PingShan district of SheZhen City Environmental Air Pollution

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Abstract. Environmental air pollution has become a matter of great concern to people. From 2014 to 2015, continuous automatic monitoring of environmental air quality and daily meteorological data, this study try to find out the main pollutants that affect the environmental air quality in Pingshan district.

General Situation of the Research Area and Data Sources

Pingshan district is located in the northeast of Shenzhen city, connecting huiyang dayawan development zone in the east, longgang central city with developed commerce and complete supporting facilities in the north, yantian port and pinghu railway hub in the west, and dapeng peninsula with original ecology in the south. It is the main industrial base in the east of Shenzhen with a total area of 168.0 square kilometers. The natural terrain of Pingshan area is mainly shallow hills and basins, with gentle terrain and good construction conditions. The terrain is high in the west, high in the south, low in the east and low in the north.

Data source

(1) continuous automatic monitoring of environmental air quality and daily meteorological data in Pingshan district. Meteorological factor monitoring data and environmental air quality monitoring factor data are from Pingshan and Xiapi monitoring stations. Meteorological factors include temperature, humidity, air pressure, wind speed, wind direction and other 5 items, among which 16125 groups of hourly data in 2014 and 17462 groups of hourly data in 2015 were collected. Environmental air quality monitoring factors include 7 items, including SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO, O_3, O_3-8h, etc. There were 8760 groups in 2014 and 8760 groups in 2015.

(2) environmental quality bulletin of Pingshan district from 2014 to 2015.

(3) from January 1, 2014 to December 31, 2015, MODIS (1KM AOD) product data are the basis.

Analysis of Pollution Characteristics

In order to find out the main pollutants that affect the environmental air quality in Pingshan district, this study calculated the average daily concentration comprehensive pollution index of SO_2, NO_2, PM_{10}, $PM_{2.5}$, O_3, CO and O_3, as well as the number of days of occurrence of 8 kinds of pollutants, including SO_2, NO_2, PM_{10}, $PM_{2.5}$, O_3, CO and O_3 from 2014 to 2015，shown in TABLE Ⅰ and Fig.1 for details.

According to the statistical results, the primary pollutant in Pingshan area is $PM_{2.5}$, followed by O_3. The comprehensive air pollution index of Pingshan monitoring station was 1.992 and 1.766 in 2014 and 2015. Xiapi monitoring station air comprehensive pollution index in 2014 and 2015 is 2.156 and 2.055, two years, two stations are the primary pollutant $PM_{2.5}$.

According to the proportion of air pollutants in the AQI statistics of Pingshan district in the past

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two years, $PM_{2.5}$ was the most important pollutant in the AQI statistics of Pingshan monitoring station in 2014, accounting for 46.85%, followed by O_3, accounting for 26.03%. NO_2 and PM_{10} accounted for 18.63% and 5.8% of other pollutants. Xiapi monitoring station AQI statistics in the number of days $PM_{2.5}$ as the primary pollutant is the largest, accounting for 67.67%, followed by PM_{10}, accounting for 13.97%; O_3 and CO account for 11.23% and 7.12% of other pollutants.

In the AQI statistics of Pingshan monitoring station in 2015, $PM_{2.5}$ was the primary pollutant for the most days, accounting for 43.29%, followed by O_3, accounting for 24.11%, NO_2 accounting for 16.99%, PM_{10} accounting for 8.49%, and CO accounting for 7.12%. "PI PI" monitoring station AQI statistics of $PM_{2.5}$ as the number of days the most important pollutant, 41.92%, followed by PM_{10}, 35.89%, other pollutants O_3 accounted for 9.86%, NO_2 accounted for 8.22%.

It can be seen from the above that the air pollutants with more days in the AQI statistics of Pingshan district in the past two years are $PM_{2.5}$, PM_{10} and O_3 respectively.

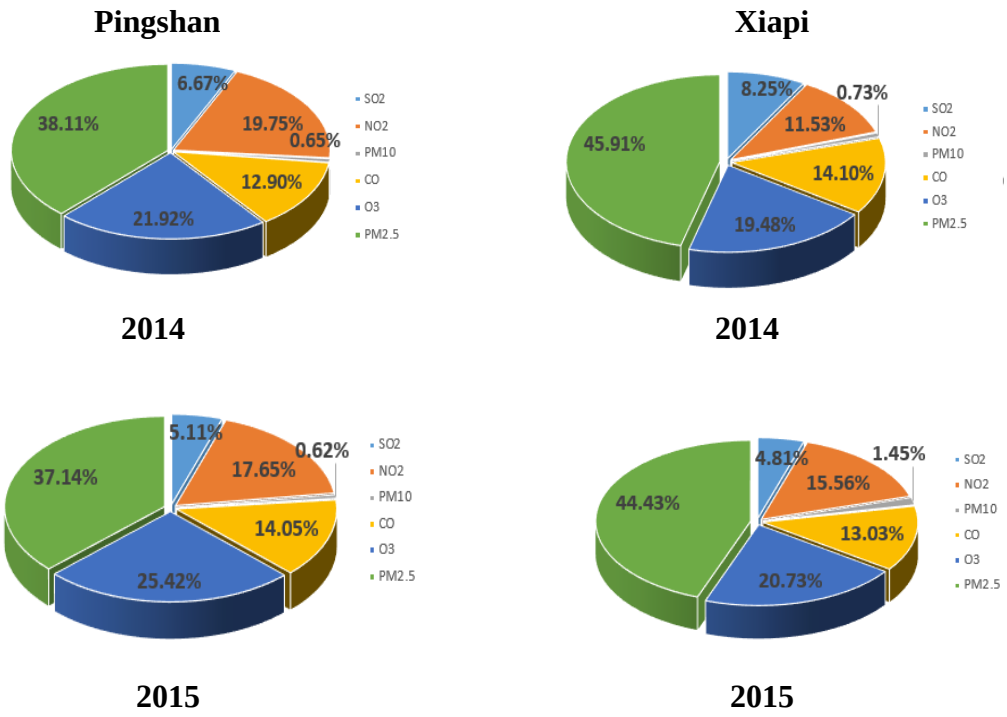


Fig1 Proportion of air pollutants in AQI statistics of Pingshan district in recent two years

TABLE1 ENVIRONMENTAL AIR POLLUTANT POLLUTION INDEX AND POLLUTION LOAD COEFFICIENT OF PINGSHAN DISTRICT FROM 2014 TO 2015

Year		2014		2015	
Monitoring Point Position		*Pingshan*	*Xiapi*	*Pingshan*	*Xiapi*
January	Composite pollution index	2.980	2.895	2.666	2.930
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$
	Days	27	30	28	28
February	Composite pollution index	1.716	1.798	2.351	2.320
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$
	Days	16	18	17	20
March	Composite pollution index	2.031	2.369	1.693	1.901
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$
	Days	19	23	19	25
April	Composite pollution index	1.936	2.053	1.781	2.071
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	O_3	$PM_{2.5}$

	Days	14	13	12	14
May	Composite pollution index	1.323	1.662	1.268	1.524
	Primary pollutant	NO_2	$PM_{2.5}$	NO_2	$PM_{2.5}$
	Days	15	16	12	18
June	Composite pollution index	1.457	1.709	0.966	1.126
	Primary pollutant	O_3	$PM_{2.5}$	O_3	NO_2
	Days	11	21	15	13
July	Composite pollution index	1.547	1.695	1.301	1.466
	Primary pollutant	O_3	$PM_{2.5}$	O_3	$PM_{2.5}$
	Days	12	17	16	10
August	Composite pollution index	1.335	1.617	1.712	2.014
	Primary pollutant	NO_2	$PM_{2.5}$	$PM_{2.5}$	PM_{10}
	Days	12	13	9	15
September	Composite pollution index	1.778	1.919	1.712	2.125
	Primary pollutant	O_3	$PM_{2.5}$	O_3	PM_{10}
	Days	18	19	12	23
October	Composite pollution index	2.674	2.743	2.108	2.558
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	PM_{10}
	Days	17	24	21	19
November	Composite pollution index	2.362	2.547	2.116	2.672
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	NO_2	PM_{10}
	Days	25	27	19	30
September	Composite pollution index	2.722	2.815	1.559	1.968
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	PM_{10}
	Days	23	26	21	16
Whole Year	Composite pollution index	1.992	2.156	1.766	2.055
	Primary pollutant	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$
	Days	171	247	158	153

Data distribution regulation analysis

In order to further analyze the characteristics of environmental air pollution in Pingshan area, the distribution and variation of monitoring data in recent years were analyzed. In this study, percentiles were calculated based on monitoring data of PM_{10}, $PM_{2.5}$, O_3, O_3-8h, as shown in TABLE Ⅱ to TABLE Ⅷ. The frequency distribution of pollutants in different concentration ranges is shown in Fig. 2 to Fig. 8 for details. As can be seen from the figure, the maximum frequency interval of pollutants is also inclined to the side of small value, showing an obvious skewed distribution. The frequency distribution of seven pollutants in different concentration ranges is shown in Fig. 2 to Fig. 8. As can be seen from the figure, the maximum frequency interval of the seven pollutants also tends to the side of the small value, showing an obvious skewed distribution.

TABLE II. Distribution law of PM_{10} pollutant concentration data

Time	Monitoring Point Position	Sample	Min	percentile							Max	Average	Standard Error	Standard Deviation	variance
				5	*10*	*25*	*50*	*75*	*90*	*95*					
2014	Pingshan	8760	0.001	0.018	0.024	0.034	0.054	0.084	0.111	0.128	0.339	0.062	0.0004	0.0365	0.00133
	Xiabei	8760	0.001	0.022	0.029	0.044	0.054	0.099	0.133	0.158	0.459	0.076	0.0005	0.0452	0.00204
2015	Pingshan	8760	0.001	0.016	0.021	0.031	0.048	0.072	0.101	0.117	0.326	0.056	0.0004	0.0340	0.00115
	Xiabei	8760	0.001	0.016	0.022	0.036	0.064	0.106	0.166	0.222	0.001	0.083	0.0008	0.0709	0.00503

TABLE III. Distribution law of O_3 pollutant concentration data

Time	Monitoring Point Position	Sample	Minimum	percentile							Maximum	Average	tandard Erro	Standard Deviation	variance
				5	*10*	*25*	*50*	*75*	*90*	*95*					
2014	Pingshan	8760	0.001	0.005	0.010	0.026	0.052	0.086	0.124	0.145	0.530	0.061	0.0003	0.0456	0.00208
	Xiabei	8760	0.001	0.007	0.009	0.024	0.052	0.088	0.123	0.142	0.302	0.061	0.0003	0.0447	0.00200
2015	Pingshan	8760	0.001	0.004	0.008	0.022	0.045	0.076	0.110	0.129	1.224	0.053	0.0004	0.0416	0.00173
	Xiabei	8760	0.001	0.007	0.009	0.021	0.042	0.072	0.101	0.119	0.411	0.050	0.0004	0.0363	0.00131

TABLE IV. Distribution regulation of O_3-8h pollutant concentration data

Time	Monitoring Point Position	Sample	Minimum	percentile							Maximum	Average	Standard Error	Standard Deviation	variance
				5	*10*	*25*	*50*	*75*	*90*	*95*					
2014	Pingshan	6600	0.001	0.011	0.017	0.030	0.052	0.083	0.118	0.138	0.275	0.061	0.0000	0.0437	0.00191
	Xiabei	6569	0.002	0.010	0.014	0.028	0.053	0.085	0.114	0.131	0.262	0.060	0.0000	0.0427	0.00182
2015	Pingshan	8760	0.002	0.009	0.014	0.026	0.047	0.073	0.102	0.118	0.184	0.053	0.0004	0.0337	0.00113
	Xiabei	8760	0.003	0.010	0.014	0.026	0.045	0.069	0.092	0.107	0.174	0.050	0.0003	0.0303	0.00092

TABLE V. Distribution regulation of $PM_{2.5}$ pollutant concentration data

Time	Monitoring Point Position	Sample	Minimum	percentile							Maximum	Average	Standard Error	Standard Deviation	variance
				5	*10*	*25*	*50*	*75*	*90*	*95*					
2014	Pingshan	8760	0.001	0.007	0.011	0.018	0.033	0.052	0.067	0.078	0.289	0.037	0.0003	0.0236	0.00056
	Xiabei	8760	0.001	0.012	0.017	0.026	0.041	0.062	0.081	0.094	0.367	0.046	0.0003	0.0276	0.00076
2015	Pingshan	8760	0.001	0.008	0.011	0.016	0.027	0.043	0.061	0.075	0.142	0.033	0.0002	0.0215	0.00046
	Xiabei	8760	0.003	0.012	0.015	0.020	0.034	0.053	0.077	0.094	0.233	0.041	0.0003	0.0268	0.00072

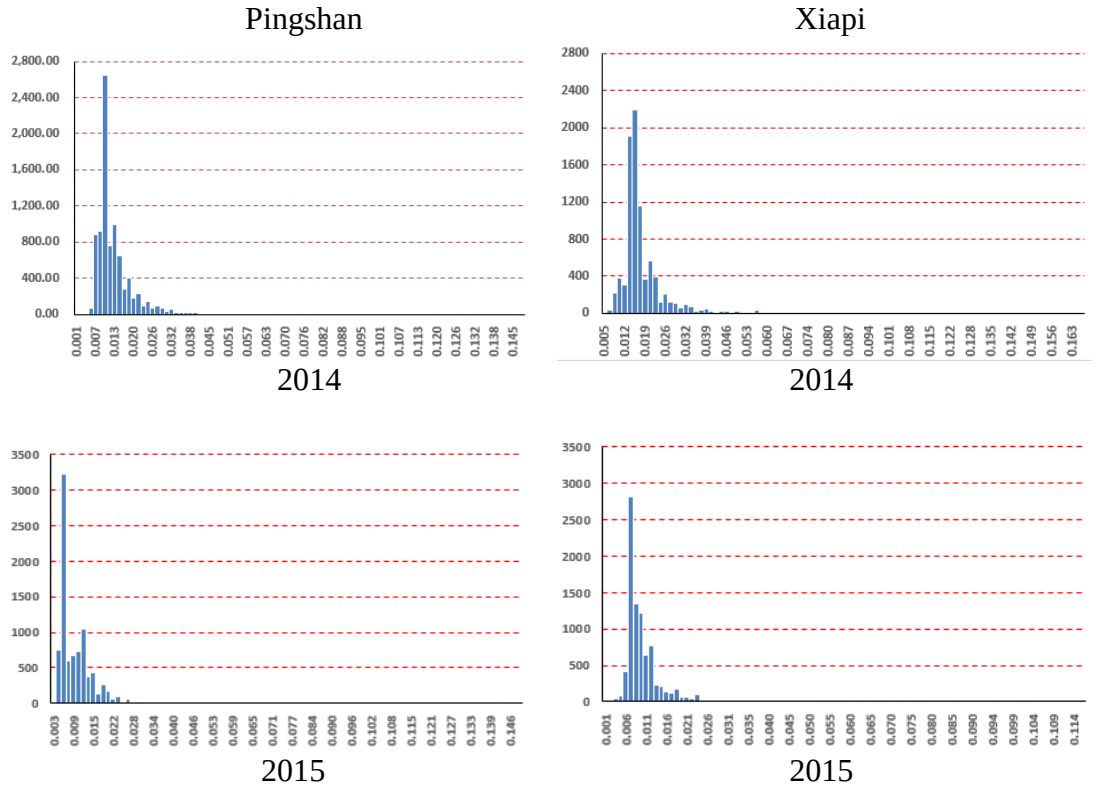
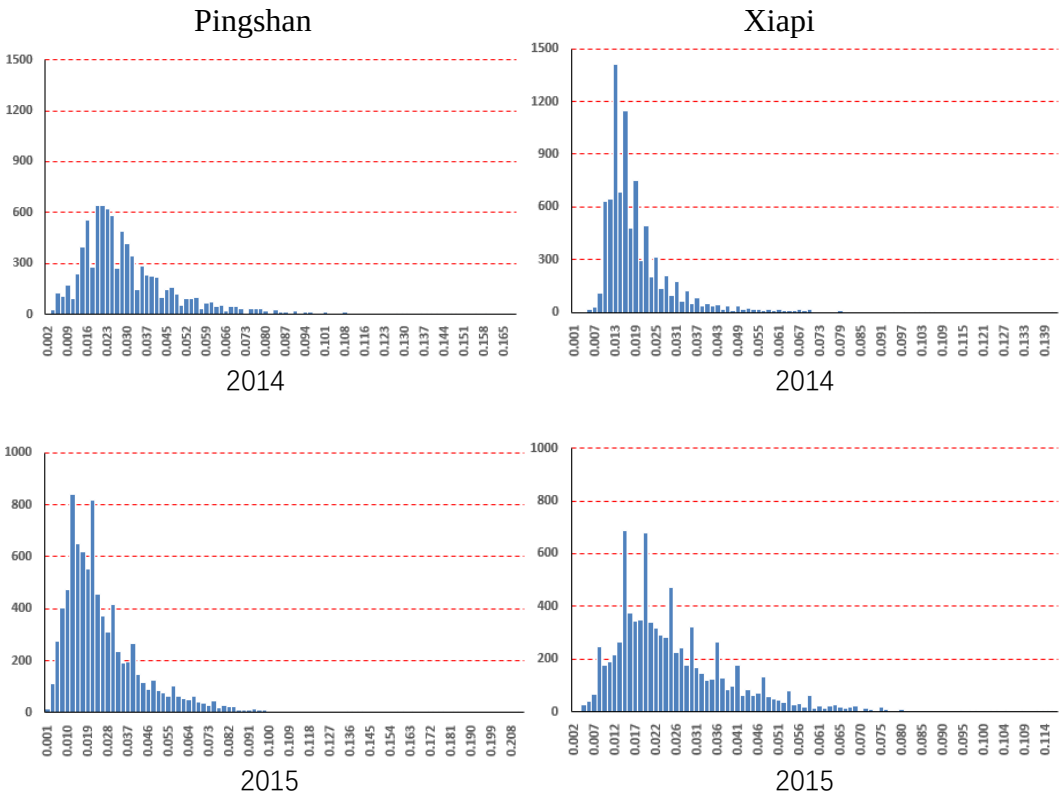


Fig.2. Frequency distribution of SO_2 average hourly concentration (mg/m^3)



Frequency distribution of NO_2average hourly concentration (mg/m^3)

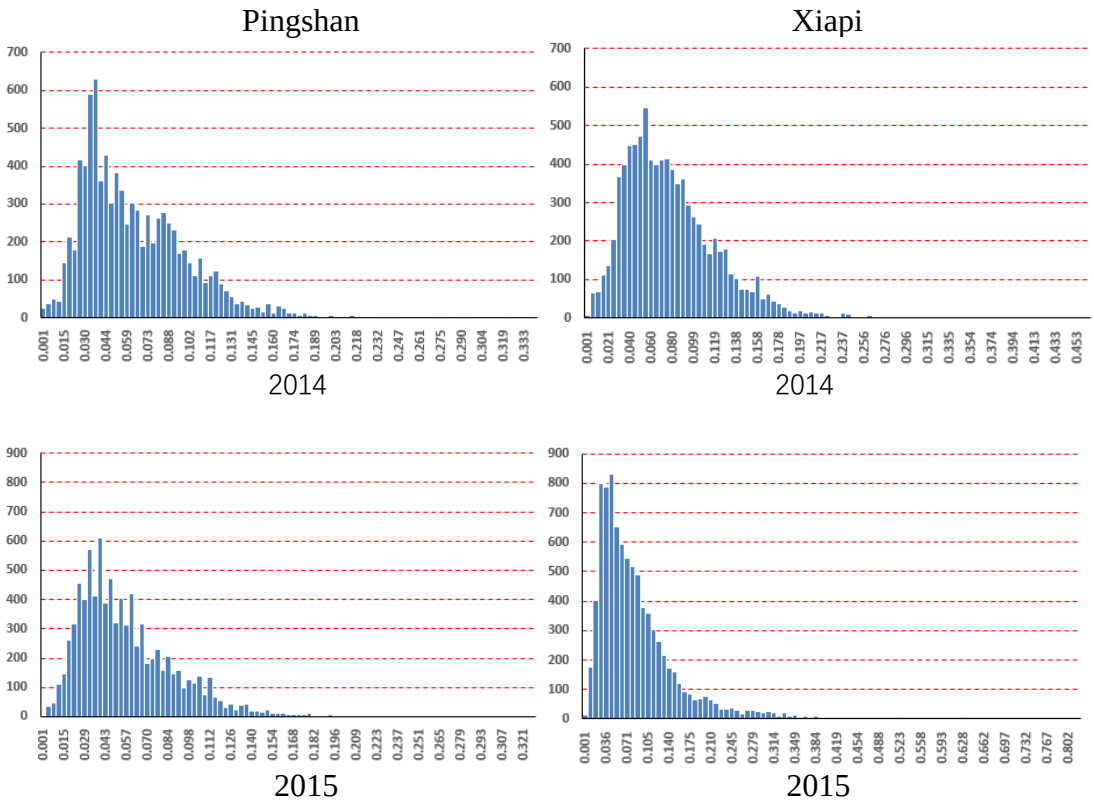


Fig.3. Frequency distribution of PM_{10} average hourly concentration (mg/m^3)

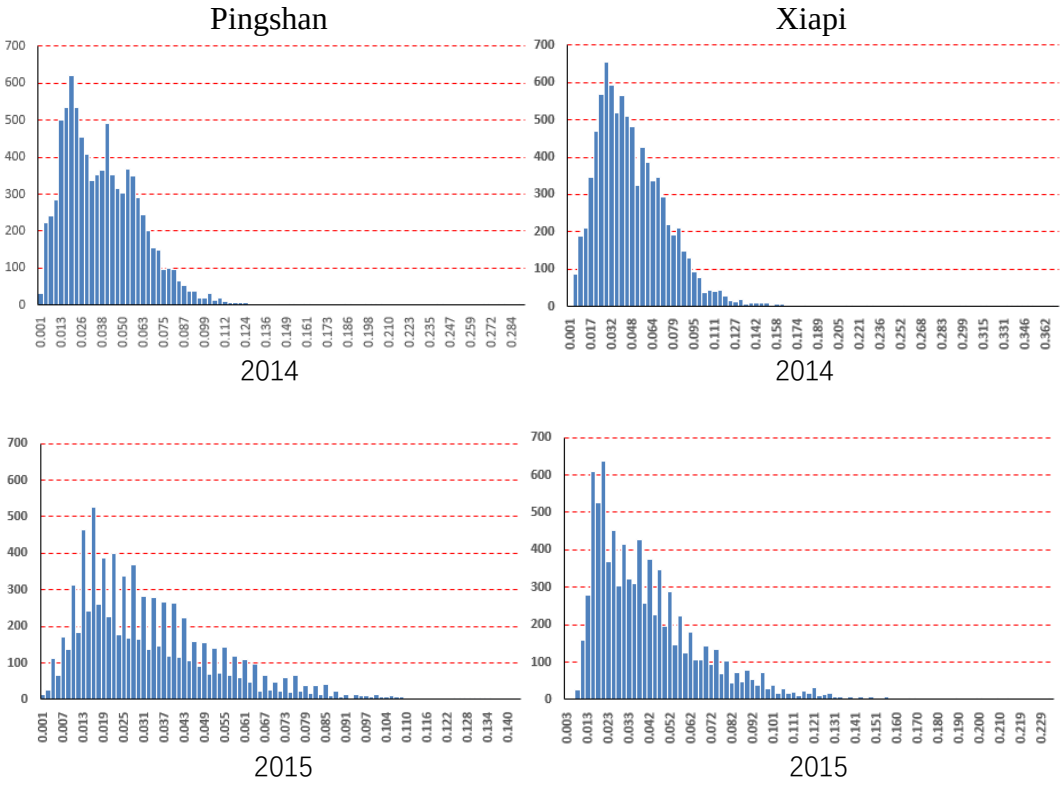


Fig.4. Frequency distribution of $PM_{2.5}$ average hourly concentration (mg/m^3)

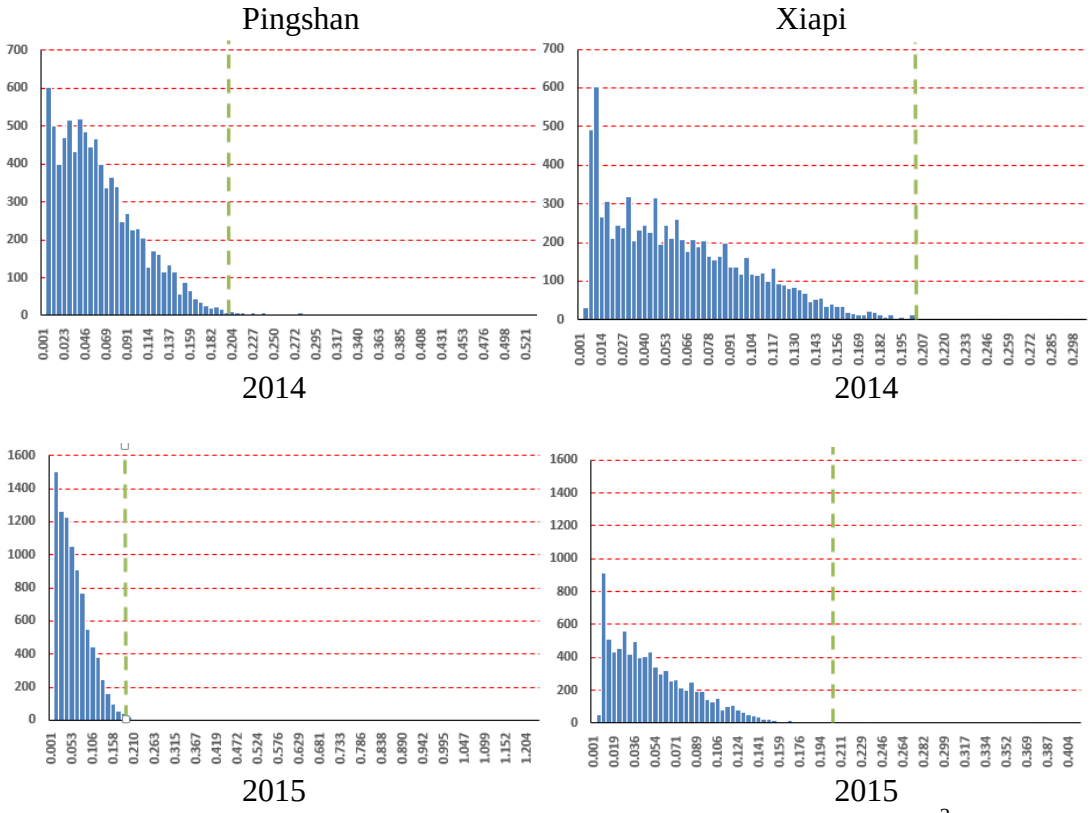


Fig.5. Frequency distribution of O_3 average hourly concentration (mg/m^3)

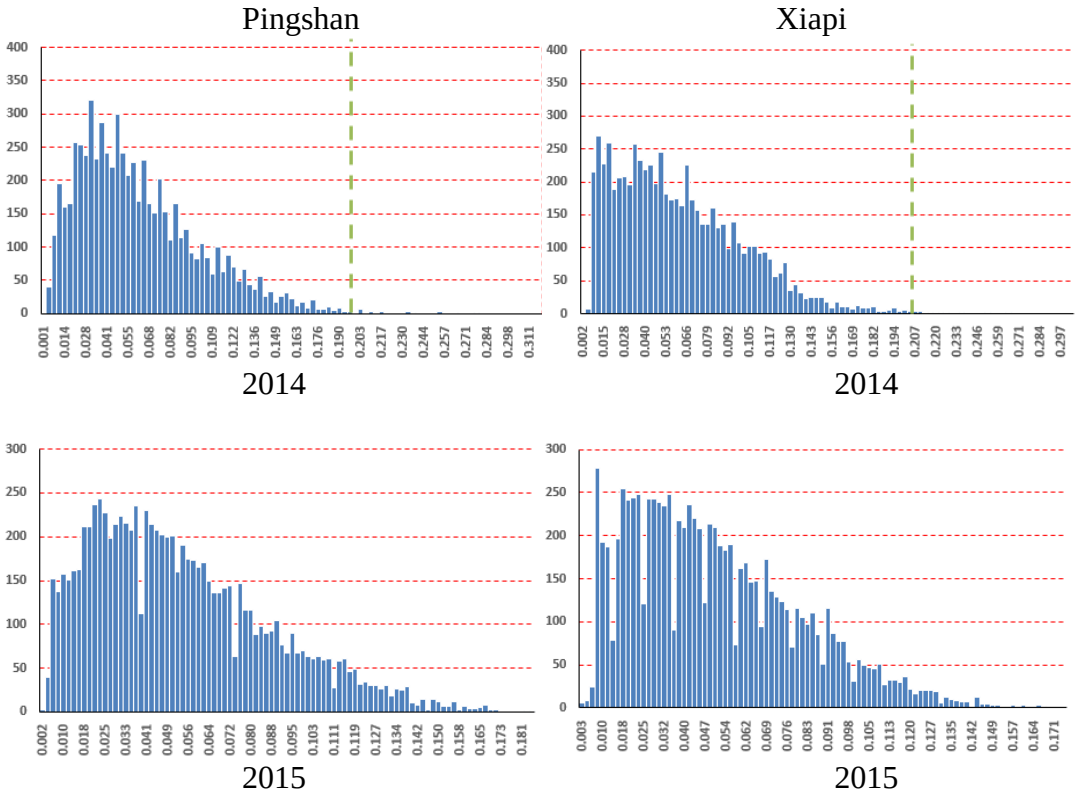


Fig.6. Frequency distribution average 8-hour concentrationof O_3 (mg/m^3)

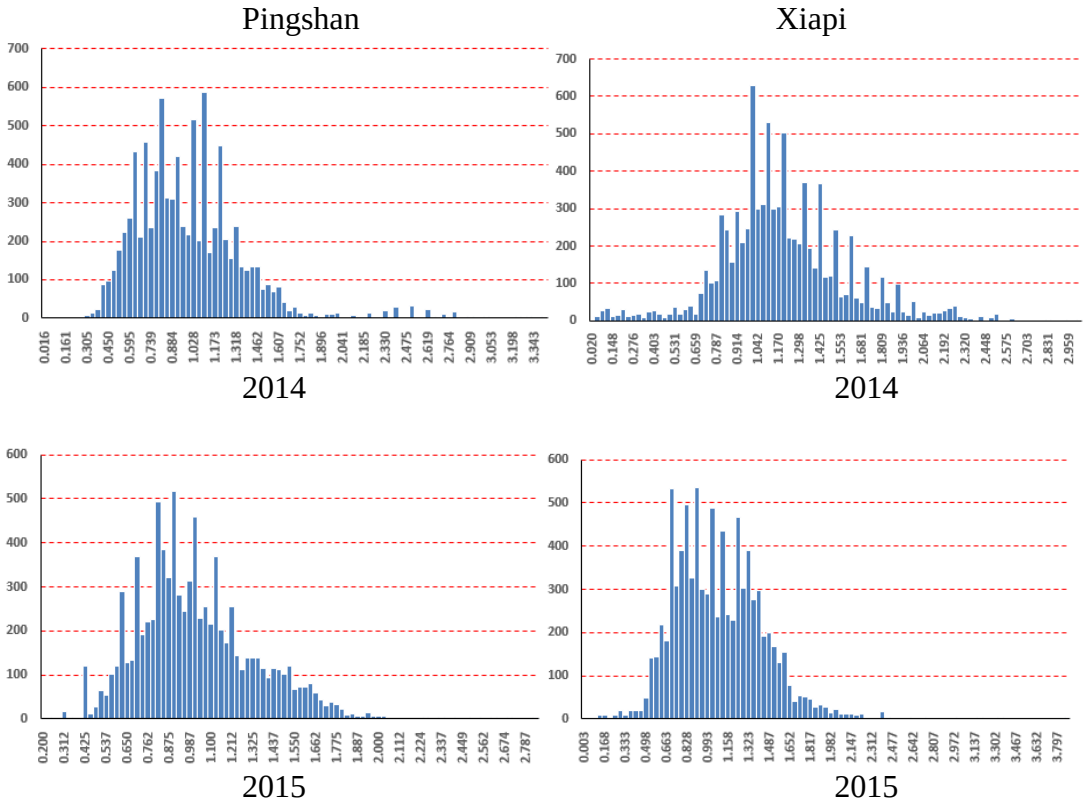


Fig.7. Frequency distribution of CO average hourly concentration (mg/m^3)

Conclusion

(1) The maximum frequency interval of the seven pollutants also tends to the side of the small value,

showing an obvious skewed distribution.

(2) The concentration trend of SO_2, NO_2 and PM_{10} pollutants in working days and rest days is basically consistent with that in minor long holidays. The concentration of rest days is slightly higher than that in minor long holidays and work days. $PM_{2.5}$, O_3 and CO are the three pollutants slightly higher than the rest days and working days.

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