Multiple Regression approach for air quality assessment using integrated Surface, satellite, and meteorological data over Jaipur, Rajasthan India.

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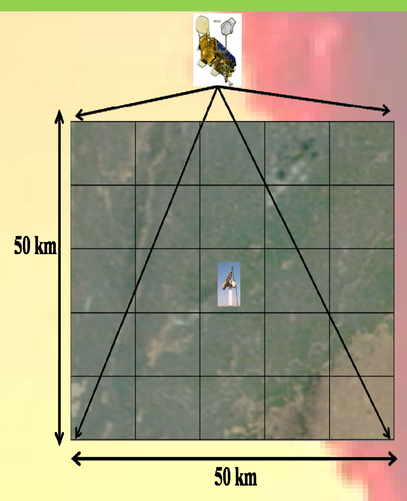
OBJECTIVES

1. To examine and derive the quantitative relationship of Respirable Suspended Particulate Matter (RSPM) size < 10 µm with Aerosols Optical Depth (AOD) and meteorological variables .

2.Multivariable regressions analysis with and without meteorology is conducted to find the best regression model over the region of study by adjusting key variables.

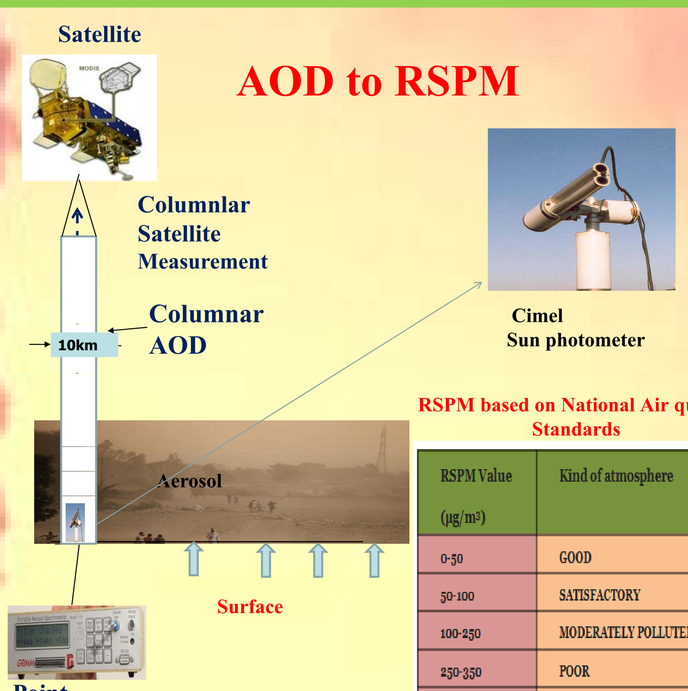
3. Comparison with air quality index of National Ambient Air Quality Standards (NAAQS), India for assessing the present air quality status over Jaipur, a semi arid region in North-western India.



Jaipur AERONET Site
Latitude: 26.90° N
Longitude: 75.80° E

MODIS Resolution 10 km X 10 km
Jaipur AERONET SITE ± 0.25 ≈
50 km X 50 km (i.e 5 pixel X 5 pixel)

METHODOLOGY

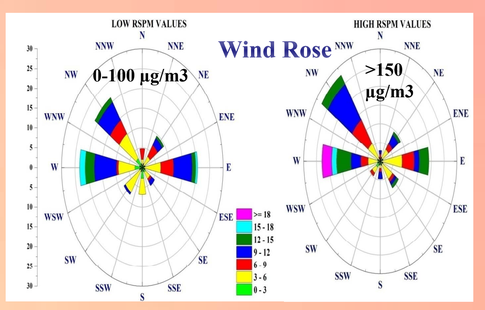


AOD to RSPM

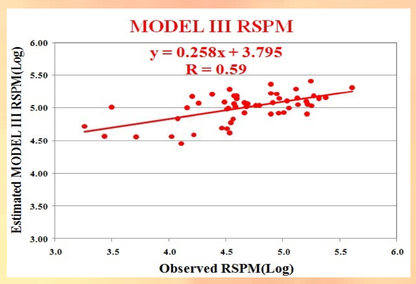
RSPM based on National Air quality Standards

RSPM Value (µg/m³)	Kind of atmosphere
0-50	GOOD
50-100	SATISFACTORY
100-250	MODERATELY POLLUTED
250-350	POOR
350-430	VERY POOR
>430	SEVERE

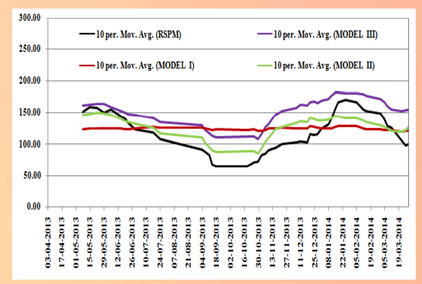
Coefficients Table	MODEL I	MODEL II	MODEL III
Intercept	110.42	226.56	6.22
AOD	26.42	56.85	0.19
Temperature(°C)		-2.95	-0.03
Humidity(%)		-1.54	-0.01
WS(km/hr)		2.21	0.02



Validation Results



Scatter Graph of Predicted RSPM (MODIS) Vs Observed RSPM

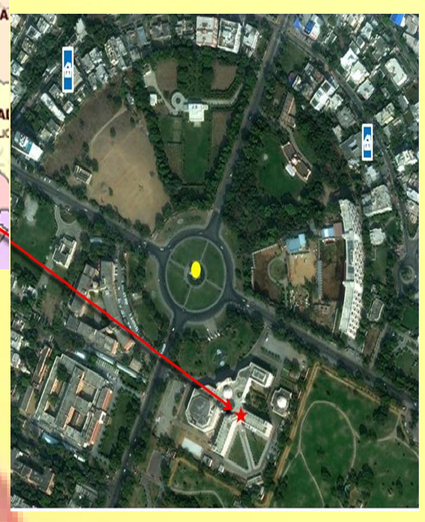


10 Point Moving Average Graph to Show the trend

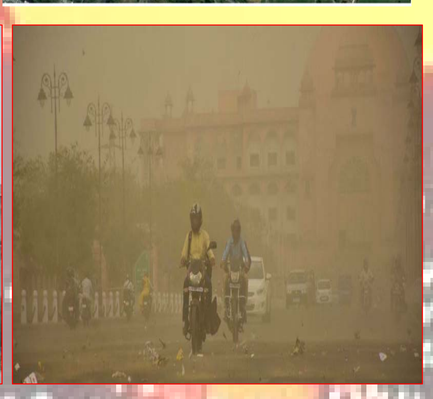
SITE AND CURRENT SITUATION POLLUTION

Vehicular emissions and dust particles are main sources of atmospheric pollution at Jaipur.

During the normal days average RSPM triggers around 100-250 (µg/m³) as per the National Ambient Air quality standards (NAAQS) this range comes under the moderately polluted category.



During Dust storms it can go in the range of 250-430 which comes under the severe quality of air pollution according to NAAQS.



Clear Sky Dust Storm

DATA & TOOLS

Time Period : April, 2010 - March, 2013(For Regression Equation)

April ,2013 - March, 2014(For Validation)

AOD Data:-

- ❑AERONET Level 2 Daily Average (For Validation of Satellite Data)
- ❑MODIS Level 2 Daily Average

Meteorology Data:-

Temperature, Relative Humidity, Wind speed (wunderground.com)

Validation over Jaipur Malviya Industrial Area Site (26.9° N and 75.8 °E)

- ❑ Area averaged values of AOD over Jaipur within ±0.25 °
- ❑ Area (75.75, 26.85, 75.85, 26.95)
- ❑Regression Models

REGRESSION MODELS CONSIDERED

Simple Linear →

MODEL I

$$RSPM = \alpha + \beta \times AOD$$

Multiple Linear →

MODEL II

$$RSPM = \alpha + \beta_1 \times AOD + \beta_2 \times T + \beta_3 \times RH + \beta_4 \times WS$$

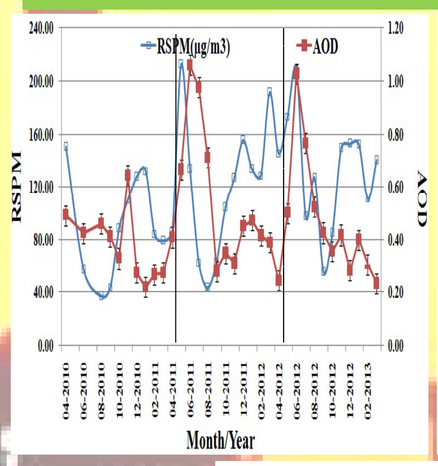
Log-Linear →

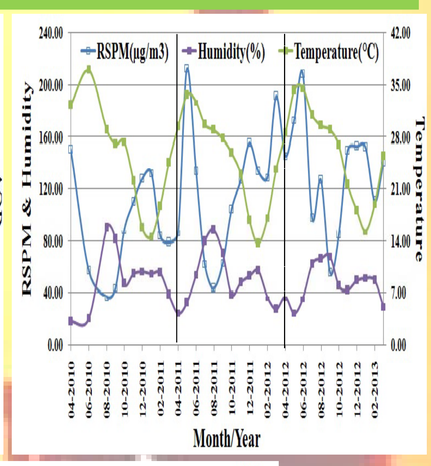
MODEL III

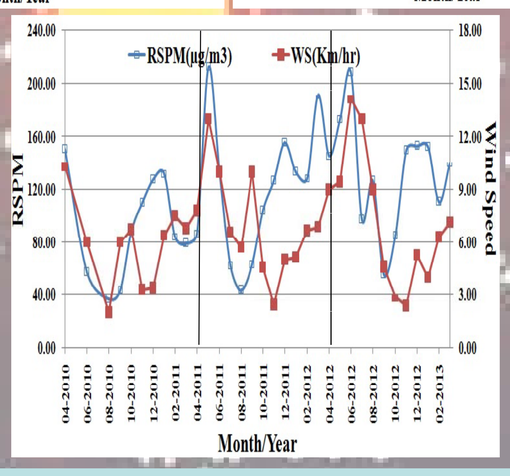
$$LN(RSPM) = \alpha + \beta_2 \times T + \beta_3 \times RH + \beta_1 \times LN(AOD) + \beta_4 \times WS$$

α is intercept, β,β1, β2, β3, β4, are regression coefficients

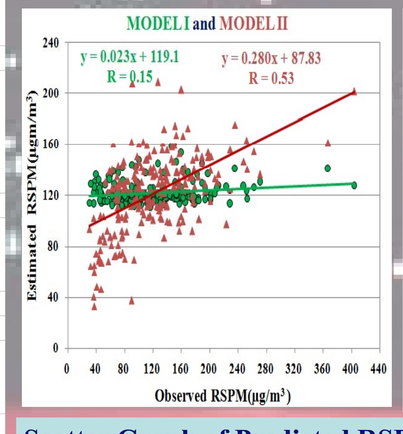
RESULTS & DISCUSSIONS

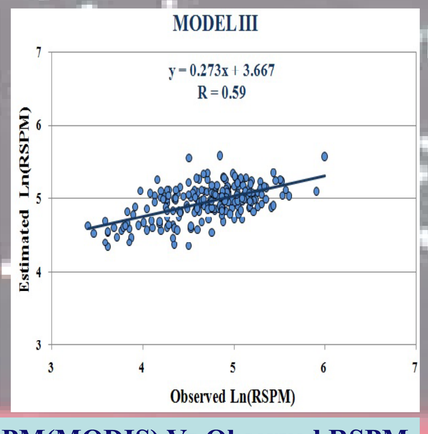






Monthly Variation of AOD, RH,T, WS with RSPM

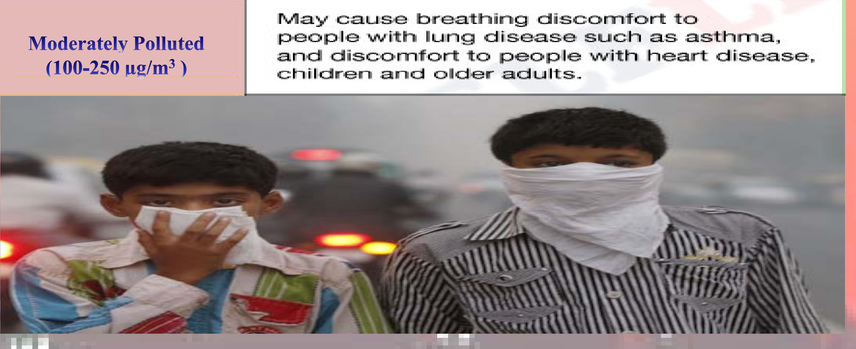




Scatter Graph of Predicted RSPM(MODIS) Vs Observed RSPM for MODEL I, II and III

GRAPHICAL CONCLUSIONS

Statistical Techniques to quantify the deviation of model(s) from the RSPM observations



❑The average RSPM obtained from RPCB observations is 119.6µg/m³ whereas the predicted average is 152.4µg/m³.This comes under "Moderately Polluted" category as per NAAQS.

AQI	ASSOCIATED HEALTH IMPACTS
Moderately Polluted (100-250 µg/m³)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.

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