Zhongwei
25	Urumqi	41.27	Xinnin	88.21	Jinchang	19.05		29.58	Hanzhong	1.09	Baoji	95.63	Dingxi	79.41	Yannan
26	Wujiaqu	40.82	Yannan	87.08	Zhongwei	18.94	Xian	27.49	Wuzhong	1.08	Shanglu	94.81	Tachen	79.30	Ili

27	Dingxi	40.4	Linxia	86.2	Hami	18.7	Weina	27.2	Dingxi	1.06	Crete	94.2	XianYa	79.	
28	Gunna	38.7	Jiuqua	86.1	Wuwei	17.9	Ankan	26.9	Wuwei	1.06	Bortala	93.0	Tiansh	78.	Silver
29	Jiayug	38.6	Zhong	83.6	Jiayug	17.6	Gunna	26.2	Shangl	1.03	Aksu	91.9	Kashg	77.	Xinnin
30	Jincha	37.7	Pinglia	80.8	Hanzh	17.5	Shangl	26.1			Karam	91.8		75.	Jincha
31	Jiuqua	36.9	Shangl	79.1	Pinglia	17.2		26.1			Ankan	91.6	Yanna	75.	Jiayug
32	Lanzh	36.8	Tiansh	78.9	Guyua	16.9		26.1			Yinchu	90.9	Pinglia	74.	
33		36.4		78.7	Huang	16.0	Pinglia	25.8	Guyua			90.8	Turpa	74.	
34	Longn	36.2		76.6		16.0	Jiuqua	25.2	Huang	0.96	Gunna	90.3	Karam	74.	Zhang
35	Pinglia	35.5	Dingxi	76.3	Yulin	15.9	Changj	24.6	Longn	0.96	Qinya	88.9		73.	Pinglia
36	Qinya	34.0	Silver	74.8	Linxia	15.4	Wujiaq	23.3			Shizuis	88.6	Xian	73.	Ankan
37		33.2	Yulin	74.1	Ili	14.6	u	0	Hami	0.91	han	7	Silver	52.	
38	Silver	32.6	Qinya	73.7	Zhang	14.3	Turpa	23.1	Jiayug	0.89	Pinglia	88.3		72.	Hami
39	Tiansh	32.5	ng	72.3	ye	13.6	n	1	uan	0.88	Longn	87.9	Guyua	72.	Tiansh
40	Wuwei	32.5	Bortala	71.5	Dingxi	13.6	Yushu	2	wei	0.87	an	0	n	25	ui
41	Zhang	32.1	Zhang	72.3	Tiansh	13.6		21.6	Gunna		Tiansh	87.8	Xinnin	70.	
42	Ye	32.0	ye	71.5	ui	7	Altay	9	n	0.87	ui	0	g	76	Dingxi
43	Guyua	32.1	Gunna	69.9	Gunna	13.6		20.7	Zhang		Wuzho	87.2		70.	Guyua
44		32.1	n	69.9	n	5	Shihezi	8	ye	0.86	ng	7	Hotan	32	n
45	Shizuis	32.0	Hami	68.5	Bortala	13.1	Urumq	20.7			Jincha	85.8	Hanzh	70.	
46	Han	32.0	Guyua	68.5	Ankan	13.1	i	8	Bortala	0.85	ng	2	ong	32	Haibei
47	Yinchu	31.3	Guo	68.3	Ankan	13.1	Haina	20.7	Ankan	0.83	Guyua	85.6	Ankan	70.	Gunna
48	Wuzho	30.4	n	66.5	g	5	n	1	g		n	7	g	19	n
49	Zhong	30.1	Longn	68.3	Qinya	13.0	Hanzh	19.8	Qinya	0.83	Altay	85.3	Ili	70.	Shangl
50	Wei	30.4	an	66.5	ng	9	ong	2	ng		Zhong	83.9		69.	Qinya
51	Guolo	29.3	Guolo	63.2	Shangl	12.9	Kashg	19.6	Karam	0.81	wei	9	Korla	52	ng
52		30.1	Karam	63.2	ou	0		7	y			83.8		69.	Guolo
53	Guolo	29.3	y	61.7	Guolo	12.8	Aksu	18.5	Jincha	0.80	Yushu	8	Altay	10	u
54		29.3	Haina	61.7	Karam	12.1		17.7	Guolo	0.77	Jiuqua	82.0	Wuzho	66.	Haina
55	Haibei	28.9	n	61.6	y	0	Baoji	8	u		n	2	ng	02	n
56	Haido	28.7	Haina	11.2	Haina	11.2	Huang	17.5				79.9		65.	Karam
57	ng	28.7	Haibei	10.6	n	2	gnan	9	Altay	0.77	Haixi	4	Yushu	93	y
58	Haina	25.2	Jincha	60.5	Haibei	7	Guyua	16.7	Haina	0.77	Dingxi	77.3	Longn	65.	Bortala
59	n	25.2	ng	58.5				5	n		Guolo	77.1	an	56	
60		24.4	Haixi	57.6	Haixi	8.45	Hami	4	Tachen	0.73	u	0	Changj	62.	Haixi
61	Haixi	24.4	Jiayug	57.6	Longn	7.60		14.1	g			76.7	i	61.	Longn
62	Huang	17.0	uan	40.9	an		Korla	8	Yushu	0.67	Haibei	2	Hami	12	an
63	gnan	17.0	Tachen	40.9	Yushu	7.32	Karam	14.0		0.65	Zhang	76.3	Wujiaq	52.	Tachen
64	Xinnin	16.5	g	38.3	Tachen	7.12	y	6	Haibei		ye	4	u	51	g
65		12.3	Yushu	22.6	g		Tachen	12.8		0.63	Haina	74.6		51.	
66	Yushu	7	Altay	7	Altay	5.47	g	7	Haixi		n	1	Bortala	69	Yushu
67		12.3						12.8			Jiayug	67.5	Urumq	47.	
68		7					Crete	7	Crete	0.62	uan	0	i	42	Altay

Table. S2. Pearson Correlation between AQI and six criteria pollutants (PM_{2.5}, PM₁₀, SO₂, NO₂, CO, and O₃) in northwest China (NWC) during 2015-2018. The abbreviations are as follows: AQI (air quality index), PM_{2.5} (fine particulate matter), PM₁₀ (coarse particulate matter), SO₂ (sulfur dioxide), NO₂ (nitrogen dioxide), CO (carbon monoxide), and O₃ (ozone).

	PM _{2.5}	PM ₁₀	SO ₂	NO ₂	CO	O ₃
Annual	R/sig./n	R/sig./n	R/sig./n	R/sig./n	R/sig./n	R/sig./n
AQI	.901**/0.000/365	.855**/0.000/365	.852**/0.000/365	.644**/0.000/365	.805**/0.000/365	-.568**/0.000/365
PM _{2.5}		.897**/0.000/365	.965**/0.000/365	.864**/0.000/365	.961**/0.000/365	-.831**/0.000/365
PM ₁₀			.833**/0.000/365	.710**/0.000/365	.788**/0.000/365	-.697**/0.000/365
SO ₂				.868**/0.000/365	.975**/0.000/365	-.836**/0.000/365
NO ₂					.920**/0.000/365	-.930**/0.000/365
CO						-.899**/0.000/365
Spring						
AQI	.770**/0.000/92	.748**/0.000/92	.598**/0.000/92	.357**/0.000/92	.530**/0.000/92	-.423**/0.000/92
PM _{2.5}		.874**/0.000/92	.854**/0.000/92	.643**/0.000/92	.843**/0.000/92	-.753**/0.000/92
PM ₁₀			.670**/0.000/92	.458**/0.000/92	.629**/0.000/92	-.596**/0.000/92
SO ₂				.846**/0.000/92	.946**/0.000/92	-.804**/0.000/92
NO ₂					.842**/0.000/92	-.688**/0.000/92
CO						-.900**/0.000/92
Summer						
AQI	.551**/0.000/92	.626**/0.000/92	.231*/0.027/92	-.010/0.926/92	-.603**/0.000/92	.724**/0.000/92
PM _{2.5}		.868**/0.000/92	.129/0.220/92	.138/0.189/92	-.020/0.853/92	.071/0.500/92
PM ₁₀			.206*/0.049/92	.135/0.199/92	-.280**/0.007/92	.143/0.173/92
SO ₂				.628**/0.000/92	-.118/0.261/92	.331**/0.001/92
NO ₂					.333**/0.001/92	-.060/0.572/92
CO						-.659**/0.000/92
Autumn						
AQI	.934**/0.000/91	.924**/0.000/91	.879**/0.000/91	.859**/0.000/91	.899**/0.000/91	-.765**/0.000/91
PM _{2.5}		.951**/0.000/91	.948**/0.000/91	.947**/0.000/91	.969**/0.000/91	-.879**/0.000/91
PM ₁₀			.869**/0.000/91	.901**/0.000/91	.889**/0.000/91	-.835**/0.000/91
SO ₂				.934**/0.000/91	.976**/0.000/91	-.868**/0.000/91
NO ₂					.946**/0.000/91	-.853**/0.000/91
CO						-.895**/0.000/91
Winter						
AQI	.894**/0.000/90	.701**/0.000/90	.729**/0.000/90	.430**/0.000/90	.727**/0.000/90	-.325**/0.002/90
PM _{2.5}		.550**/0.000/90	.745**/0.000/90	.663**/0.000/90	.881**/0.000/90	-.567**/0.000/90
PM ₁₀			.450**/0.000/90	-.018/0.870/90	.272**/0.009/90	.088/0.410/90
SO ₂				.439**/0.000/90	.781**/0.000/90	-.299**/0.004/90
NO ₂					.826**/0.000/90	-.864**/0.000/90
CO						-.724**/0.000/90

Note: The correlations are expressed as Pearson's correlation coefficient, where *, and ** denote significant correlations at p b 0.01, and p b 0.05 (two-tailed) respectively.