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Research Article

Using Three Order Spline Interpolation Method to Research PM2.5 Pollution

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Abstract: This thesis mains focus on current situation of the PM2.5 pollution,the content of pollutants,the change of the content of PM2.5.Firstly,I use three cubic spline interpolation method to simulate a set of missing data with MATLAB,according to the data of the content of PM2.5 of Beijing in 2015 March.Secondly,I further analyze the degree of PM2.5 pollution with the quality standard of Chinese air pollution degree index system,On the basic of previous data.The results shows that contamination index of the selected data is severe pollution.Finally,I find The wind speed,Temperature and Rainfall are main factor influencing the content of PM2.5 according to detailed analysis on factors influencing PM2.5.Furthermore Vehicle exhaust emissions,The increase use of coal,High emission in high emission enterprises also the factors influencing haze.

Keywords: PM2.5; Index system; Three spline interpolation; MATLAB.

PREFACE

The development of science, the advancement of science and technology, the acceleration of human life and the increasing frequency have caused the rapid deterioration of the current environment. Among the environmental pollution, air pollution is extremely serious. At present, many authoritative medical experts and atmospheric meteorologists believe that the haze caused by PM2.5 is more harmful to human health than sandstorms. This kind of invisible fine particles will not only affect the normal response of the respiratory system, but also further increase the damage to the cardiovascular system, and the increase in the concentration of ultrafine particles has a great relationship with the decrease in the blood supply capacity of the heart (Zhengzhi, W. *et al.*, 2014). Many studies have now shown that particulate matter can cause damage to the respiratory and cardiovascular systems, leading to asthma, lung cancer, cardiovascular disease, birth defects and premature death. Nowadays, it is of great significance to study PM2.5, the most polluting component.

As Beijing is one of the most serious smog pollutions, the monitoring of Beijing PM2.5 is also professional and accurate. Therefore, the PM2.5 data of Beijing in March 2015 was analyzed accordingly. By collecting and sorting out the data for the days of March 01-10 in Beijing (except the 5th). In this article, I will use the cubic spline interpolation method to fit and complement the 9-day data, and use matlab to perform the cubic spline interpolation method to obtain the PM2.5 concentration content on the 5th. The data obtained by the fitting are used for analysis, and then the PM2.5 change trend of each sample point is discussed. On this basis, the index system constructed according to the national air pollution evaluation standards is compared to draw corresponding conclusions.

Survey of PM2.5 in Beijing

After searching and analyzing relevant data, the total concentration of Beijing on March 10, 2019 was 298.2 micrograms per cubic meter, which was one-eighth of the national PM2.5 concentration, and the concentration was extremely high.Based on the PM2.5 pollutant concentration data in Beijing over the past five years:(1) In the past five years, Beijing has suffered 442 pollutions (referring to PM2.5 greater than 75 micrograms / cubic meter), with an average of 1.9 times per week, with an average duration of 68 hours, which takes nearly three days.(2) The duration of Beijing's excellent air quality state for five years is 21 hours.(3) 86% of the pollution processes have reached severe pollution, with a duration of 27 hours each time, which

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is nearly 4 hours longer than the average duration of good air quality.

We also found that in these five years: the duration of Beijing's excellent air quality was about 24%, and more than half of the time (about 56%) was due to general air pollution (meaning that the PM2.5 concentration was between 75 and 75%). Micrograms / cubic meter and 150 micrograms / cubic meter); and about 23% of the time were in a state of severe air pollution; the proportion of the three air quality states changed little from 2014 to 2018.

ANALYSIS OF PM2.5 POLLUTION BASED ON CUBIC SPLINE INTERPOLATION

Selection of data

According to the relevant information, the PM2.5 concentration in Beijing from March 1-10, 2019 was obtained after the collation, and the concentration on the 5th was missing from the data. Using the cubic spline interpolation method in Matlab to obtain the required data and a smooth curve, the obtained data also minimizes errors. The following mainly uses Matlab to fit the missing data. The data are shown in Table 5-1.

Table 5-1 Beijing city in 2015 March 01-10,the concentration of PM2.5 (except05)

Date	PM2.5 Content
2019.03.01	250.6
2019.03.02	255
2019.03.03	261.4
2019.03.04	264
2019.03.06	265.2
2019.03.07	266.6
2019.03.08	271
2019.03.09	285
2019.03.10	298.2

METHOD IMPLEMENTATION

The spline difference procedure for PM2.5 concentration using Matlab is as follows:

```
x=[01 02 03 04 06 07 08 09 10];
y=[250.6 255 261.4 264 265.2 266.6 271 285 298.2];
xi=01:1:10;
xH=05;
yspline=interp1(x,y,xi);
yH=interp1(x,y,xH);
plot(x,y,'*',xH,yH,'o',xi,yspline,'-')
```

The running result is: yH = 53, and the curve is shown in Figure 5-2. The solid point indicates the known data, and the empty point indicates the required data. As shown in the figure, the PM2.5 concentration on the 5th is 265 μg / m3.

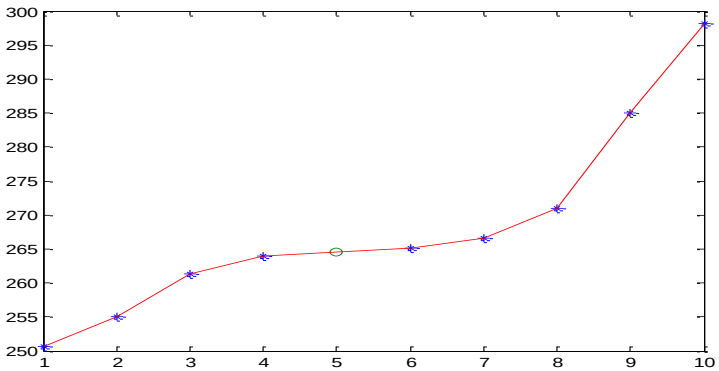

Fig 5-1 On March 01-10 PM2.5 concentration

RESULT ANALYSIS

Construction of Indicator System

According to the relevant information, the standard air pollution indicator system of China was sorted out, as shown in Table 6-1:

Table 6-1: The standard of air pollution China

Air quality class	24-hour PM2.5 average standard value
excellent	0-35 μg / m3
good	35-75 μg / m3
Light pollution	75-115 μg / m3
Moderately polluted	115-150 μg / m3
Severe pollution	150-250 μg / m3
Severe pollution	More than 250 μg / m3 and above

Related Conclusions

- The missing data was fitted and supplemented, and the PM2.5 concentration on March 5, 2019 was 265 μg / m3. The PM2.5 content of the selected data is gradually increasing.
- In this paper, according to the national air quality standards combined with the selected data for a comparative analysis, it can be concluded that during the days of March 01-10, 2019 in Beijing, air quality was severely polluted.
- According to the data, during the days of March 01-10, 2019 in Beijing, under the same temperature conditions, the daily PM2.5 concentration will be different due to other different factors.

CONCLUSION

This Article Discusses The Following Issues:

1. Relevant analysis of the extracted PM2.5 data in Beijing:

1. The data supplemented by the fitting is converted into a histogram. It is found that the higher the PM2.5 content, the more serious the air pollution, and the longer the haze.
2. In this paper, according to the national air quality standards combined with the selected data for a comparative analysis, it can be concluded that during the days of March 01-10, 2015 in Beijing, air quality was severely polluted.
3. According to the data, during the days of March 01-10, 2015 in Beijing, under the same temperature conditions, the daily PM2.5 concentration will be different due to other different factors.

Research on the Influencing Factors of PM2.5 Concentration:

1. In the sample books, the lowest PM2.5 value was March 1, and the wind was the highest and the temperature was the lowest in March. On the contrary, the most polluted March 10 was the day when the wind was the lowest and the temperature was the highest. It can be found that increasing the temperature can reduce the concentration of PM2.5. For the same reason, the increase of wind speed and the increase of precipitation can reduce the concentration of PM2.5.
2. The period with the highest concentration is from 8 am to 10 am and 6 to 8 pm every day; the season with the highest concentration is autumn and winter; the weather with the highest concentration is cooling weather with no wind or rain or snow.
3. In recent years, smog caused by PM2.5 has become a kind of urban disease, and related environmental experts have begun to turn to the research of smog. The research found that smog is not only affected by wind, temperature and precipitation; more authoritative data point out that automobile exhaust emissions, increased coal combustion, and high pollution from high-emission companies are also a contributing factor to the serious haze phenomenon. Therefore, fighting the haze has become a mobilization for all.

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