Investigation and analysis of PM2.5 air quality data in Chengdu

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12/12/2019

Abstract

This article mainly describes the definition, formation, harm and preventive measures of PM2.5. In order to deepen the reader's impression of the harm of PM2.5, this article quoted to describe the harm of London's smog to the public in 1952 and the economic impact on Britain at that time, focusing on the harm of PM2.5 to human body(Bliss Air, 2019). Besides, the data about PM2.5 in Chengdu found from the Kaggle database were collated and analyzed, and the real information of PM2.5 was shown to the readers in a graphical way (Kaggle.com, 2019). Therefore, readers are urged to think about and prevent this environmental pollution phenomenon.

Keywords: PM 2.5, London, 1952, smog, definition, formation, data, database, pollution, harm, collation, graphical, phenomenon.

Introduction

The rapid development of China's economy in recent years is universally acknowledged. As a Chinese, I am very proud and very proud. However, China's air quality has become extremely worrying because of its efforts to develop industries such as heavy industries and oil that emit large amounts of polluting gases. Many scientists use PM2.5 as a measure of air quality to inform Chinese citizens. What is PM2.5? It is an extremely small particle in the air, with a diameter of 2.5 microns or less. PM2.5 has a small particle size, is rich in a large number of toxic and harmful substances and stays in the atmosphere for a long time and has a long transportation distance, so it has a greater impact on human health and atmospheric environment quality. Although such small particles, when the number of these particles become extremely large, can directly affect People's Daily life and even harm human health. In order to learn more about the influence of PM2.5, I chose this project as reference to find out more relevant information about air pollution to people’s life. I don't want to do any research on pollution in Beijing because it is known for its very poor air quality. Therefore, I chose Chengdu, a well-known Hot-Pot city, as the main target of this project.

Literature Review

There are two types of PM2.5: natural and man-made. Natural factors are dust blown up by the wind, plant pollen, spores, and airborne bacteria. There are also natural disasters such as volcanic eruptions that release large amounts of ash and dust storms that produce large amounts of fine particles that are transported into the atmosphere. When people see the gray sky, they are already victims. The fine particulate standard, proposed by the United States in 1997, is intended to more effectively monitor the emergence of industrialization of small, harmful particles that had been ignored in the old standards. Fine particulate matter index has become an important index to measure and control the degree of air pollution. By the end of 2010, except for the United States and some countries of the European Union, which included fine particulate matter in national standards and imposed mandatory restrictions, most countries in the world had not yet carried out monitoring of fine particulate matter, and most generally monitored PM10

(Carrington, 2019). In order to highlight the harmful impact of air pollution on human beings and society, I found a classic example, Great Smog of 1952 in London, to illustrate. December 5, 1952, solstice 9, a large number of factory production and residential coal heating emissions difficult to diffuse, accumulated in the city above. London was blanketed in thick smog and traffic was at a standstill. People's lives have been disrupted and their health seriously compromised. Many citizens have chest tightness, suffocation and other discomfort, morbidity and mortality increased sharply. The smog killed as many as 4,000 people that month, according to one estimate. The event became known as the "London smog incident" and became one of the top 10 environmental hazards of the 20th century (HISTORY, 2019). In Chengdu, the smog is also the best evidence of PM2.5 (Chengdu Living, 2019). Some people would say that Chengdu is famous for hot pot. Is it because of the air pollution caused by people eating too much hot pot? The answer is of course not. The gas from eating hot pot is not the "killer behind the scenes" that will destroy our next generation. The main thing is the huge amount of coal burning in Chengdu and the exhaust from people's cars. China is also a big cars importer. In affluent cities, it's really not that hard for one person to own two or more cars. If everyone drives a car, then children and elderly people of a certain age and people with respiratory problems are better off staying indoors, or at least wearing a face mask because the levels of PM 2.5 in the air have exceeded their tolerance (Yu-Fei Xing, 2019). What are the PM 2.5 standards for different groups of people? From the information about PM 2.5, I got a set of relevant data (Bliss Air, 2019). The air quality index of 0 to 50 is in this area and the environmental quality is so good that you can go out. 51 to 100 means people can go out, but don't stay outside for long. 101 to 150 means that some people with respiratory or heart disease, babies, and some very old people can't stay out for long periods of time and try to stay home. 151 to 250 means the air quality is already very poor, and healthy people are advised not to stay out too long. A score above 250 means weather conditions have reached extreme levels, and everyone is advised to stay at home and rest. Based on the above PM2.5 air quality evaluation criteria, I searched Chengdu's current air quality. The data fluctuates around 200, which means the air quality in Chengdu is already so bad that it is no longer suitable for the

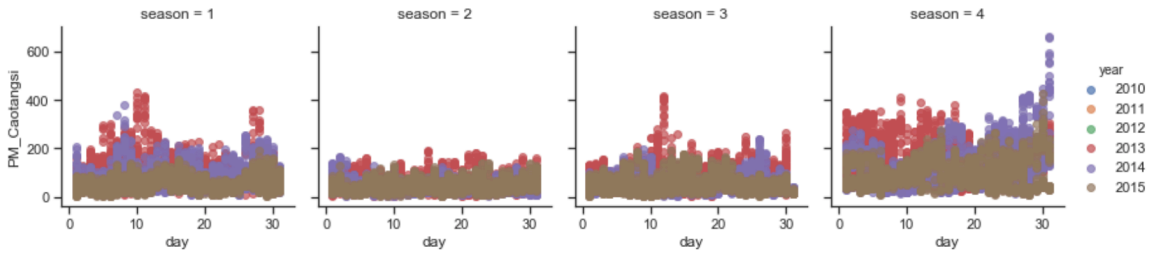
young, the very young, the elderly and those with respiratory and heart problems to go out and exercise. This kind of air quality has affected a lot of People's daily life and health.

Methods

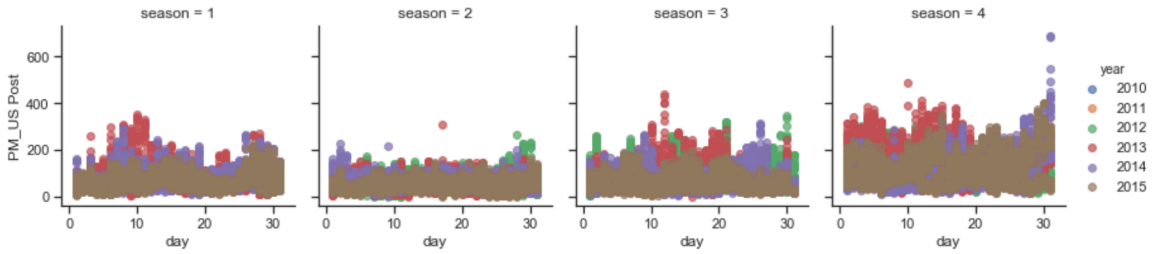
When I decided to use the Chengdu PM2.5 air quality data collection table, it was confusing to see a lot of capital letters. When I read the information carefully, I got a lot of useful data. The first hours, days, months, seasons, and years are easy to understand. And then PM 2.5's air quality index in different places. HUMI is just a Humidity, it means concentration of water vapor present in air. And for water vapor, it is the gaseous state of water which could not be seen through the human eyes. The PRES is air pressure which could make people chest tightness if it is too high. The CBWD is combined wind direction. The lws is Cumulated wind speed which could be a big issue if the wind speed is too high. Precipitation is also important because rainfall exceeding a certain amount can cause flooding. Similarly, iprec, cumulative water volume is also a measure of water. Because of the sheer size of the data, various types of data can make the graph extremely difficult to understand. Therefore, I integrated and collected the required information, and selected the content I needed for a graphical design. First of all, I got all the PM2.5 data of Chengdu, and of course all the PM2.5 data of Chengdu as a whole. Because the data is still complex, I averaged the data to get the graph of the second part below. In this way, it is obvious that the PM2.5 in Chengdu is different from that in other areas. Next, I focused on the process of time, and presented the data in the form of graphs through the changes of every month and every day. Finally, I showed the percentage of different PM2.5 data values in each year.

Results

a) Overview of PM 2.5 in Chengdu and one of its towns from 2010 to 2015



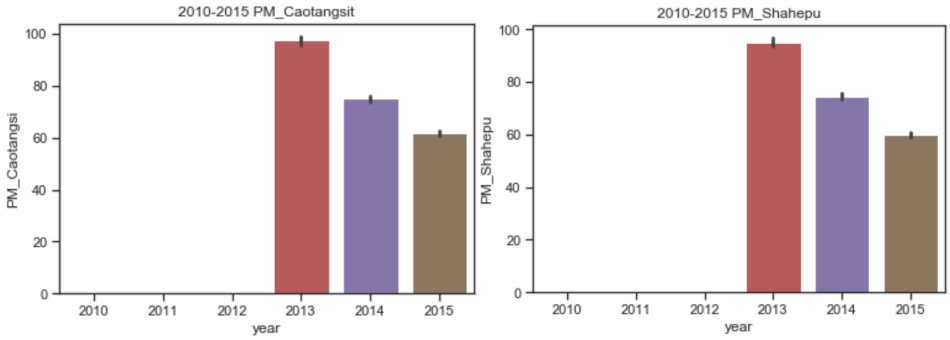
X = day, y = PM 2.5 in town Caotangsi, different colors represent different year



X = day, y = PM 2.5 in town Caotangsi, different colors represent different year

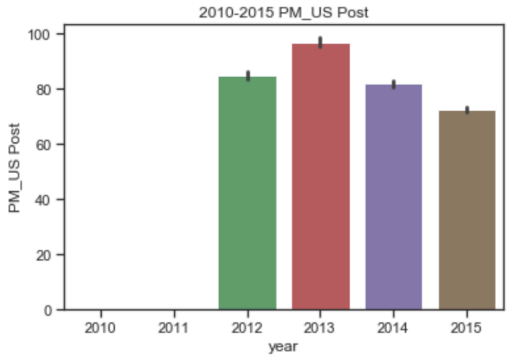
In this part, we can get two rough pictures of PM2.5 air pollution data values in Caotangsi and Chengdu in different years. From 2010 to 2015, the most active year or two was 2013 and 2014. From the two pictures we can clearly see that the red and purple points are at the highest point in each period. This shows that PM2.5 levels peaked in 2013 to 2014 and decreased in 2015.

b) Compare PM 2.5 in two example towns and whole city Chengdu



X = year, y = PM 2.5 in Caotangsi

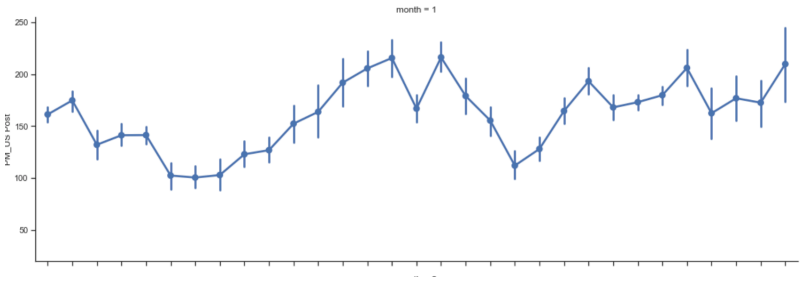
X = year, y = PM 2.5 in Shahepu



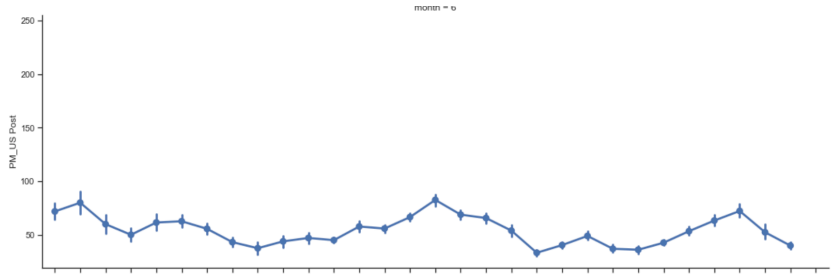
X = year, y = PM 2.5 in Chengdu

I'm not going to go into much detail here, because this picture is pretty straightforward. These three pictures were collected from PM2.5 data of the whole city of Chengdu, Caotangsi and Shahepu. Since the PM2.5 of Chengdu is presented to us after all other regions are integrated, the PM2.5 here reached a certain level of pollution in 2012. And the PM2.5 data of Caotangsi and Shahepu are very close, because the regional difference is not very big, and the heavy factories and coal mines in both regions are very few, so their air quality is very good until 2013.

c) To use PM 2.5 in Chengdu as example, to show which month the data changed the most



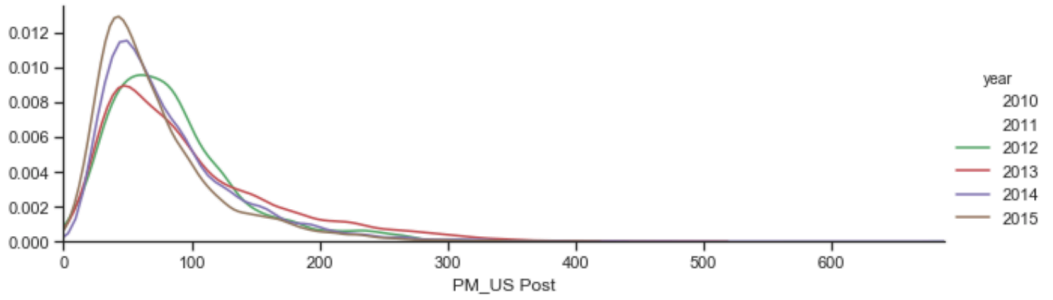
X = day, Y = PM 2.5 in Chengdu (in January)



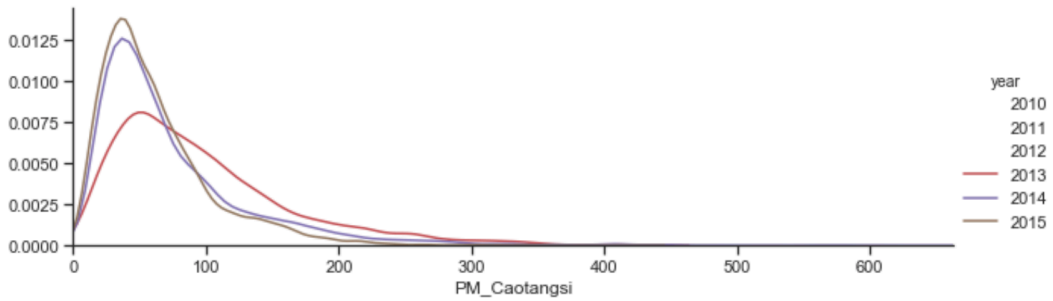
X = day, Y = PM 2.5 in Chengdu (in June)

Since the data is too large, I made many graphs to let me know all kinds of information about PM 2.5. Here I took two screenshots for a more detailed explanation. The first picture is the difference of PM 2.5 data in Chengdu in January. Since it is all January PM 2.5 data from 2010 to 2015, we can clearly see the difference in daily data. The following chart shows the difference in PM2.5 data in June. When we compare the two figures, it is easy to find that the difference of PM 2.5 in June is not very big, it is almost a point, indicating that PM 2.5 is stable and does not rise or fall in a month every year. In January, however, it became apparent for two reasons. The first is that Chinese people have the Spring Festival in January. The Spring Festival is the equivalent of Christmas in the United States, with people all over the country going home to spend the holiday with their families. At this time the car exhaust and for the festive fireworks will seriously pollute the air. The second is that as the weather gets colder, factories burn coal to supply the heating needed to keep warm. So I think these two points are the main reason for the difference between January and June.

d) To compare PM 2.5 from different years in Chengdu and one of its towns



X = PM 2.5 in Chengdu, Y = % of this value among this year of PM 2.5 values



X = PM 2.5 in Caotangsi, Y = % of this value among this year of PM 2.5 values

In this part, it is clearly to see that before year 2012, Chengdu did not get trouble by PM2.5 air pollution. When I first expressed the data in code, I didn't quite understand the meaning of NaN. When I searched for some information about PM2.5, I think NaN here means that the air quality is very good, so there is no need for PM2.5 testing and information collection. Therefore, this proves that in 2012, Chengdu as a whole does not need to prevent PM2.5. However, from 2012 to 2014, especially 2013, PM2.5 kept rising. At the same time, in the town of Caotangsi, there was some air pollution from 2012 to 2014, and the pollution was the most serious in 2013. But interestingly, in 2015, both the city as a whole and the small town of Caotangsi reduced PM2.5 emissions. I think this is a series of regulations on PM2.5 emission by the Chinese government.

Conclusion

In conclusion, PM 2.5, as a small particle often ignored by people in daily life, can actually have a great impact on human life, and even have the opportunity to threaten human life. Now the world has entered an era of rapid development, not only China, but also many industrial powers are also producers of PM2.5. As a very big city in China, Chengdu has improved people's living standards through the development of heavy industry, but the quality of life also needs a beautiful blue sky. We don't want our future children to live in a gray world. And I don't want them to see the blue sky just in the painting. The problem of pollution in the world is not to be underestimated, and we need to work together. All the problems of nature that we can understand and see need to be addressed. We can't wait until the pollution threatens our lives.

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