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The Change Characteristics of Air Quality and Major Pollutants in Nanjing——Based on the Analysis of the Early and Late Stages of the Youth Olympic Games

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ABSTRACT. *Objective To explore the spatial and temporal distribution characteristics of major air pollutants in Nanjing, and to propose practical countermeasures for the study of air pollution control measures .Methods The daily concentration sequence records of air quality index and various pollutant sub-indexes in Nanjing from 2013 to 2014 and the daily concentration records of air quality index of two suburban national control points in Xuanwu District and Pukou District of Nanjing were collected. The main changes in atmospheric quality in Nanjing were explored by observing daily, weekly and monthly mean and annual mean changes. Results Through observation and comparison, the overall air quality in 2014 was slightly better than that in 2013 and reached the lowest in the whole year in August, but the air quality index remained high around July-August. According to the analysis, in August, the Youth Olympic Games was held in Nanjing, and a series of air remediation measures were carried out to meet the requirements of the contract. However, these remediation measures also stopped with the end of the Youth Olympic Games. As a result, the air quality index rose sharply after August. Conclusion The results of the study verified the effectiveness of the remediation measures taken in the early stage of the Youth Olympic Games, and this control measures can also be used in the future atmospheric remediation. It should be noted that in the development of relevant prevention and control measures, Consider the impact on the economic activities of related industries.*

KEYWORDS: *Air pollution; Air quality; Nanjing; Prevention Measures*

1. Introduction

As a capital city of Jiangsu Province,Nanjing has experienced rapid development of urbanization and industrialization in recent years. At the same time, urban air pollution index has risen steadily, and smog has occurred frequently, posing a great threat to the lives and health of residents. And with the development of the city, the main pollutants that affect the quality of the air are also constantly changing. Hang

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Weiqi and Chen Jianjiang believe that the diurnal variation of atmospheric diffusion conditions and the daily variation of pollutant emissions are the main causes of daily changes in air pollutants[1]; Lu Yunxia, Liu Haibin and others believe that industrial sources are the main factors causing air pollution, especially industrial carbon dioxide. And industrial nitrogen dioxide is particularly obvious for air pollution[2]; Chen Junliang, Li Wenmei and others through the site measured data and NASA MODIS aerosol optical thickness (AOD) analysis shows that $pm_{2.5}$ has become the primary pollutant affecting Nanjing's air quality[3]; Feng Yanyan, Jiang Tingmei and others used Anderson's 8-level particle size distribution sampler to draw the conclusion that the air pollution in Nanjing was the most serious in December, and its primary pollutant was $pm_{2.5}$[4]. Jin Xin, Fu Yu et al. used the Spearman rank correlation coefficient method. The trend of air quality change in Nanjing from 1981 to 2010 was summarized. It is believed that particulate matter pollution is still the main factor affecting air quality, and fine particle pollution is gradually increased[5]. Based on the 2013-2014 Nanjing air quality data published by the environmental monitoring website, this study analyzes the main pollutants affecting Nanjing's air quality during 2013-2014. The research results can provide reference for Nanjing to formulate atmospheric environmental pollution prevention and control measures. Atmospheric environmental governance in neighboring areas is also useful.

2. Subjects& methods

2.1 Subjects

It consists of two parts. The first part is the temporal and spatial variation characteristics of major pollutants in Nanjing. The second part is the comparative analysis of air quality before and after the Youth Olympic Games.

2.2 Resource

The daily concentration sequence records of the total 730-day air quality (AQI) index and its sub-indexes of pollutants collected in Nanjing in 2013 and 2014 were collected, as well as the two suburban national control points in Xuanwu District and Pukou District. The daily concentration sequence of the air quality (AQI) index is recorded from the Jiangsu Environmental Monitoring Website.

2.3 Methods

This paper takes the main atmospheric pollutants SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO, O_3 in Nanjing as the research object. All the collected data are entered into the Excel database. After examination, the SPSS is formed into an analysis database to analyze the atmospheric pollutants in the area. Statistical analysis was performed on different time scales (day, week, month, year), suburban differences, and before and after the Youth Olympic Games, and charts were drawn.

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3. Results

3.1 Analysis of the overall situation of air quality in Nanjing

In 2013, the total number of days of environmental air quality in Nanjing (ie, the secondary standard) was 202 days, the compliance rate was 55.34%, the annual average was 110.39, the standard was not met, and the ambient air quality exceeded 163 days (including 98 days of mild pollution). Moderate pollution for 32 days, heavy pollution for 27 days, and serious pollution for 6 days). In 2014, the total number of days of environmental air quality in Nanjing (ie, the secondary standard) was 190 days, the compliance rate was 52.05%, the annual average was 107.55, the standard was reached, and the ambient air quality exceeded 175 days (including 126 days of mild pollution). Degree of pollution for 30 days, heavy pollution for 17 days, severe pollution for 2 days).

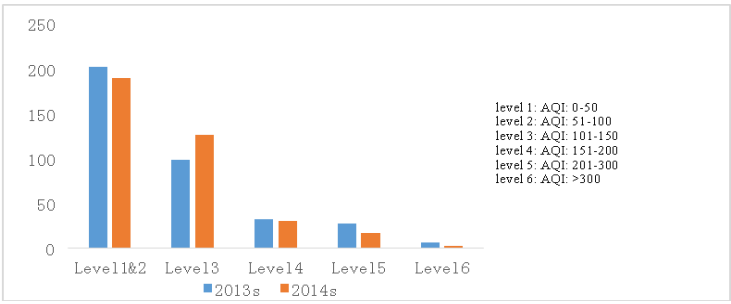

Figure.1 Air Pollution Degree of Nanjing in 2013 and 2014 (Day)

The annual average values of various pollutants of air quality, SO_2, NO_2, PM_{10}, $PM_{2.5}$, CO, and O_3 are shown in Fig. 2, with PM_{10} and $PM_{2.5}$ having the highest annual average concentrations. The correlation between air quality and various pollutants is shown in Table 2. The correlation coefficient of PM_{10} and $PM_{2.5}$ is the highest, which shows that they are the main atmospheric pollutants in Nanjing.

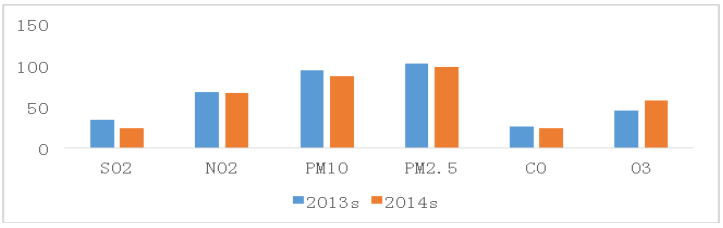

Figure.2 Comparison of annual average values of pollutants in Nanjing in 2013 and 2014

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Table 2 Pearson correlation between air quality AQI and various pollutants

	SO_2	NO_2	PM_{10}	$PM_{2.5}$	CO	O_3
AQI	0.63	0.64	0.94	0.93	0.81	0.92

(1) Day Change PM_{10}, $PM_{2.5}$ and NO_2 both show double-peak structure at 8 o'clock in the morning and evening; SO_2 is high in daytime concentration, low in nighttime concentration, and highest in 10:00 in the morning; O_3 day change shows a typical unimodal structure, afternoon Two points reach the maximum of the day; CO reaches the lowest value of the day at two in the afternoon.

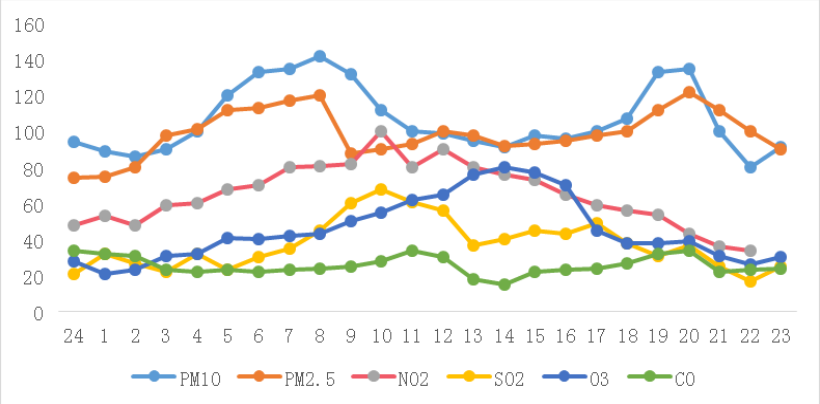

Figure. 3 Daily changes in Nanjing air quality sub-indices

(2) Weekly Changes Each sub-index shows a weekend effect with a high working day and a low rest day.

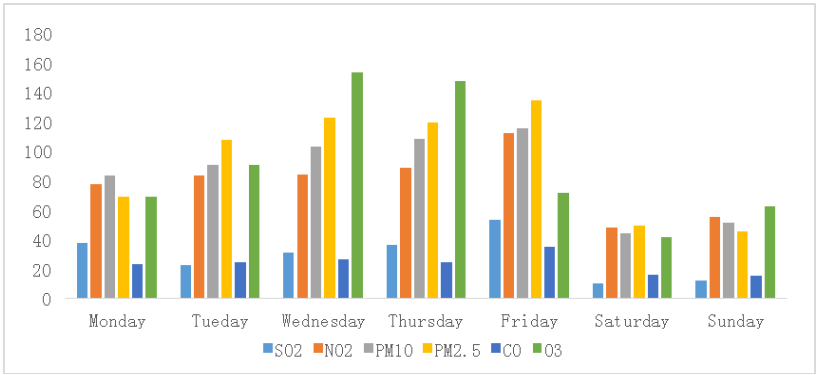

Figure. 4 Weekly changes in Nanjing air quality sub-indices

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(3) Seasonal Changes PM_{10}, $PM_{2.5}$, NO_2 and SO_2 all exhibit low summer concentrations and high winter concentrations.

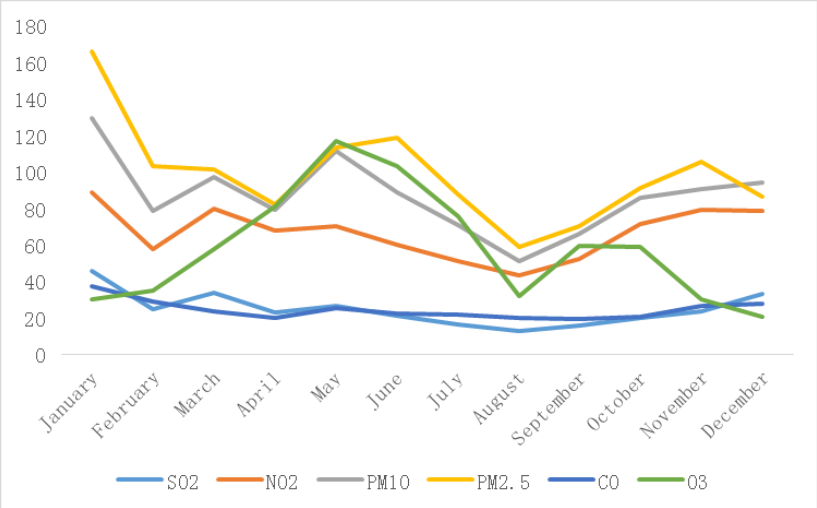

Figure. 5 Monthly mean value change of Nanjing air quality index

(4) Suburban Changes Suburban differences are not as significant as we think. From the following figure, it can be seen that the AQI of the Pukou District as an industrial area and the Xuanwu Lake area of leisure tourism is very similar, indicating that air pollution is mobile and will not be different because of the area obvious difference.

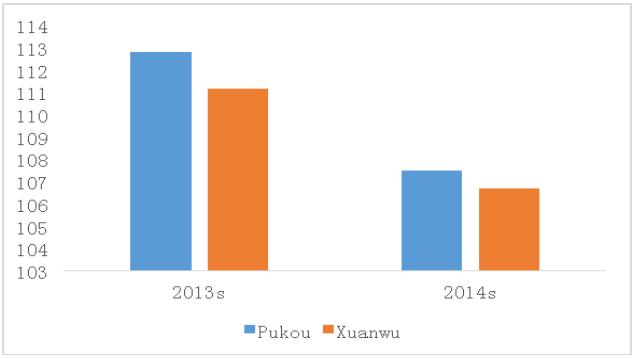

Figure. 6 Comparison of the annual average of the AQI index between Pukou District and Xuanwu District

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Through the changes in the air quality index of Nanjing in the past two years, it can be seen that the atmospheric pollutants in Nanjing have obvious seasonal characteristics and are significantly affected by the climate. Nanjing belongs to the subtropical monsoon climate. In summer, it is affected by the southeast monsoon and has more precipitation[6]. Therefore, under the influence of typhoon and subtropical high in summer, the air quality is better. In winter, it is mainly affected by the northerly wind and less precipitation, so the air quality in winter is poor. . In addition, the straw burning in the early spring of Nanjing will be affected by the southwest monsoon, which will increase the air pollution in Nanjing. The spatial distribution of atmospheric pollutants in Nanjing is not obvious, and the suburban differences are not significant, which is closely related to the air pollution mobility[7].

In order to achieve the air quality as the pre-set goal of the Youth Olympic Games, Nanjing has scientifically established air quality objectives in combination with the requirements of the event, the time of the event and environmental conditions, and adopted a series of measures. It can be seen from Fig. 7 that the August AQI index is significantly lower than the other months of the year, indicating that the air quality in Nanjing has improved to some extent during the Youth Olympic Games[8].

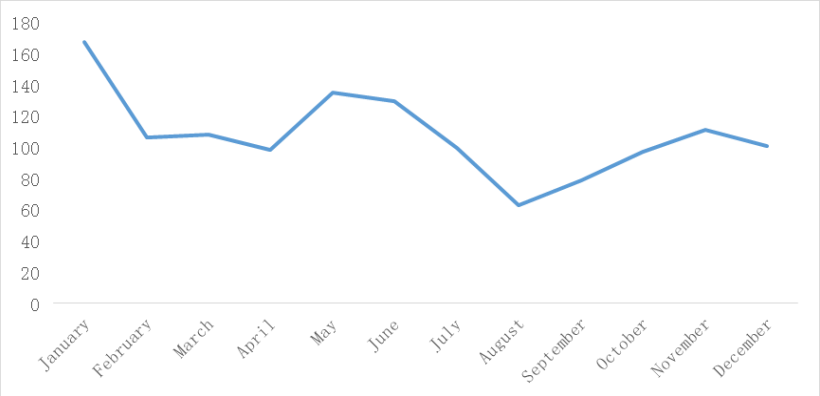

Figure. 7 Changes in the mean value of the AQI index for each month in Nanjing in 2014

However, compared with 2013 (Fig. 8), it can be seen that the AQI index of the previous months of April, May, June and July is significantly higher than the 2013 AQI index. Due to the over-production of factory enterprises before the start of the Youth Olympic Games, air pollution was rapidly becoming serious, and AQI suddenly rose. At the same time, the end of the Youth Olympic Games, the AQI index rose rapidly from the end of August. So overall, the air quality in 2014 is not optimistic compared to 2013

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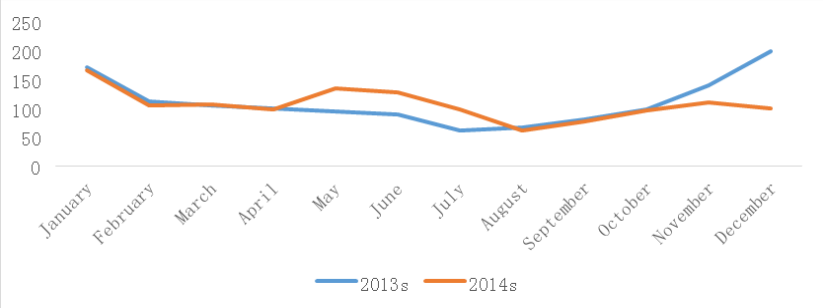

Figure 8 Comparison of the annual average of the AQI index for the Youth Olympic Games (2014) and the Non-Young Olympics Year (2013)

4. Discussion

The primary pollutant of air in Nanjing is $PM_{2.5}$. Among the sources of PM2.5, the cumulative contribution rate of industry is 46.4% (including coal-fired contribution rate of 27.4%, industrial production contribution rate of 19.0%) and motor vehicle exhaust contribution rate. The contribution rate was 24.6%, the dust contribution rate was 14.1%, and the contribution rate of other pollution sources was 14.9%. It can be seen that industrial pollution is the main reason for the failure of air quality in Nanjing[9,13].In addition, burning straw seriously pollutes the environment, destroying the ecological balance and affecting the climate. The incineration emits a large amount of particulate matter and toxic and harmful substances, which causes the atmospheric environment of the Yangtze River Delta to deteriorate significantly under adverse atmospheric conditions[10,12].Relevant government departments should formulate corresponding measures to speed up the management of industrial pollution and optimize the energy structure. We must reasonably control the total amount of energy consumption, especially to strictly control the total amount of coal consumption, strictly control the projects of new coal consumption, and gradually realize the transformation of Nanjing's energy structure. In addition to coal control, dust control, controlled production,and car control will contribute to the optimization of air quality in Nanjing[11].

References

[1] Hang Weiqi, Chen Jianjiang (2000). Influence and prevention of burning straw in the field on environmental quality.Environmental Monitoring Management and Technology, no.2, pp.36-37.

[2] LuYunxia, Liu Haibin, Li Wenqing (2014).Research on Environmental Risk Analysis and Countermeasures in Nanjing. Anhui Agricultural Science Bulletin, vol.20, no. 24, pp.97-98, 143.

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[3] Chen Junliang, Li Wenmei, Yang Liu, et.al (2016).Temporal and Spatial Distribution of PM_(2.5) in Nanjing City in 2013. Anhui Agricultural Sciences,v ol.44, no. 21, pp.53-56, 114.
[4] Feng Yuyan, Jiang Tingmei, Zhai Ping, et.al.(2015).Characteristics of Atmospheric Particulate Matter in the Eastern Suburbs of Nanjing.China Powder Science and Technology, vol.21, no.4, pp.30-35.
[5] Jin Xin, Fu Wei, Lu Xiaobo, et.al (2014). Evaluation of Historical Evolution of Air Pollution in Nanjing. China Resources Comprehensive Utilization, vol.32, no.6, pp.34-37.
[6] Xu Mengjie, Shi Minqi (2018). Analysis of the change trend of atmospheric quality and the characteristics of the year in Nanjing.Green Science and Technology, no.18, pp.82-84+89.
[7] Sun Zhiqiang, Ji Dongsheng, Song Tao (2010). Air pollution observation and comparison analysis in Beijing and its surrounding areas during the Olympic Games. Environmental Science, no. 12, pp.2852-2859.
[8] Xie Fangjian, Li Wenqing, Yu Yiyong (2014). Retrospective Evaluation and Enlightenment of Air Quality Assurance of Nanjing Yaqing Society. Environmental Monitoring and Warning, no.2, pp.1-4.
[9] Zhu Bin, Su Jifeng, Han Zhiwei, et.al (2010). Analysis of a serious air pollution process in Nanjing and surrounding areas caused by straw burning. China Environmental Science, no.5, pp.85-86
[10] Yin Cong, Zhu Bin, Cao Yunchang, et.al (2011). Discussion on the causes of air quality in Nanjing caused by straw burning. China Environmental Science, no.2, pp.207-213.
[11] Huang Jun (2015). Urban Air Quality from Industrial Structure——Taking Nanjing as an Example. China Market, no.26, pp.229-230.
[12] Yue Yueguo (2011). The total energy consumption can be controlled. China Environmental News, 09-21001.
[13] Pan Liangbao, Tang Hao, Liu Xiaolei (2015). Review and Enlightenment of Air Quality Assurance in Nanjing Youth Olympic Games. Environmental Monitoring and Warning, no.3, pp.1-3.