Characteristics of Particulate Matter Pollution in China

Jingkun Jiang
School of Environment
Tsinghua University

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In 2010, ambient particulate matter pollution has become the fourth leading risk factors of disability-adjusted life-years (DALYs) in China.

Since 1960, visibility in China has degraded significantly which is linked with high particulate matter concentrations.

Long-term trend of PM$_{10}$ pollution in China
Geographic location of Chinese cities reporting air pollution index (PM$_{10}$, SO$_2$ and NO$_2$)
Days with $\text{PM}_{10}$ as the primary pollutant for all monitored cities

<table>
<thead>
<tr>
<th>Year</th>
<th>Days Included</th>
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<tbody>
<tr>
<td>2001</td>
<td>47</td>
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<td>2002</td>
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<td>2010</td>
<td>86</td>
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<tr>
<td>2011</td>
<td>120</td>
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</tbody>
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Seasonal variations of PM$_{10}$ concentration in Chinese cities (2001-2011)
Annual $\text{PM}_{10}$ concentration in Chinese cities
Annual PM$_{10}$ concentration in Chinese cities

2011

PM10 (ug/m3)
- < 40
- 40 - 70
- 70 - 100
- 100 - 130
- > 130
Annual $\text{PM}_{10}$ concentration in Chinese cities (2001-2011)
Long-term trend of PM$_{10}$ in Beijing
In recent years, PM$_{2.5}$ becomes a popular word in China

- An severe air pollution event happened in Beijing in Nov. 2011
- The release of hourly PM$_{2.5}$ mass concentration by US embassy on twitter triggers widely discussion on air quality in China
- The revision of national ambient air quality standard: approved by the State Council on Feb. 2012

http://opinion.china.com.cn/event_835_1.html
Hourly concentrations of six air pollutants for 74 Chinese cities are available since January 2013.

PM$_{2.5}$
PM$_{10}$
SO$_2$
NO$_2$
CO
O$_3$

http://113.108.142.147:20035/emcpublish/
This new national monitoring network was on time to capture pollution characteristics in January 2013 during which extensive haze episodes happened across China.

Satellite Images from NASA

BBC NEWS
CHINA
12 January 2013 Last updated at 08:14 GMT
Beijing air pollution soars to hazard level

The New York Times
January 12, 2013
On Scale of 0 to 500, Beijing’s Air Quality Tops ‘Crazy Bad’ at 755
Average PM$_{2.5}$ and PM$_{10}$ concentrations in 74 cities during January 2013 were 128.7 and 184.4 $\mu$g/m$^3$, respectively.

Jiang et al., Aerosol Air Quality Res, 2014 (in press)
Annually average PM$_{2.5}$ concentrations in 74 Chinese cities (2013)

Highest: Xingtai (~160 μg/m$^3$)

Beijing (~90 μg/m$^3$)

Shanghai (~60 μg/m$^3$)
Comparing PM pollution levels in Chinese cities (January 2013)
PM$_{2.5}$ and PM$_{10}$ correlate with wind speed and relative humidity (Beijing as an example)
Air Pollution Prevention and Control Action Plan was released by the State Council of China in September 2013

• ten measures were proposed: from pollution reduction to the change of energy structure, industrial structure, and beyond;

• Clear goals were set: by 2017, PM$_{2.5}$ concentration in Chinese cities should decrease by 10% or more comparing to 2012; while that in Beijing and neighboring area should decrease by 25%.
Take home messages:

- Though China has reduced its PM$_{10}$ concentrations during the last decade, PM$_{2.5}$ is still a severe environmental problem in China;

- Controlling both primary PM emission and precursor emission are needed to control PM pollution in China;

- With the release of Action Plan by the State Council, stricter air pollution control measures is being implemented and lower PM concentration is anticipated in the future (e.g., the goal of PM$_{2.5}$ concentration in Beijing in 2017 is \(~60\ \mu g/m^3\) .