Decision Support System (v 1.0) for Air Quality Management in New Delhi, India

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Supplementary material
Text S1:S5
Figures: S1:S3
1. Domain details

Supplementary figure 1: The model domain used for DSS. The location of Delhi has been identified.

2. Comparison between DSS simulated air quality index and that derived from the corresponding measurements:
Supplementary figure 2: Comparison between DSS simulated air quality index (AQI) for PM$_{2.5}$ and the corresponding AQI calculated from the station measurements averaged over Delhi for both the seasons. The black-colored dotted line represents the best fit, and the equation for the best-fit line is written in the top left corner of each panel.

3. Formulae for statistical parameters for evaluating model-simulated PM$_{2.5}$ mass concentration

\[ M = \text{predicted concentration} \]
\[ O = \text{observed concentration} \]
\[ n = \text{sample size (number of hours or number of days)} \]

1. Mean Bias = \( \frac{1}{n} \times \sum_{1}^{n} (M - O) \)

2. Mean Error = \( \frac{1}{n} \times \sum_{1}^{n} |(M - O)| \)

3. Root Mean Square Error = \( \sqrt{\left( \frac{1}{n} \sum_{1}^{n} (M - O)^2 \right) / n} \)

4. Normalized Mean Bias = \( \frac{\sum_{1}^{n} (M - O)}{\sum_{1}^{n} O} \)

5. Normalized Mean Error = \( \frac{\sum_{1}^{n} |(M - O)|}{\sum_{1}^{n} O} \)

6. Fractional Bias = \( \left( \frac{1}{n} \right) \times \frac{\sum_{1}^{n} (M - O)}{\sum_{1}^{n} (M + O)} \)

7. Fractional Error = \( \left( \frac{1}{n} \right) \times \frac{\sum_{1}^{n} |(M - O)|}{\sum_{1}^{n} (M + O)} \)
4. Contingency table and the formulae used for the calculation of statistical parameters

Considering all the entries in the observations and the forecasts we can compute the values of a,b,c, and d by using the following contingency table. Using those values, we can compute the required statistical parameters listed below.

<table>
<thead>
<tr>
<th>Forecast</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
<td>a</td>
</tr>
<tr>
<td>No</td>
<td>c</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistic name</th>
<th>Interpretation</th>
<th>Formula</th>
<th>unit</th>
<th>Ideal value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (A)</td>
<td>Ability of the forecast to predict events and non-events</td>
<td>( A=\frac{(a+d)}{(a+b+c+d)} \times 100 )</td>
<td>%</td>
<td>100</td>
</tr>
<tr>
<td>False Alarm Rate (FAR)</td>
<td>The tendency of the model to give an incorrect forecast of a non-event</td>
<td>( FAR = \frac{(b/(a+b))}{100} )</td>
<td>%</td>
<td>0</td>
</tr>
<tr>
<td>Probability of Detection (POD) or Hit rate</td>
<td>The ability of the model to give a correct forecast of an event</td>
<td>( POD = \frac{(a/(a+c))}{100} )</td>
<td>%</td>
<td>100</td>
</tr>
<tr>
<td>Critical Success Index (CSI), also called Threat Score</td>
<td>The ability of the model in correctly predicting the event when the event exists either in forecasts or in observations.</td>
<td>( CSI = \frac{(a/(a+b+c))}{100} )</td>
<td>%</td>
<td>100</td>
</tr>
<tr>
<td>Success Ratio</td>
<td>Success rate for the forecasts</td>
<td>( SR = 100 - FAR )</td>
<td>%</td>
<td>100</td>
</tr>
</tbody>
</table>
Bias

Ratio of the tendency of getting a false forecast for a non-event from the model to that of getting a false forecast for an event from the same model

Bias = POD/SR

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5. Effects of a 20% reduction in emissions from Delhi's transport sector and Jhajjar districts on PM$_{2.5}$ mass concentrations in Delhi during the study period:

Supplementary figure 5: Simulated effects of a 20% reduction in emissions from Delhi's transport sector and Jhajjar districts on PM$_{2.5}$ in Delhi during October 2021 - February 2022 period.