Research BRIEFS

NCAP-COALESCE

CarbOnaceous AerosoL Emissions, Source apportionment & ClimatE impacts

Understanding scientific complexities related to carbonaceous aerosols focussing on issues underlying their origin and fate, and their role as drivers of regional climate change over India.

Diurnal variability of PM2.5 over India using MEERA-2.

Kunal Bali, Sagnik Dey, Dilip Ganguly .

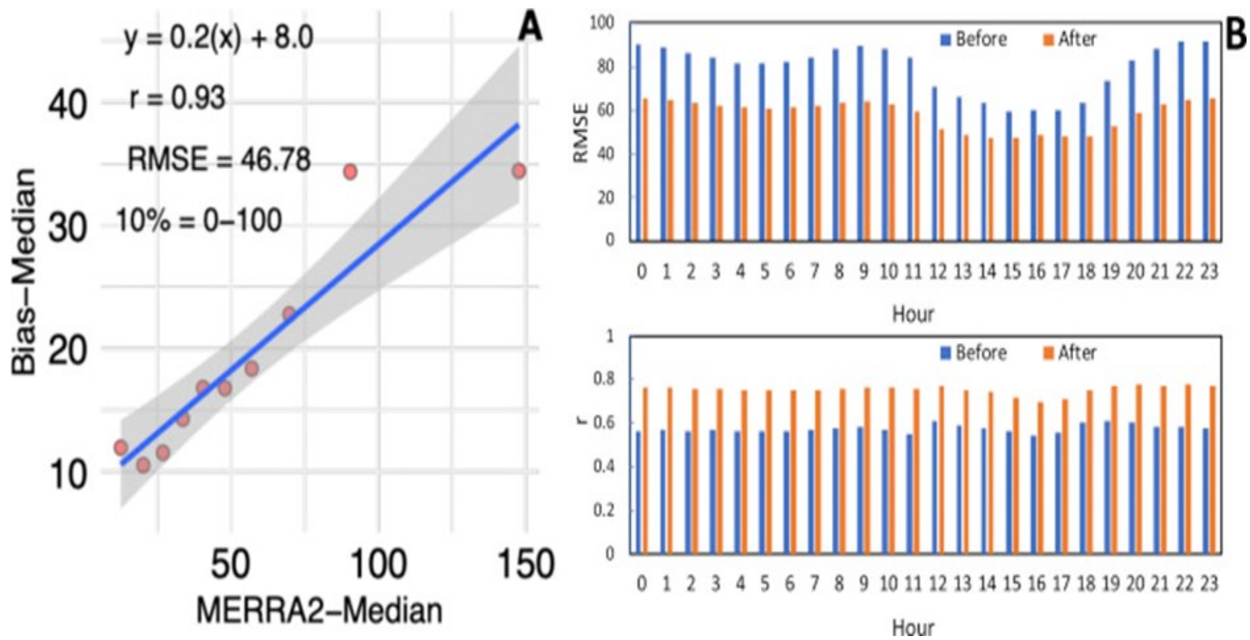

Figure 1. Relationship between (a) the median bias in MERRA-2 data at every 10th percentile range and (b) the root mean square error (top panel) and correlation coefficient (bottom panel) at every hour before and after the bias correction. Spatio-temporal matching is done by averaging data from all ground-based monitoring sites falling within a single MERRA-2 grid for a 1-hr duration. A flow chart regarding data processing is given in supplementary information S2.

Key highlights:

- Diurnal pattern of ambient PM2.5 is examined over India using MERRA-2 reanalysis data.
- MERRA-2 data is calibrated using reference in-situ data (CPCB).
- Diurnal amplitude exceeds 30 μg m−3 over large part of the country.
- Annual increasing trend is strongly governed by the trend in Oct–Feb.
- A declining planetary boundary layer height contributes to the rise in PM2.5 in these months.

Summary:

PM2.5 exposure in some areas of India and identify the times of maximum and minimum exposure and its seasonal shift. This explains the underestimation in satellite-based PM2.5 exposure estimates (related to ground-based measurements that cover 24-h duration) that uses AOD data from sensors onboard polar-orbiting satellites crossing India in the late morning to early afternoon hours. In the regions where the diurnal amplitude is small, satellite-based estimates of exposures are more representative. We also show that the increasing trend at the annual scale is strongly controlled by an increase in PM2.5 during the Oct–Feb period. This suggests that if the .

emissions during these months can be controlled at the source, the increasing annual trend can be arrested. Although we map hour-by-hour changes in PM2.5 concentration in this work, we cannot identify the primary sources with this data alone. Further analysis is required to attribute source characterization to the observed hourly variation in PM2.5 exposure. However, this study provides the opportunity to identify the major sources that can be attributed to the maximum PM2.5 (corresponding to the observed peak timing) exposure at a regional scale.

The integration of the spatially and temporally continuous MERRA-2 reanalysis data with ground-based measurements (temporally continuous) and satellite-based measurements (temporally discontinuous but can provide information at high spatial resolution) is perhaps the way forward in the future. We hope these results would help formulate better air pollution mitigation plans so that the national burden of disease attributed to ambient air pollution could be decreased by evidence-based policy actions at the regional and national levels.

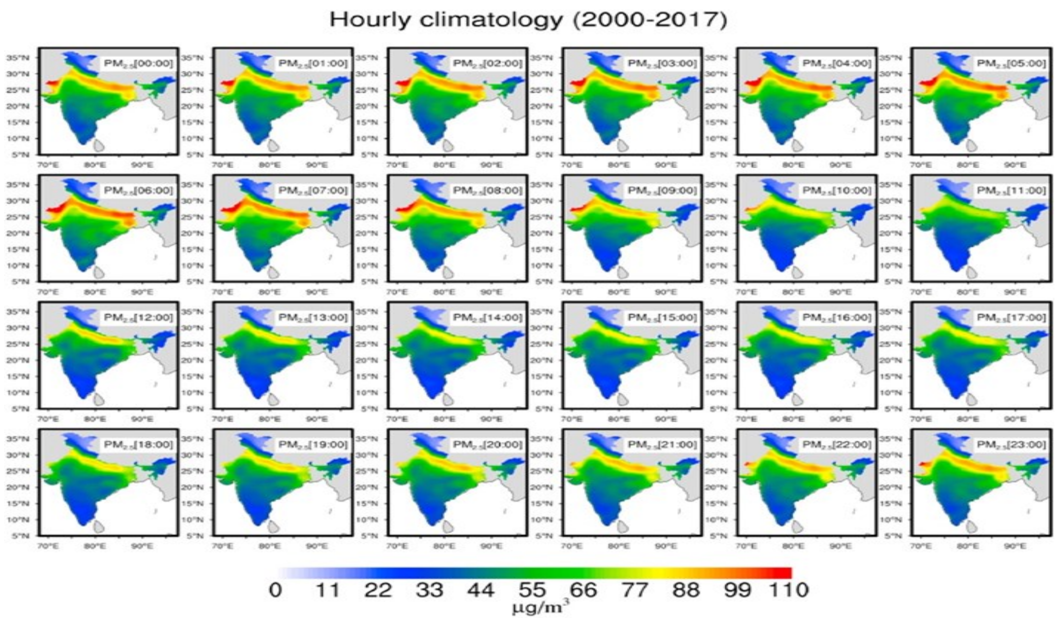

Figure 1: Mean annual ambient PM2.5 exposure in India for each hour cycle (00:00 IST represents 00:00–01:00 IST duration).

Major findings :

- The integration of the spatially and temporally continuous MERRA-2 reanalysis data with ground-based measurements (temporally continuous) and satellite-based measurements (temporally discontinuous but can provide information at high spatial resolution) is perhaps the way forward in the future to estimate he surface PM2.5 concentration.

- Our results reveal a large diurnal amplitude in PM2.5 exposure in some areas of India and identify the times of maximum and minimum exposure and its seasonal shift. This explains the underestimation in satellite-based PM2.5 exposure estimates (related to ground-based measurements that cover 24-h duration) that uses AOD data from sensors onboard polar-orbiting satellites crossing India in the late morning to early afternoon hours.

Research Article

Citation

Kunal Bali, Sagnik Dey, Dilip Ganguly, Diurnal patterns in ambient PM2.5 exposure over India using MERRA-2 reanalysis data, Atmospheric Environment,

Link:https://doi.org/10.1016/j.atmosenv.2020.118180

Contact

Prof. Chandra Venkataraman

National Co-ordinator

(NCAP-COALESCE Project)
Interdisciplinary Programme in Climate Studies

Indian Institute of Technology, Bombay Powai, Mumbai-400076, India

Phone: 91-22-2576-5141

https://ncapcoalesce.iitb.ac.in/

Consortium partners in the NCAP-COALESCE network