Study on a continuous haze event in January 2015 in Pukou, Nanjing

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Outline

• Introduction
• Data and Methods
• Results and Discussion
• Conclusion
Introduction

- Haze has negative effects on climate change, environment and human health. Fine particulate matter (PM$_{2.5}$) play an important role in the formation of the haze.
- Nanjing is located in Yangtze River Delta, one of the four major areas with severe haze pollution. Highly economic development also resulted in high emissions of atmospheric pollutants.
- A continuous haze episodes occurred in Nanjing from 14 to 28 January 2015, This work try to analyze the event from meteorological condition and mass transport involved in this event.
Data and Methods

• Data
  a. Meteorological parameters
    ENVIS, Germany, Agriculture experiment station, NUIST
  b. Concentrations of six criteria pollutants
    PM$_{2.5}$, PM$_{10}$, CO, SO$_2$, NO$_2$ and O$_3$,

• Methods
  a. PBLH calculation
    NOAA Reanalysis, NCEP GDAS
  b. Backward trajectory    HYSPLIT 4.0
Results and Discussion

Fig. 1. Hourly concentration of 6 criteria pollutants in January 2015
Results and Discussion

Table 1. Information on 6 criteria pollutants in January 2015

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Standard deviation</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{2.5}$ (µg/m$^3$)</td>
<td>100</td>
<td>64</td>
<td>284（严重）</td>
<td>7</td>
</tr>
<tr>
<td>PM$_{10}$ (µg/m$^3$)</td>
<td>156</td>
<td>82</td>
<td>407（重度）</td>
<td>21</td>
</tr>
<tr>
<td>CO (mg/m$^3$)</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>NO$_2$ (µg/m$^3$)</td>
<td>54</td>
<td>35</td>
<td>178（良）</td>
<td>12</td>
</tr>
<tr>
<td>O$_3$ (µg/m$^3$)</td>
<td>27</td>
<td>22</td>
<td>93</td>
<td>1</td>
</tr>
<tr>
<td>SO$_2$ (µg/m$^3$)</td>
<td>24</td>
<td>15</td>
<td>77</td>
<td>2</td>
</tr>
</tbody>
</table>
Results and Discussion

Table 2. Information on the haze event in January 2015

<table>
<thead>
<tr>
<th>Event</th>
<th>PM$_{2.5}$ (µg/m$^3$)</th>
<th>PM$_{10}$ (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± S.D</td>
<td>Maximum</td>
</tr>
<tr>
<td>part1</td>
<td>64 ± 46</td>
<td>190</td>
</tr>
<tr>
<td>Part2</td>
<td>49 ± 24</td>
<td>123</td>
</tr>
<tr>
<td>Part3</td>
<td>99 ± 38</td>
<td>230</td>
</tr>
<tr>
<td>Part4</td>
<td>153 ± 49</td>
<td>284</td>
</tr>
<tr>
<td>Part5</td>
<td>112 ± 85</td>
<td>250</td>
</tr>
</tbody>
</table>
Results and Discussion

Fig. 2. Near-surface meteorology and PM2.5 mass concentration variations
Results and Discussion

Fig.3. Daily variation of 6 criteria pollutants
Results and Discussion

Fig. 4. Hourly PM2.5 mass concentration and the corresponding near-surface wind speed and direction.
Results and Discussion

Fig. 5. Wind rose diagrams of wind speed and PM$_{2.5}$ concentration
Results and Discussion

Fig. 6. Hourly PM2.5 mass concentration and the corresponding T and RH.
Results and Discussion

• Backward trajectories

Fig. 7. 48-h backward trajectory of the Nanjing
Results and Discussion

• Backward trajectories

Fig. 8. 48-h backward trajectory of the Nanjing
Results and Discussion

Fig. 9. Pressure distribution at 20:00 on 24 January 2015
Results and Discussion

Fig. 10. Pressure distribution at 8:00 on 26 January 2015
Results and Discussion

Fig. 10. Pressure distribution at 20:00 on 26 January 2015
Conclusion

• The low height of the planetary boundary layer, regional transfer, stationary meteorological condition and local emissions contributed to the haze formation.

• The main reason that caused high concentration of PM$_{2.5}$ is different in different haze event.

• The concentration of PM$_{2.5}$ and PM$_{10}$ has a significant diurnal variation. Peak value appeared at 10:00 and 17:00, respectively.
Thank you