International Journal of Mathematics and Statistics Invention (IJMSI)
E-ISSN: 2321 – 4767 P-ISSN: 2321 - 4759
www.ijmsi.org Volume 5 Issue 7 || August. 2017 || PP 23-25

The Strategy for Air Pollution Decision Services of Six Urban Districts in Tianjin

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ABSTRACT : *Tianjin has been undergoing long-time air pollution in recent years. According to the real-time observational data, which is collected through eight monitoring stations of Tianjin Environment Monitoring Center (the center monitoring station has been changed in the middle of the monitoring) in six urban districts in Tianjin, the paper provides statistical analysis of data sequence about Air Quality Index (AQI), PM2.5, PM10, SO2, NO2, O3 and CO, and summarizes air pollution decision services in Tianjin. The analysis indicates that the air pollution in Tianjin is mainly caused by PM2.5 and PM10, and centrally occurred in winter. Two pollution peaks are December and January 18th to February 14th period. December is the main period of time when exists hazardous air pollution, which is featured by long duration and high pollution intensity. Currently, Tianjin is focus on coal-controlling and emission reduction, and Co-prevention and Co-management in Beijing-Tianjin-Hebei Region to control the air pollution.*

KEYWORDS : *Air Pollution; Cluster Analysis; Correlation Analysis; Tianjin Urban*

Date of Submission: 01-01-2017 Date of acceptance: 24-08-2017

I. INTRODUCTION

With the acceleration of urbanization and industrialization, smog occurs frequently, exerting increasingly negative effects on urban atmospheric environment and human health. Smog is the result of specific climatic conditions and human activities interact. Economic and social activities in the high-density population will inevitably emit large quantities of fine particulate matter ($PM_{2.5}$: particulate matter less than 2.5 microns in diameter), once the discharge capacity exceeds atmospheric circulation and carrying capacity, the concentration of fine particles will continue to accumulate. At this time, if affected by static steady weather and other factors, the range of smog will be extended. Although seems mild, smog contains over twenty kinds of dangerous particles and toxic substances. Smog is more harmful than fog and the diameter of fine powered particulates in it is usually below 0.01 micron. These particulates can enter into bronchus and give rise to respiratory disease, cerebrovascular disease and sinusitis. Meanwhile, when smog occurs, the air pressure decreases, inhalable particles rockets, air fluidity gets worse and the diffusion rate of harmful bacteria and viruses becomes lower, leading to an increased virus concentration in the air and a raised risk of disease transmission. In December, 2016, medium and high level smog occurred frequently. Smog centrally occurs in winter because pollutants emission from coal burning increases as the heating season arrives, and natural factors like dry climate lead to the accumulation of the smog, and unfavorable weather like temperature inversion and static wind happens regularly. This paper analyzes the environmental monitoring data from May, 2016 to March, 2017 and the strategy for air pollution decision services, aiming to offer advice and suggestions to the government.

II. OVERVIEW OF THE SMOG CONDITION

2.1 Durability of the smog

According to the data, smog has occurred 890 times from May, 2016 to March, 2017. It has occurred 143 times in the area represented by Nanjing Road and Dali Road, 144 by Qinjian Street, 154 by Nankou Road and Zhongshan North Road, 147 by Dazhigu Street, 146 by Qianjin Road, and 156 by Binshui West Road. Smog has occurred 37 times for over three consecutive days. Durative pollution happened in three periods: January 25th, 2017 to February 14th, 2017; December, 2016; November 20th, 2016 to November 30th, 2016. The AQI was continuously over 250 from December 30th, 2016 to January 7th, 2017. Only nine days' AQI rates good in December, 2016, and ten days in November, 2016.

Table 1. Frequency of pollution level of streets in Tianjin

Degree	Frequency	Nanjing Road and Dali Road	Qinjian Street	Nankou Road and Zhongshan North Road	Dazhigu Street	Qianjin Road	Binshui West Road
>100	890	143	144	154	147	146	156
150~200	171	26	25	30	32	28	30
200~250	127	25	20	20	23	20	19
250~400	171	28	28	33	24	26	32
>400	24	2	5	5	5	5	2

Table 2. Air quality time distribution frequency tab le of Tianjin

Time	2016.5	2016.6	2016.7	2016.8	2016.9	2016.10	2016.11	2016.12	2017.1	2017.2
Good AQI Frequency	221	203	205	252	223	141	77	119	129	99
Pollution Frequency	83	81	77	37	26	109	114	207	89	69

2.2 Seasonality of smog

The condition of air pollution varies from season to season. The pollution is slight in summer and autumn, the AQI of which are mainly good, while the pollution is heavy in spring and winter, the AQI of which are mainly over 100. The following line graph reveals the change of AQI from May, 2016 to March, 2017. According to the calculation formula of AQI, the graph can also indicate the change of $PM_{2.5}$ and PM_{10}. The graph demonstrates that the AQI is rising, and the changing point is on November 15th, 2016, which was exactly the heating day in 2016 in Tianjin. Since the heating day, the AQI has increased substantially and the durability of smog has become manifest .

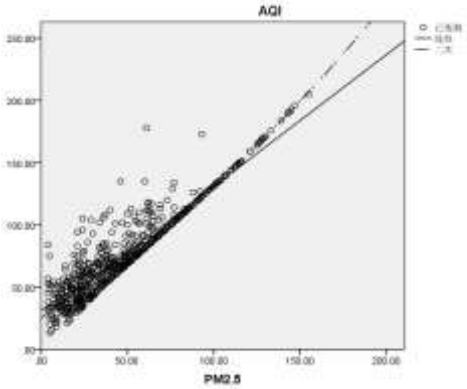

Figure 1. The relationship between AQI and $PM_{2.5}$ concentration

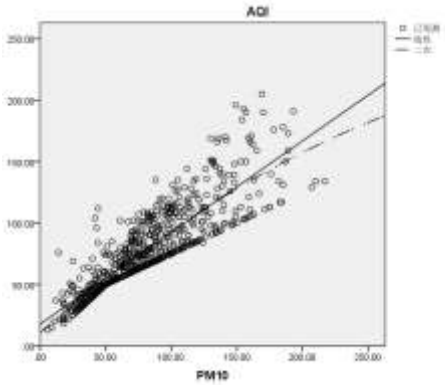

Figure 2. The relationship between AQI and PM_{10} concentration

According to the real-time data about AQI and PM_{10} concentration in Tianjin, the index AQI has a linear relationship with the PM_{10} concentration with y=0.746x+17.676 as the slope, the fitting degree of which reaches 0.747. This shows that AQI is highly related to PM_{10} concentration.

III. METEOROLOGICAL SERVICE STRATEGY

Tianjin municipality takes air pollution control as its primary mission. It revises Regulations of Tianjin Municipality on Atmospheric Pollution Prevention and Control and carries out Fresh Air Action. It will take comprehensive measures to prevent air pollution, including“five-control” schedule, namely controlling coal, vehicles, dust, pollution and new projects; four methods, namely, law, politics, economics, science and technology; “ three principles”, referring to management without dead angles, supervision without blind areas and monitoring without blank spaces.

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Yimin Li "The Strategy for Air Pollution Decision Services of Six Urban Districts in Tianjin." International Journal of Mathematics and Statistics Invention (IJMSI) , vol. 5, no. 8, 2017, pp. 23-25.