The seven figures are as follows:

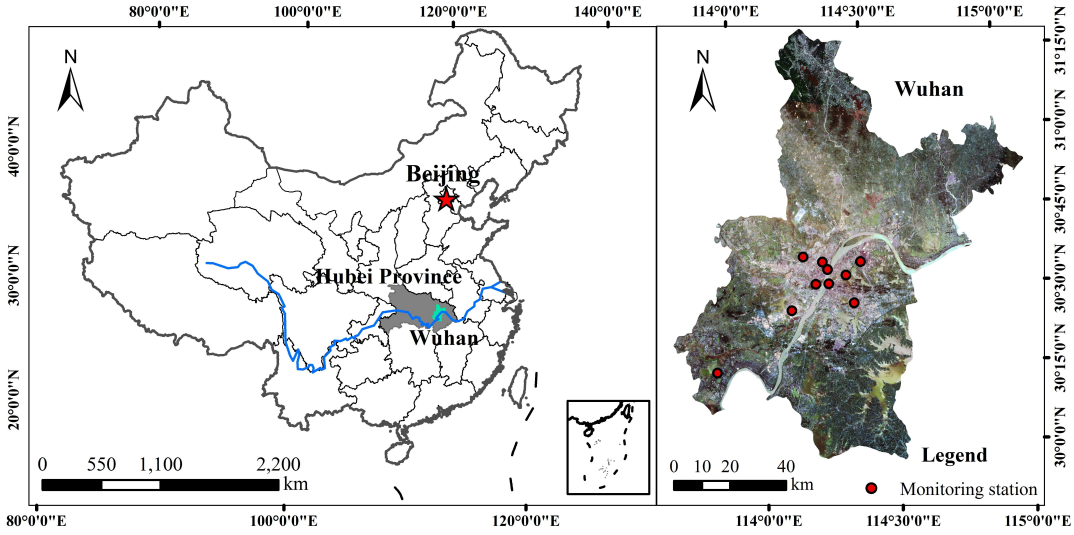

Fig. 1 Location of the study area in China (A: map of China, B: map of Wuhan).

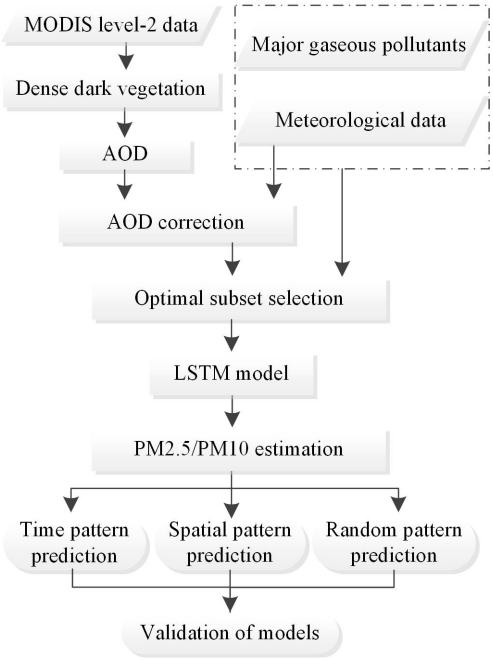

Fig. 2 A flow chart of the research process.

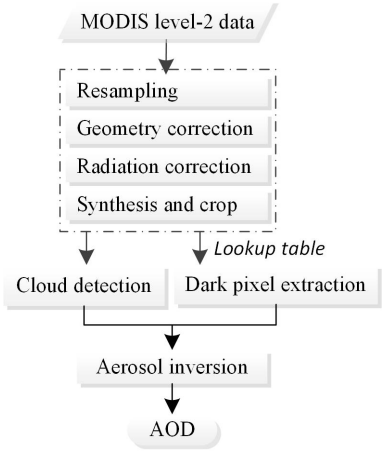

Fig. 3 A flow chart of the AOD retrieval.

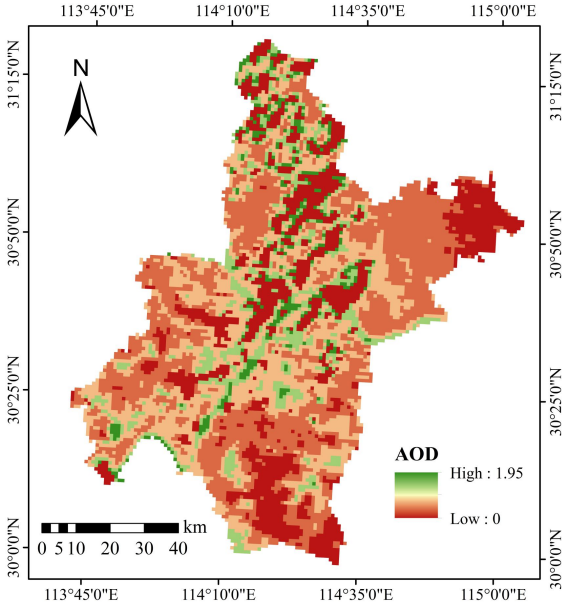

Fig. 4 AOD retrieval on July 18th.

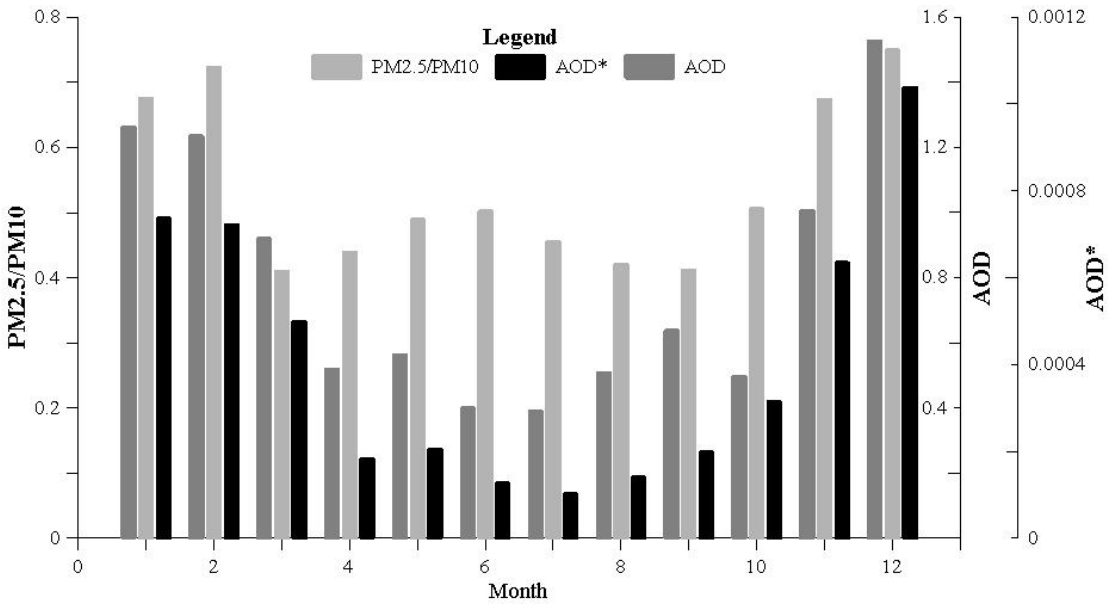

Fig. 5 A bar chart of monthly average PM2.5/PM10, AOD and AOD*.

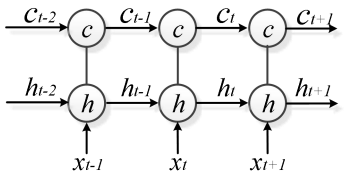

Fig. 6 The calculation process of unit *c* in the LSTM model.

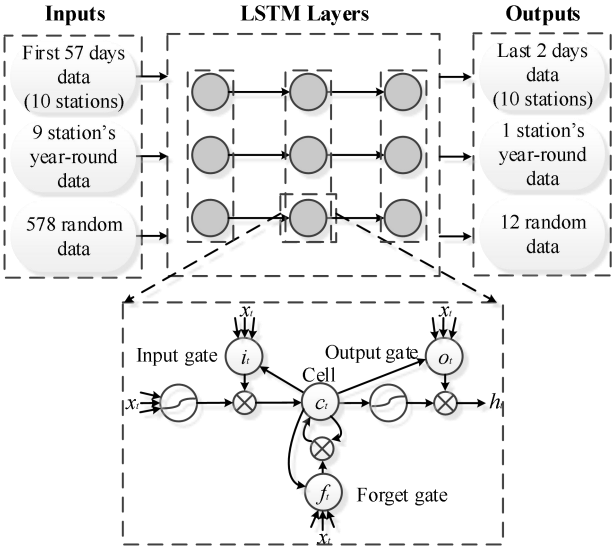

Fig. 7 Architecture of the LSTM model.

The seven tables are as follows:

Table 1 Monthly average concentrations of PM2.5, PM10, and gaseous pollutants in 2017.

Month	PM2.5 (μg/m^3)	PM10 (μg/m^3)	SO_2 (μg/m^3)	NO_2 (μg/m^3)	O_3 (μg/m^3)	CO (mg/m^3)
Jan	99.48	147.26	26.66	48.20	36.86	1.40
Feb	121.17	167.42	16.63	46.01	36.13	1.44
Mar	59.44	145.11	27.04	51.88	60.96	1.11
Apr	41.27	93.87	16.07	38.35	93.18	0.93
May	52.85	107.95	12.00	40.15	125.30	0.93
Jun	27.80	55.35	4.82	25.45	102.20	0.81
Jul	24.23	53.13	6.05	17.77	107.92	0.62
Aug	27.37	65.09	11.07	24.47	73.24	1.04
Sep	36.20	87.85	19.11	40.55	139.25	1.33
Oct	39.07	77.20	13.65	43.64	54.00	1.10
Nov	90.88	134.91	21.53	62.36	54.28	1.19
Dec	111.15	148.29	27.06	70.21	21.78	1.50

Table 2 Monthly averages of the meteorological data.

Month	Average rainfall (0.1 mm)	Evaporation capacity (0.1 mm)	Average surface temperature (0.1℃)	Average air pressure (0.1 hPa)	Relative humidity (-1%)	Sunshine intensity (0.1 h)	Average temperature (0.1℃)	Average wind velocity (0.1 m/s)
Jan	0.00	18.09	62.19	10230.27	63.91	58.06	47.78	16.51
Feb	38.84	19.55	108.27	10151.31	72.03	24.23	103.45	29.35
Mar	0.00	29.34	140.11	10166.74	64.14	94.10	115.67	14.52
Apr	0.00	35.81	211.98	10103.29	69.60	105.93	181.67	16.16
May	0.00	36.81	288.18	10062.96	66.83	103.69	240.91	10.72
Jun	30.49	37.48	289.44	10002.23	84.54	64.80	261.32	18.69
Jul	2.33	57.25	366.30	10011.06	70.70	112.87	317.36	22.14
Aug	24.15	37.88	318.01	10017.01	81.09	84.67	296.38	18.88
Sep	0.00	45.47	289.04	10093.00	69.64	106.04	242.16	19.61
Oct	20.54	19.50	199.33	10138.21	84.03	61.31	176.99	11.60
Nov	0.00	21.36	157.65	10180.33	75.21	85.71	131.89	13.28
Dec	0.00	15.80	59.94	10222.16	67.78	76.57	42.91	9.12

Table 3 Monthly average AOD, PBLH, f(RH), and AOD*.

Month	AOD ($\times 10^{-1}$)	PBLH	f(RH)	AOD* ($\times 10^{-4}$)
Jan	12.610	428	4.00	7.366
Feb	12.343	444	3.85	7.221
Mar	9.200	461	4.00	4.989
Apr	5.192	713	4.00	1.820
May	5.625	686	4.00	2.050
Jun	4.000	631	5.00	1.268
Jul	3.895	686	5.56	1.021
Aug	5.083	686	5.26	1.409
Sep	6.375	741	4.35	1.978
Oct	4.964	395	4.00	3.142
Nov	10.06	412	3.85	6.345
Dec	15.263	412	3.57	10.377

Table 4 Factors selected by the optimal subset method.

Factors \ R^2	0.461	0.460	0.460	0.457	0.455	0.455	0.454	0.453	0.452	0.452
CO	√	√	√	√	√	√	√	√	√	√
Average rainfall	√	√	√	√	√		√	√	√	√
Evaporation capacity	√	√	√	√	√	√	√	√	√	√
Relative humidity	√	√	√		√		√	√	√	√
Sunshine intensity	√	√	√	√	√	√	√	√		√
Average wind velocity	√	√		√	√	√	√	√	√	√
AOD*	√	√	√	√	√	√	√	√	√	√
SO_2	√	√	√	√	√	√	√	√	√	√
O_3	√	√	√	√	√	√	√	√	√	√
Average air pressure		√		√	√	√				
Average surface temperature				√	√	√				√
Average temperature							√			
NO_2								√		

Table 5 The results and relative error rates of the time pattern predictions.

Measured value	Predicted value					Relative error rate (%)				
	LSTM	MLP	BP	SVM	CHAID	LSTM	MLP	BP	SVM	CHAID
0.8212	0.7682	0.7329	0.7786	0.6698	0.4853	6.4540	10.7526	5.1875	18.4364	40.9036
0.7436	0.6910	0.6526	0.6961	0.7841	0.4853	7.0737	12.2378	6.3878	5.4465	34.7364
0.6629	0.5962	0.4624	0.7074	0.8353	0.6753	10.0618	30.2459	6.7129	26.0069	1.8706
0.6950	0.6297	0.5955	0.6850	0.5628	0.6753	9.3957	14.3165	1.4388	19.0216	2.8345
0.7816	0.6102	0.5134	0.6871	0.8092	0.5145	21.9294	34.3142	12.0906	3.5312	34.1735
0.6311	0.6795	0.6608	0.5864	0.7032	0.6487	7.6691	4.7061	7.0829	11.4245	2.7888
0.7959	0.4918	0.5211	0.6870	0.8568	0.6973	38.2083	34.5270	13.6826	7.6517	12.3885
0.8743	0.8487	0.7104	0.6474	0.7451	0.6973	2.9281	18.7464	25.9522	14.7775	20.2448
0.7204	0.4774	0.6087	0.8106	0.7446	0.8206	33.7313	15.5053	12.5208	3.3592	13.9089
0.9854	0.6031	0.7445	0.7154	0.6760	0.8206	38.7964	24.4469	27.4000	31.3984	16.7242
0.7079	0.7842	0.7606	0.8321	0.6089	0.7959	10.7784	7.4446	17.5449	13.9850	12.4311
0.9455	0.7127	0.7531	0.7064	0.7285	0.7959	24.6219	20.3490	25.2882	22.9508	15.8223
0.7200	0.4969	0.4701	0.6692	0.8172	0.6931	30.9861	34.7083	7.0556	13.5000	3.7361
0.8600	0.8848	0.5717	0.6192	0.6907	0.6931	2.8837	33.5233	28.0000	19.6860	19.4070
0.6571	0.6311	0.6055	0.7011	0.8522	0.5812	3.9568	7.8527	6.6961	29.6911	11.5508
0.9189	0.6849	0.6583	0.6195	0.7146	0.5812	25.4652	28.3600	32.5824	22.2331	36.7505
0.7640	0.7573	0.5281	0.6549	0.5406	0.7870	0.8770	30.8770	14.2801	29.2408	3.0105
0.9273	0.7777	0.5247	0.6354	0.7155	0.7870	16.1329	43.4164	31.4785	22.8405	15.1299
0.6277	0.6417	0.7458	0.7308	0.5392	0.6951	2.2304	18.8147	16.4250	14.0991	10.7376
0.8896	0.8075	0.6556	0.6685	0.6694	0.7534	9.2289	26.3040	24.8539	24.7527	15.3103
Mean:						15.1704	22.5724	16.1330	17.7017	16.2230
Maximum:						38.7964	43.4163	32.5824	31.3984	40.9036
Minimum:						0.8770	4.7061	1.4388	3.3592	1.8706

Table 6 The results and relative error rates of the spatial pattern prediction.

Models	LSTM	MLP	ANN	SVM	CHAID
Mean:	32.1585	37.6755	34.1333	34.0207	33.7718
Maximum:	160.3270	216.3275	222.9295	204.7317	230.1367
Minimum:	0.1545	0.1451	0.1124	0.9026	0.2396

Table 7 The results and relative error rates of the random pattern prediction.

Measured	Predicted value					Relative error rate (%)				
value	LSTM	MLP	BP	SVM	CHAID	LSTM	MLP	BP	SVM	CHAID
0.5870	0.5723	0.5443	0.5762	0.6091	0.4928	2.5043	7.2743	1.8399	3.7649	16.0477
0.6213	0.7449	0.6402	0.6561	0.6826	0.6795	19.8938	3.0420	5.6012	9.8664	9.3675
0.9843	0.6650	0.4874	0.6247	0.6185	0.7422	32.4393	50.4826	36.5336	37.1635	24.5962
0.8000	0.6238	0.4500	0.4772	0.5231	0.4928	22.0250	43.7500	40.3500	34.6125	38.4000
0.4638	0.4656	0.4773	0.4773	0.5136	0.4928	0.3881	2.9107	2.9107	10.7374	6.2527
0.7010	0.6913	0.5697	0.6811	0.6675	0.6795	1.3837	18.7304	2.8388	4.7789	3.0670
0.2222	0.3502	0.5598	0.4292	0.3971	0.3737	57.6058	151.9352	93.1593	78.7129	68.1818
0.5929	0.7606	0.6807	0.6543	0.6598	0.6795	28.2847	14.8086	10.3559	11.2835	14.6062
0.9571	0.5940	0.5346	0.6246	0.6698	0.6164	37.9375	44.1438	34.7404	30.0178	35.5971
0.7576	0.7611	0.6095	0.5959	0.6398	0.4928	0.4620	19.5486	21.3437	15.5491	34.9525
0.6277	0.6921	0.5654	0.6935	0.6802	0.6795	10.2597	9.9251	10.4827	8.3639	8.2523
0.8896	0.6743	0.5290	0.7551	0.7353	0.7422	24.2019	40.5351	15.1192	17.3449	16.5692
Mean:						19.7821	33.9239	22.9396	21.8496	22.9909
Maximum:						57.6058	151.9352	93.1593	78.7129	68.1818
Minimum:						0.3881	2.9107	1.8399	3.7649	3.0670