

Supplementary materials of

An empirical mode decomposition for establishing spatiotemporal air quality trends in Shandong, China

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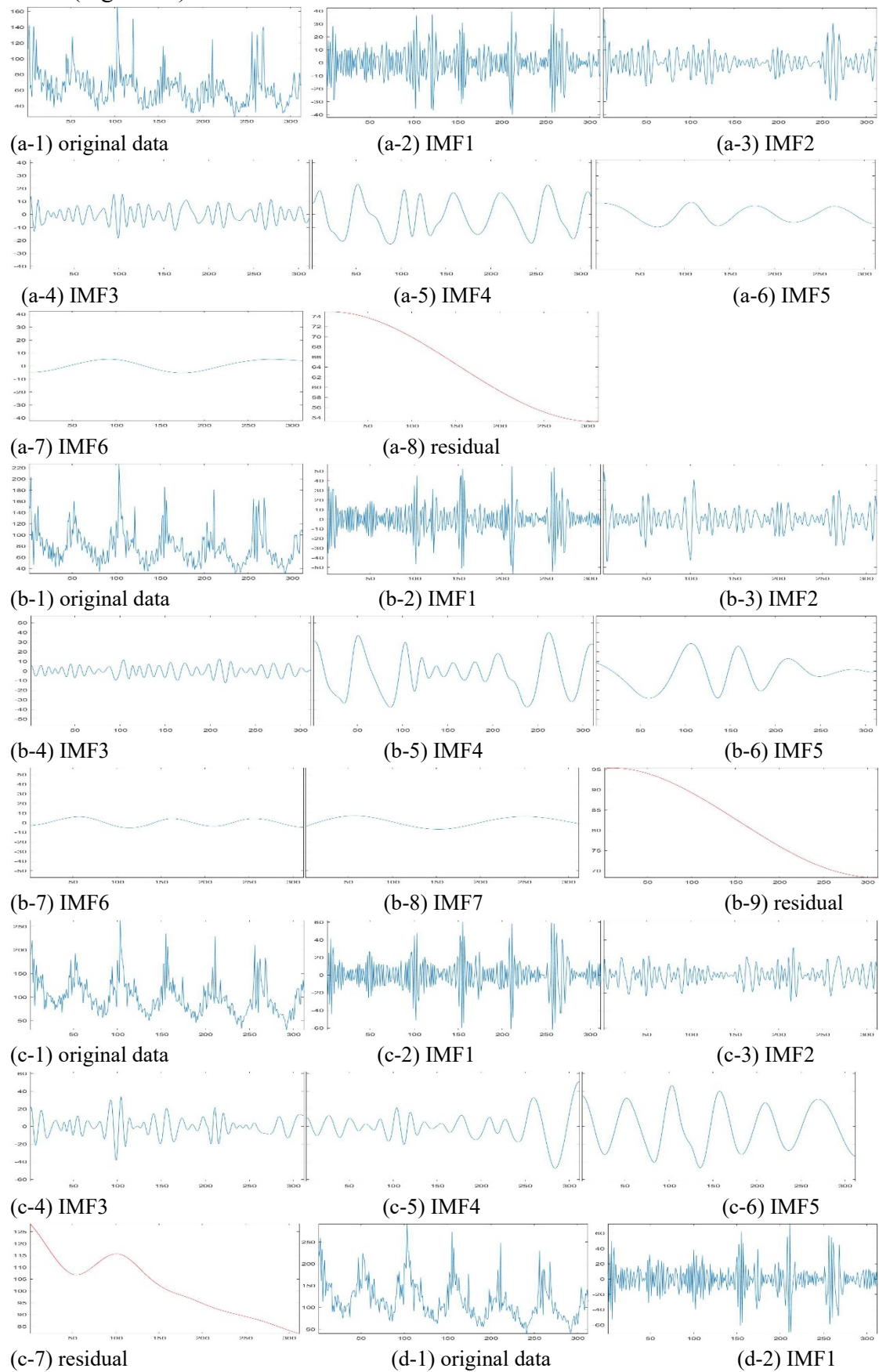
Table S1. Statistical summary and proportions of the weekly average AQI values at the 91 stations

City	Station Name	Statistical summary				Percentage reaching the standard					
		Max	Min	Median	Mean	I (0-50)	II (51-100)	III (101-150)	IV (151-200)	V (201-300)	VI (>300)
Jinan	Kegansuo	336.83	26.00	101.34	107.92	2.24%	47.12%	37.82%	8.33%	4.17%	0.32%
Jinan	Agricultural Scientific Institute	374.29	30.14	113.72	123.35	1.60%	37.18%	38.46%	13.14%	9.29%	0.32%
Jinan	BDA Jinan	311.33	29.14	98.33	105.08	2.24%	50.00%	37.18%	7.37%	2.88%	0.32%
Jinan	Chemical Factor	353.14	35.86	103.65	113.44	1.60%	44.87%	35.90%	11.54%	5.77%	0.32%
Jinan	Provincial Seed Warehouse	335.00	39.43	110.36	116.64	0.96%	38.46%	44.23%	11.54%	4.49%	0.32%
Jinan	City Monitoring Station	368.50	32.29	109.39	115.53	1.60%	39.42%	43.91%	10.26%	4.17%	0.64%
Jinan	Changqing District Communist Party School	287.00	36.18	101.21	108.99	3.21%	45.51%	36.54%	10.26%	4.49%	0.00%
Jinan	Vocational and Technical College	271.71	22.43	96.55	105.33	5.45%	50.00%	29.49%	10.26%	4.81%	0.00%
Jinan	Environmental Monitoring Station	307.33	31.00	85.43	96.78	3.53%	59.62%	27.88%	5.77%	2.88%	0.32%
Jinan	BDA Zhangqiu	310.33	31.50	89.43	96.98	6.73%	56.09%	27.24%	7.05%	2.56%	0.32%
Qingdao	Yang Kou	190.53	19.00	57.91	61.84	34.94%	57.05%	7.69%	0.32%	0.00%	0.00%
Qingdao	Licang District Substation	218.29	23.71	73.00	80.69	13.78%	65.38%	16.35%	3.85%	0.64%	0.00%
Qingdao	Shibei District Substation	196.14	19.43	60.57	65.62	33.33%	56.41%	7.69%	2.56%	0.00%	0.00%
Qingdao	Shinan District East Substation	197.43	26.29	64.78	69.41	19.23%	72.12%	6.09%	2.56%	0.00%	0.00%
Qingdao	Sifang District Substation	210.57	21.29	66.36	72.60	21.47%	64.10%	11.22%	2.88%	0.32%	0.00%
Qingdao	Shinan District West Substation	231.43	22.43	60.36	65.30	31.73%	59.94%	7.05%	0.64%	0.64%	0.00%
Qingdao	Laoshan District Substation	248.86	26.29	65.50	72.13	25.00%	62.50%	8.65%	3.53%	0.32%	0.00%
Qingdao	Huangdao District Substation	257.14	25.43	72.52	79.70	14.42%	68.59%	12.50%	2.88%	1.60%	0.00%
Qingdao	Chengyang District Substation	241.57	24.29	69.64	76.78	17.63%	65.71%	12.82%	3.53%	0.32%	0.00%
Qingdao	Jimo EPA Substation	252.57	27.00	72.23	82.01	16.99%	58.97%	16.35%	5.77%	1.92%	0.00%
Qingdao	BDA Jimo Substation	188.71	21.43	59.44	65.16	29.49%	61.22%	7.69%	1.60%	0.00%	0.00%
Qingdao	JN Substation	285.43	18.00	73.72	81.27	22.44%	52.56%	16.67%	7.05%	1.28%	0.00%
Qingdao	No. 2 Substation	251.14	24.29	65.91	72.46	28.85%	56.09%	11.54%	2.24%	1.28%	0.00%
Qingdao	Jiaozhou EPA	256.43	22.57	70.43	77.21	17.95%	62.50%	15.38%	3.21%	0.96%	0.00%
Qingdao	Jiaozhou No. 1 Middle School	259.29	20.00	68.32	75.63	19.23%	64.42%	12.18%	3.53%	0.64%	0.00%
Qingdao	Laixi EPA Substation	211.33	20.86	64.94	75.18	22.12%	58.33%	14.42%	4.17%	0.96%	0.00%
Qingdao	People's Square Substation	206.00	27.57	69.57	77.84	22.12%	56.09%	16.35%	5.13%	0.32%	0.00%

Qingdao	Pingdu No. 1	275.57	22.33	76.07	83.00	15.06%	59.62%	19.87%	4.49%	0.96%	0.00%
Qingdao	Pingdu No. 2	199.29	26.57	68.57	72.94	22.76%	61.54%	12.50%	3.21%	0.00%	0.00%
Linyi	Yihe compound	231.14	27.71	92.36	101.09	6.41%	50.32%	30.13%	9.62%	3.53%	0.00%
Linyi	Lunan Pharmaceutical Factory	291.71	28.43	95.21	106.38	8.33%	45.51%	28.21%	10.90%	7.05%	0.00%
Linyi	Xinguang Woolen Factory	251.86	20.86	96.79	105.56	6.09%	47.44%	31.73%	10.58%	4.17%	0.00%
Linyi	Hedong Insurance Company	257.43	23.00	89.31	101.26	11.54%	46.15%	28.53%	7.37%	6.41%	0.00%
Dezhou	Children's Amuzment Park	355.50	34.29	103.21	115.93	1.60%	46.15%	33.33%	11.54%	6.41%	0.96%
Dezhou	Supervision Station	355.50	33.29	102.14	114.11	2.88%	45.83%	33.33%	10.90%	6.09%	0.96%
Liaocheng	District Government	321.43	34.00	107.14	116.54	2.24%	41.99%	34.29%	15.06%	6.09%	0.32%
Liaocheng	Communist Party School	352.14	39.43	120.07	128.68	0.64%	33.97%	32.05%	26.92%	6.09%	0.32%
Binzhou	City EPA	251.43	31.29	91.21	98.25	6.09%	53.53%	28.53%	9.29%	2.56%	0.00%
Binzhou	No. 2 Water Factory	298.29	29.00	92.43	102.20	6.09%	50.96%	28.53%	11.54%	2.88%	0.00%
Binzhou	Beizhong new school	275.43	28.00	88.30	96.62	7.05%	52.24%	31.09%	7.05%	2.56%	0.00%
Zibo	People's Park	283.71	32.29	94.69	106.42	2.24%	54.49%	28.53%	9.29%	5.45%	0.00%
Zibo	Dongfeng Chemical Factory	278.57	35.43	97.82	105.37	2.56%	50.64%	34.62%	7.69%	4.49%	0.00%
Zibo	Boshan Shuangshan	331.17	26.57	95.92	105.13	2.56%	51.28%	31.73%	9.94%	4.17%	0.32%
Zibo	Zichuan Meteo. Stations	314.64	33.14	105.18	112.92	1.92%	43.91%	37.18%	12.18%	4.49%	0.32%
Zibo	Linzi Putian Park	299.86	27.57	106.86	113.09	1.92%	40.71%	42.63%	9.94%	4.81%	0.00%
Zibo	Zhoucun sanjin Group	386.14	28.14	105.02	114.97	4.17%	42.31%	33.01%	12.50%	7.69%	0.32%
Zaozhuang	Shizhong District Government	339.14	39.29	105.54	117.76	2.24%	41.35%	35.90%	13.14%	6.73%	0.64%
Zaozhuang	Xuecheng EPA	281.57	33.86	102.29	109.77	4.49%	44.87%	32.05%	13.78%	4.81%	0.00%
Zaozhuang	Yicheng District Government	298.14	29.14	103.86	115.48	1.92%	44.23%	33.65%	14.10%	6.09%	0.00%
Zaozhuang	Taierzhuang EPA	272.14	27.29	105.37	114.23	3.53%	41.35%	32.69%	16.03%	6.41%	0.00%
Zaozhuang	Shanting EPA	259.83	29.57	91.29	102.91	6.73%	48.40%	30.13%	10.58%	4.17%	0.00%
Yantai	BDA Yantai	209.29	21.86	67.79	70.73	22.76%	66.35%	8.33%	1.92%	0.64%	0.00%
Yantai	Bearing Factory	198.86	25.57	66.00	70.59	21.79%	65.71%	9.62%	2.88%	0.00%	0.00%
Yantai	Xijiao Chemical Station	190.67	25.57	67.25	72.05	19.23%	69.23%	8.97%	2.56%	0.00%	0.00%
Yantai	Laishan EPA	192.67	25.43	56.36	59.70	38.46%	57.37%	3.21%	0.96%	0.00%	0.00%
Yantai	Fushan EPA	229.86	21.00	65.38	71.70	22.76%	66.03%	8.01%	2.56%	0.64%	0.00%
Yantai	Zhaoyuan EPA	264.40	20.00	70.47	78.46	22.44%	56.41%	16.35%	3.85%	0.96%	0.00%
Yantai	Zhaoyuan Education Bureau	247.57	21.33	70.43	77.02	26.60%	52.56%	15.06%	4.81%	0.96%	0.00%
Yantai	Penglai EPA	203.71	22.41	61.59	65.97	31.09%	59.94%	6.73%	1.92%	0.32%	0.00%
Yantai	Penglai Museum	171.86	26.71	61.00	65.16	28.53%	64.42%	6.09%	0.96%	0.00%	0.00%
Yantai	Laizhou EPA	238.86	33.03	70.00	76.45	15.71%	67.31%	13.46%	2.88%	0.64%	0.00%

Yantai	Laizhou Foreign Economic Council	266.71	28.00	72.34	78.49	16.03%	64.74%	16.03%	2.24%	0.96%	0.00%
Weifang	City Arbitration Committee	327.57	28.43	89.79	98.56	3.53%	58.65%	29.49%	5.45%	2.56%	0.32%
Weifang	Weifang EPA	258.71	29.24	85.72	93.07	5.77%	59.94%	26.92%	6.41%	0.96%	0.00%
Weifang	Hanting Monitoring Station	316.14	24.14	91.15	98.61	5.13%	55.13%	31.09%	6.09%	2.24%	0.32%
Weifang	Shouguagn Monitoring Station	332.00	27.57	91.31	98.55	7.05%	53.85%	28.85%	7.05%	2.88%	0.32%
Weifang	Century School	315.00	24.43	91.75	99.21	7.37%	52.24%	29.49%	8.33%	2.24%	0.32%
Jining	Huojucheng	281.71	27.86	92.23	101.91	4.49%	52.56%	30.13%	8.65%	4.17%	0.00%
Jining	Jining Monitoring Station	296.75	32.14	92.75	103.35	5.45%	50.64%	30.45%	9.94%	3.53%	0.00%
Jining	Electrochemical Factory	255.86	29.86	95.46	101.63	4.17%	50.64%	34.29%	8.33%	2.56%	0.00%
Taian	Taian Monitoring Station	246.86	30.29	87.62	97.07	4.81%	61.22%	24.68%	4.49%	4.81%	0.00%
Taian	Population Education school	245.43	22.43	82.23	88.74	9.29%	62.82%	20.51%	5.77%	1.60%	0.00%
Taian	Shandong Electric Power School	324.14	27.00	93.36	108.28	3.21%	55.45%	25.00%	8.97%	6.09%	1.28%
Rizhao	Rizhao Monitoring Station	264.29	27.00	78.77	90.76	13.14%	57.37%	19.23%	7.05%	3.21%	0.00%
Rizhao	City Governement Square	244.29	24.29	72.14	79.16	21.79%	58.01%	14.74%	3.85%	1.60%	0.00%
Rizhao	Port Authority	250.29	26.00	73.50	80.52	18.91%	58.65%	16.67%	4.81%	0.96%	0.00%
Weihai	Huxia Technical School	174.29	22.29	52.08	57.59	44.23%	50.96%	3.53%	1.28%	0.00%	0.00%
Weihai	Shandong University at Weihai	191.57	17.83	56.15	60.10	38.78%	56.41%	3.53%	1.28%	0.00%	0.00%
Weihai	City Monitoring Station	168.86	21.69	54.50	58.29	42.31%	54.49%	1.92%	1.28%	0.00%	0.00%
Weihai	Rongcheng EPB	172.67	19.25	49.50	56.36	51.92%	43.27%	4.17%	0.64%	0.00%	0.00%
Weihai	Shandong Chengshan Tire Company	185.00	12.33	48.93	56.16	52.24%	42.31%	4.49%	0.96%	0.00%	0.00%
Weihai	Wendeng Environmental Protection Bureau	230.71	22.34	56.00	60.60	40.71%	50.96%	6.73%	1.28%	0.32%	0.00%
Weihai	Wendeng Silk Company	150.14	22.29	53.33	57.31	40.71%	54.49%	4.49%	0.32%	0.00%	0.00%
Weihai	Rushan Environmental Protection Bureau	245.86	18.43	52.57	59.45	46.47%	45.19%	7.37%	0.64%	0.32%	0.00%
Weihai	Rushan Meteorological Bureau	177.29	18.71	49.71	55.65	50.32%	42.31%	6.41%	0.96%	0.00%	0.00%
Dongying	Xicheng Sunshine EP C	299.00	23.86	86.65	94.75	8.33%	55.45%	26.60%	7.69%	1.92%	0.00%
Dongying	City Environmental Protection Bureau	248.00	25.86	77.16	84.32	12.82%	59.94%	22.44%	4.17%	0.64%	0.00%
Dongying	Gengjin village	244.50	25.43	87.15	93.94	5.77%	58.33%	28.85%	5.77%	1.28%	0.00%
Heze	City Meteorological Bureau	309.86	39.86	108.07	121.50	1.92%	40.06%	33.01%	16.99%	7.69%	0.32%
Heze	Municipal CPPCC	309.71	33.00	104.59	114.99	2.56%	44.87%	32.69%	13.46%	6.09%	0.32%
Heze	Heze University	307.43	37.00	110.79	123.04	2.88%	37.50%	34.62%	16.99%	7.05%	0.96%

Here we displayed all IMFs and trends of four cluster centers decomposed by EMD (Figure S1).



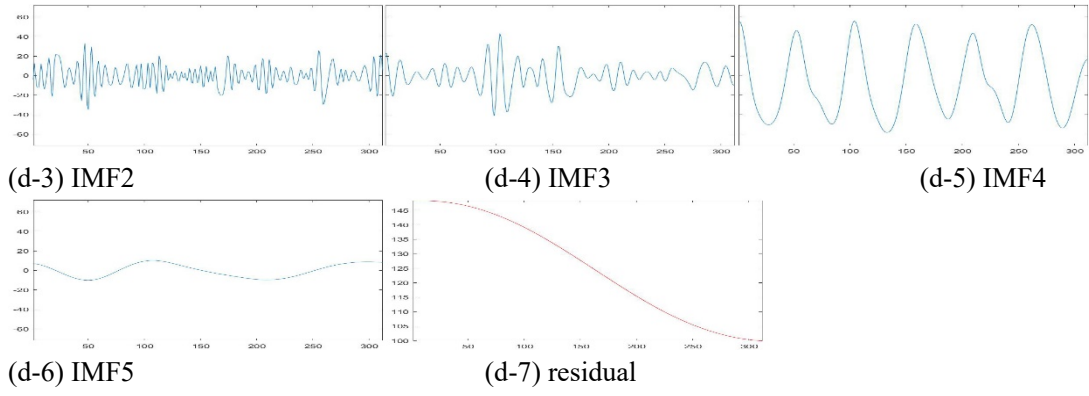


Figure S1. All IMFs and trends of four cluster centers (a, b, c and d) decomposed by EMD