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Geoscientific Model Development
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Supplement of

Decision Support System version 1.0 (DSS v1.0) for air quality management in Delhi, India

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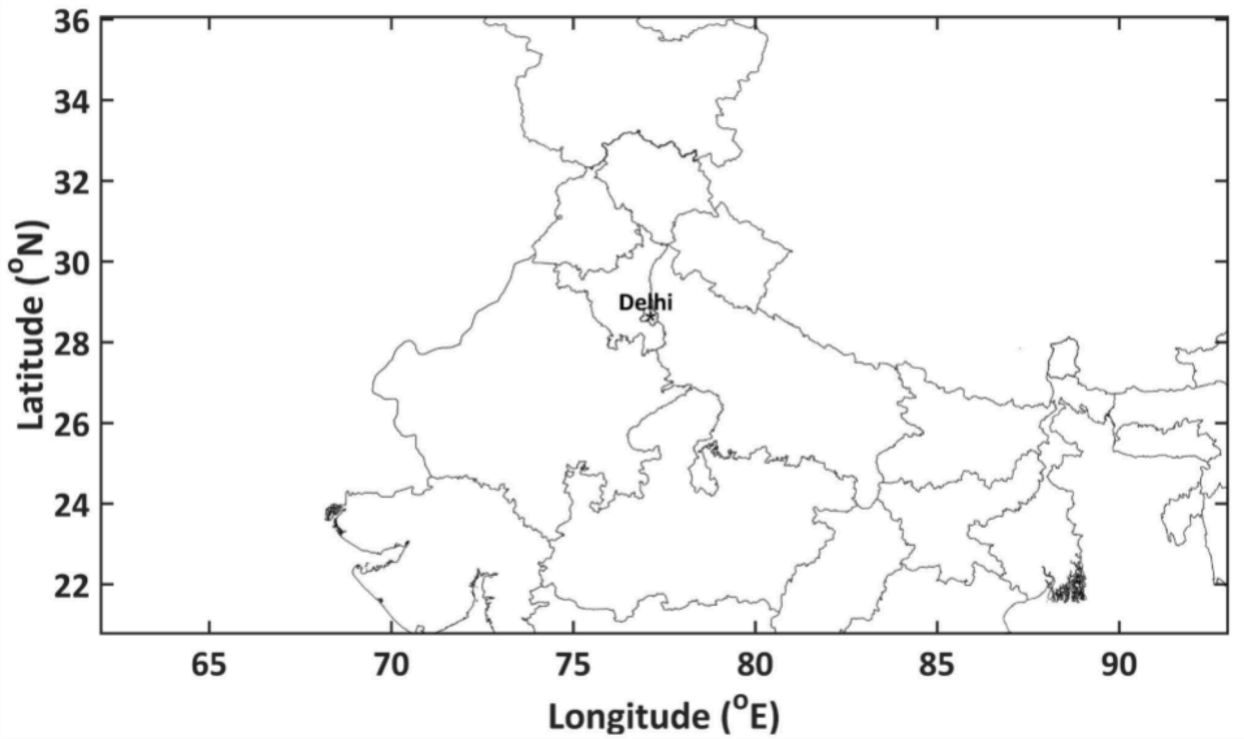
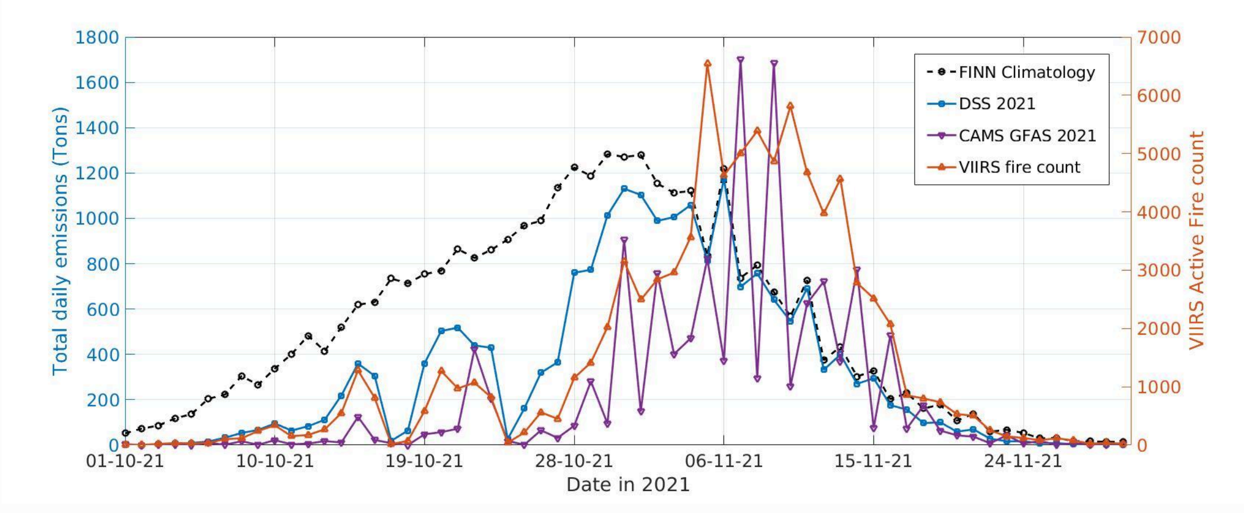
1. Domain details



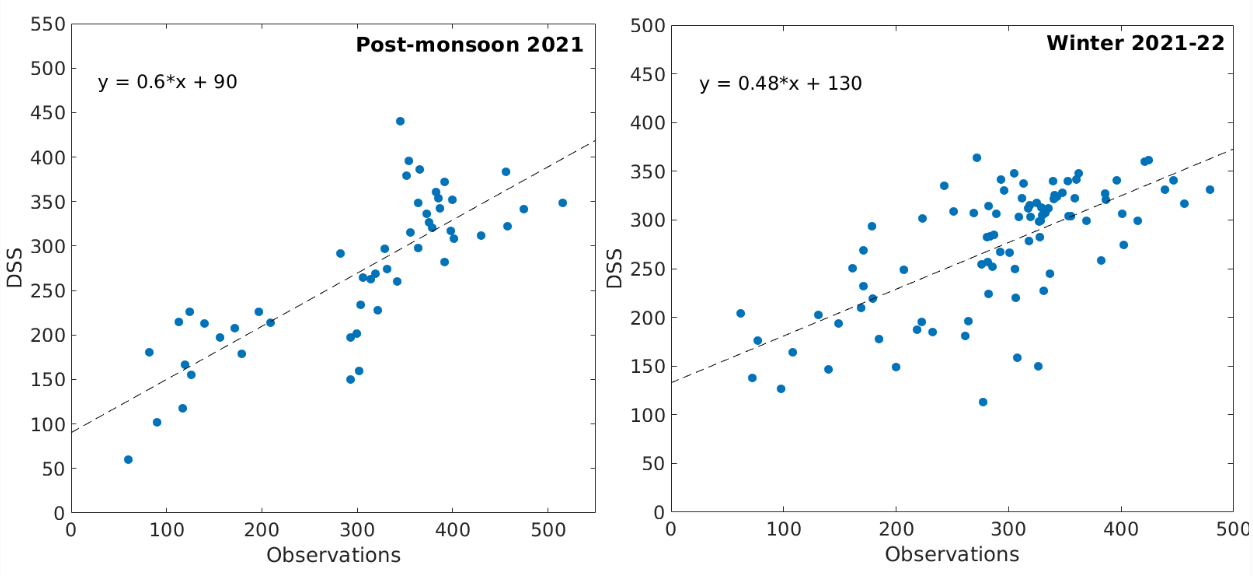
Supplementary figure 1: The model domain used for DSS. The location of Delhi has been identified.

2. Comparison of the prescribed fire emissions of Organic Carbon in the DSS framework with the other datasets (FINN, CAMS and VIIRS active fire count)



Supplementary Figure 2: Daily emissions of Organic Carbon from fires over Punjab and Haryana states of India for the period of October 2021–November 2021 from a). FINN climatology prepared using the data from 2002–2018 (Dashed black line), b). DSS modeling framework (blue line), and c). CAMS GFAS emissions database (purple line). The units are tons of Organic Carbon. The Orange line depicts daily active fire counts over the same region retrieved by the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument onboard the NASA/NOAA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite. The y-axis on the left side may be used for emissions, while that on the right side may be used for fire counts.

3. Comparison between DSS simulated air quality index and that derived from the corresponding measurements:



Supplementary figure 3: 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.

4. Formulae for statistical parameters for evaluating model-simulated $PM_{2.5}$ mass concentration

M = predicted concentration
O = observed concentration
n = sample size (number of hours or number of days)

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

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

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

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

5. Normalized Mean Error = $\frac{\sum_{1}^{n}|(M-0)|}{\sum_{1}^{n}O}$

6. Fractional Bias = $(\frac{1}{n}) \times \frac{\sum_{1}^{n}(M-O)}{\sum_{1}^{n}\frac{(M+O)}{2}}$

7. Fractional Error = $(\frac{1}{n}) \times \frac{\sum_{1}^{n}|(M-0)|}{\sum_{1}^{n}\frac{(M+O)}{2}}$

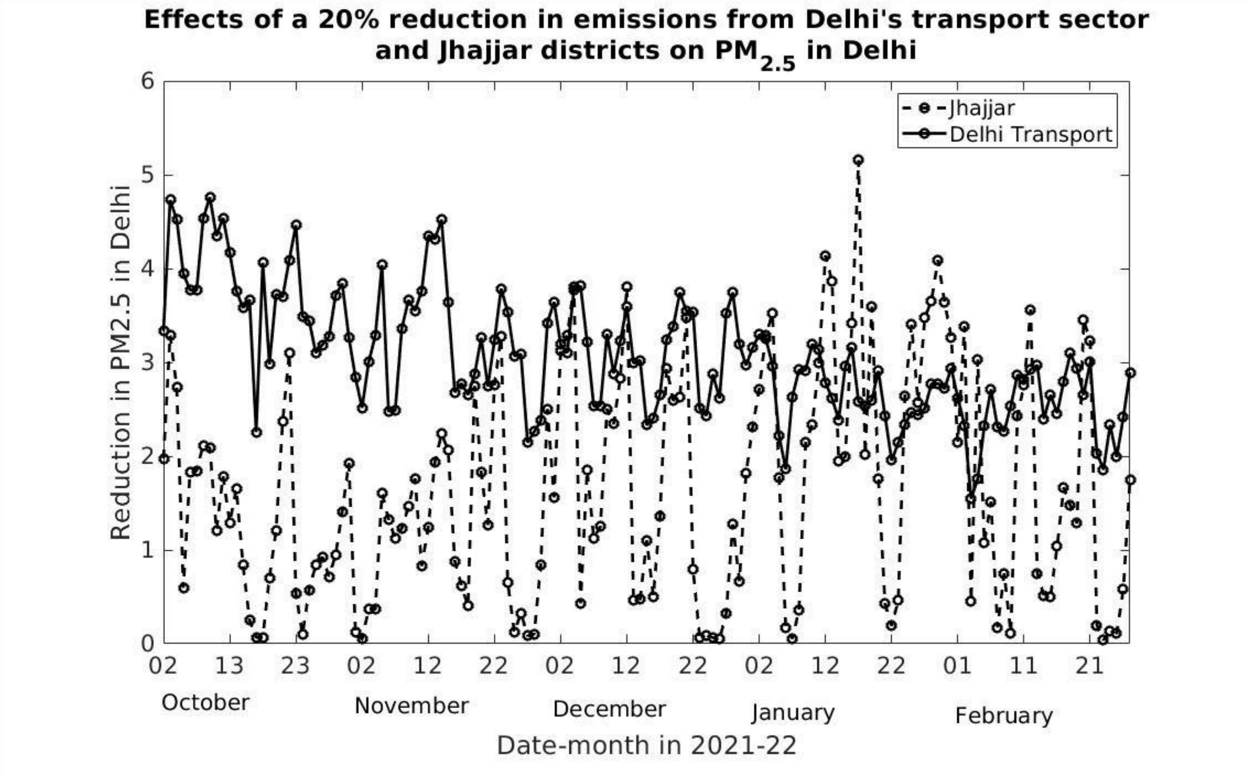
5. Contingency table and the formulae used for the calculation of statistical parameters

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.

		Observations	
		Yes	No
Forecast	Yes	a	b
	No	c	d

Statistic name	Interpretation	Formula	unit	Ideal value
Accuracy (A)	Ability of the forecast to predict events and non-events	A=(a+d)/(a+b+c+d) *100	%	100
False Alarm Rate (FAR)	The tendency of the model to give an incorrect forecast of a non-event	FAR = (b/(a+b)) *100	%	0
Probability of Detection (POD) or Hit rate	The ability of the model to give a correct forecast of an event	POD = (a/(a+c)) * 100	%	100
Critical Success Index (CSI), also called Threat Score	The ability of the model in correctly predicting the event when the event exists either in forecasts or in observations.	CSI = (a/(a+b+c)) * 100	%	100
Success Ratio	Success rate for the forecasts	SR = 100 - FAR	%	100
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	-	1

6. 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 4: 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.