Urban Air Quality Assessment Model Based on API Index
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Abstract
This paper analyzes the air pollution degree of the city, and uses the weight coefficient method to modify and improve the API standard. Based on the daily API index value of each city, the weight coefficient increases with the pollution level. The increase and the expansion of the number of severely polluted days on the degree of urban pollution make such an assessment more reasonable and scientific. In addition, this paper considers the seasonal variation of the degree of air pollution, and finally processes and calculates the data, and obtains the comprehensive ranking of the quarters and annuals of the pollution levels of the ten sample cities.

Keywords
Air quality; Evaluation model; API index; Seasonal.

1. Introduction
With the development of industry, many cities are currently subject to different levels of pollution, especially air pollution, which will directly cause harm to the human body. In recent years, although China's air pollution prevention and control work has achieved great results, due to various reasons, the situation facing China's atmospheric environment is still very serious. To realize the coordinated development of atmospheric environment and social economy, it is necessary to carry out research on the factors affecting urban environmental air quality and its impact mechanism, as well as the practical problems that need to be solved urgently to improve urban environmental quality.

2. Evaluation model establishment
The primary factor for establishing a city's air quality assessment model is whether the air quality in the area is harmful to people's health. The greater the concentration of pollutants, the greater the harm to people, so when setting the weighting factors of the stages, As the pollution level increases, the corresponding weight coefficient is also larger, and the weight is linearly related to the level. Secondly, before the pollution index does not reach the hazard value, such pollution may have potential harm to the environment. Therefore, the established evaluation model can neither ignore the serious pollution situation nor over-amplify these special conditions; neither can neglect the relatively small pollution. The situation does not allow these conditions to affect the determination of the degree of pollution. In summary, namely:

\[ C = \frac{\sum_{i=1}^{n} I_i \times K_i}{n} \]

When solving, first calculate the pollution level of one grade in a quarter, and then calculate the degree of air pollution within one, and compare the pollution degree of each quarter. Finally, the degree of air pollution in all cities was evaluated according to different time periods.
2.1 Period-based pollution levels
Since the air pollution in the city will cause damage to people's health, the frequency of serious air pollution should not be too high. Calculate the pollution level of this level in the quarter based on the daily calculation of each level of each quarter with:

\[ I_{ij} = \sum_{h=1}^{s} I_{ijh} \]

2.2 Evaluation model based on quarterly and annual assessments
Under the premise of knowing the daily pollution index and the daily air quality level of each city, comprehensive consideration of various factors, using the level of pollution of each level that has been obtained every quarter, and comprehensive evaluation of a long-term area. The severity of air pollution. Establish a quarterly model:

\[ C_i = \frac{\sum_{i=1}^{n} I_{ij} K_i}{n} \]

\[ K_i = \frac{i}{15} \quad (i=1,2,3,4,5) \]

In the above mathematical model: \( C_i \) indicates the degree of pollution in a quarter; \( n \) represents the total number of days in the quarter taken; based on this, an annual model is established:

\[ C = \frac{\sum_{i=1}^{n} I_i \times K_i}{n} \]

\[ K_i = \frac{i}{15} \quad (i=1,2,3,4,5) \]

3. Model solving
Since air pollution has a close relationship with the quarter, it compares the pollution level of the whole year, and also calculates the pollution degree ranking of each city in quarters, which is conducive to comprehensively judging the pollution level of each city. As shown in Table 1, it represents the pollution degree of each city in each quarter and year.

<table>
<thead>
<tr>
<th>Pollution city</th>
<th>Chengdu</th>
<th>Hangzhou</th>
<th>Beijing</th>
<th>Shanghai</th>
<th>Guangzhou</th>
</tr>
</thead>
<tbody>
<tr>
<td>First quarter</td>
<td>16.083</td>
<td>7.634</td>
<td>11.259</td>
<td>7.48</td>
<td>7.216</td>
</tr>
<tr>
<td>Second quarter</td>
<td>10.265</td>
<td>7.66</td>
<td>11.85</td>
<td>9.02</td>
<td>6.467</td>
</tr>
<tr>
<td>Third quarter</td>
<td>7.926</td>
<td>9.78</td>
<td>16.13</td>
<td>5.695</td>
<td>6.267</td>
</tr>
<tr>
<td>Fourth quarter</td>
<td>8.68</td>
<td>11.62</td>
<td>11.68</td>
<td>5.002</td>
<td>8.336</td>
</tr>
<tr>
<td>Overall</td>
<td>10.36</td>
<td>9.01</td>
<td>12.82</td>
<td>6.898</td>
<td>6.899</td>
</tr>
<tr>
<td>Pollution city</td>
<td>Lhasa</td>
<td>Urumqi</td>
<td>Zhengzhou</td>
<td>Wuhan</td>
<td>Xi'an</td>
</tr>
<tr>
<td>First quarter</td>
<td>2.36</td>
<td>28.41</td>
<td>12.04</td>
<td>9.293</td>
<td>14.69</td>
</tr>
<tr>
<td>Second quarter</td>
<td>2.67</td>
<td>11.53</td>
<td>9.94</td>
<td>7.41</td>
<td>14.77</td>
</tr>
<tr>
<td>Third quarter</td>
<td>7.346</td>
<td>8.826</td>
<td>13.78</td>
<td>11.9</td>
<td>9.8</td>
</tr>
<tr>
<td>Fourth quarter</td>
<td>7.053</td>
<td>11.86</td>
<td>12.405</td>
<td>13.22</td>
<td>12.32</td>
</tr>
<tr>
<td>Overall</td>
<td>4.81</td>
<td>13.113</td>
<td>11.976</td>
<td>10.244</td>
<td>12.7</td>
</tr>
</tbody>
</table>

According to the model established in this paper, the ranking of each city's quarterly and annual pollution levels from low to high can be obtained, as shown in Table 2.
The pollution ranking model for each city is based on the API index, while the API index algorithm only takes the most polluting of the three pollutants, if the pollution level of the other two is close to the largest one. Item, the API index of the day cannot accurately reflect the true pollution level. Especially in most cases, the primary pollutant is respirable particulate matter, so that when sulfur dioxide or nitrogen dioxide is the primary pollutant, inhalable solid particles still exist, specifically the error is relatively large, because of the inhalable solid particles It is mainly purified by sedimentation by its own gravity. It takes a long time and does not change much in a short time. Therefore, in the cities where sulfur dioxide and nitrogen dioxide are the primary pollutants, the results of this evaluation model are Actual contamination levels may vary slightly.

4. Conclusion

In general, atmospheric pollution sources can be mainly divided into two categories: natural sources and anthropogenic sources. Anthropogenic sources include vehicles, ships, aircraft exhaust, industrial production emissions, residential and heating, and waste incineration. The city's development density, topography and meteorology are also important factors affecting air quality. The quality of urban air quality is closely related to the seasons and meteorological conditions. Therefore, this paper is divided into different regions and different seasons. The equivalent pollution load of all pollutants of a certain pollution source is arranged according to the numerical value. The percentage and cumulative percentage are calculated from small to large, and the pollutant with the cumulative percentage greater than 80% is determined as the main pollutants of pollution sources, that is, the main factors affecting urban air quality.

References