



## Centre of Excellence for Research on Clean Air

*Q3 Report 2020, (July - September)*

### CERCA Research Projects Updates

**Project:** Monitoring Air Pollution impacting Delhi NCR using a Hybrid Approach

**PI:** Prof. Sagnik Dey, Centre for Atmospheric Sciences, Coordinator CERCA IITD

**Objectives:** 1. Estimation of contribution of various neighboring states and trans-boundary transport to Delhi air pollution  
2. Identifying the changes in open burning patterns, pollutions at large point sources (e.g., TPPs)/source clusters (e.g., brick kilns)  
3. Feedback for policymakers to judge the effectiveness of the mitigation measures implemented to curb pollution due to these three major sources.

**Update:** In this project, the first and second objectives has been completed, i.e., Identifying the changes in open burning patterns, pollution at large point sources (Thermal Power plants (TPPs), and Brick Kilns). In the last quarter, the project team has studied the change in the number of fire counts in Punjab and Haryana districts during the year 2019 – 2020. They have also learned the overall improvements in air quality from 2017 to 2019 and estimated about 31.2% reduction in air pollution level by 2024.

**Project:** Assessment and prediction of the air-quality using dynamically downscaled high-resolution data from numerical models

**PI:** Prof. Vimlesh Pant, Centre for Atmospheric Sciences IITD

**Objectives:** 1. Air-quality maps at a spatial resolution of about 1 km using numerical models and observational data. 2. Prediction of air-quality a week in advance over a desired state or region, e.g., Delhi-NCR using machine learning.

**Update:** The Team has collected data on electricity generation, fuel type, and total fuel consumption for different power plants nearby Delhi-NCR. This data collected from various reports from NTPC, Ministry of Power, Central Power Research Institute, Coal India Limited, Central Electricity Regulatory Commission, datasheets of power plants, etc. Data collected for the Dadri power plant (which runs on both Coal and Gas fuel types) shows a total electricity generation capacity of 1820 MW from coal and 817 MW from gas fuel. The year 2017 datasheet shows the total (actual) generation of 3306 MU with 2103722 MT of coal consumption. Similar data were obtained for other years for this power plant. The quality of coal used at the Dadri plant shows a 'Weighted Average Gross Calorific value values of 4820 kCal/kg. Considering the coal price of Rs 4824 per MT, the cost of per unit electricity generation and coal consumption per unit electricity generation are calculated. The results are being verified with other data sources and calculation methods, taking into consideration additional parameters.

**Project:** Public Awareness generation on Indoor Air Quality for Priority Buildings in Delhi, NCR

**PI:** CERCA in partnership with SIE

**Objective:** Main aim of this project is to generate mass awareness on indoor air quality in public places (schools, colleges, hospitals, shopping malls, metro, and residential complexes) of Delhi NCR for in urban India.

**Update:** A base line survey of indoor air quality was carried out for various buildings in Delhi NCR such as schools, colleges, hospitals, restaurants, cinema halls, offices to find out the level of indoor air pollution in these premises in partnership with Society of Indoor air (SIE). SIE has submitted a detailed report on the findings. Further, we have planned to develop indoor air quality guidelines in partnership with SIE, and also an event is being scheduled to release the results of the survey around December 2020

**Project:** Modelling of Reverse logistics network for consumed EVBs

**PI:** Prof. Nomesh Bolia, Dept. of Mechanical Engg., Co-coordinator CERCA IITD

**Objective:** To make a reverse supply chain model for used Electric Vehicle Batteries to help the electric vehicle industry to set firm foot in India. In the second part of this project, an attempt would be made to design and launch a mobile application that would aid the consumer and the company to undertake the exchange.

**Update:** The work is in progress

**Project:** Pilot deployment of Particular Matter (PM) sensors in Delhi buses

**PI:** Prof. RijuRekha Sen, Dept. of Computer Engg.

**Objective:** To use vehicle fleets that travel across the city and instrument them with sensors. This will scale up the spatial coverage of the sensors. In addition to measuring Particulate Matter (PM), the vehicle-mounted instruments should have other sensors, computation, and communication facilities, so that policy questions become more tractable. The proposed instrument should have - PM sensor (low cost, but accurately calibrated against more expensive E-BAM sensors).

**Update:** The Team has designed and built the necessary instrument, as off-the-shelf instruments from Atmos and Airveda had some shortcomings. They have conducted test runs in their car by taking power from the vehicle. The instrument is being made much more robust against high temperature, vibration etc. The data analysis software stack is in final stages, so that time series analysis, correlation of PM with traffic and other data, Spatio-temporal interpolation based on bus data for all areas of Delhi can be done. The work of Installation of sensors will be resumed after the COVID curve flattens.

**Project:** Study of E-rickshaw Operations & Development of Charging and Parking Infrastructure for E-rickshaws

**PI:** Prof. Nezamuddin, Dept. of Civil Engg. IITD

**Objective:** i) Analysing the supply characteristics of the e-rickshaw network, ii) Analysing the operational characteristics of e-rickshaw service, and iii) Identifying the optimal locations for setting up physical infrastructure for e-rickshaws and designing the optimal capacity of the charging stations.

**Update:** The project's primary goal was to conduct a field survey of e-rickshaws and analyze the data. Unfortunately, due to the COVID situation, the team cannot perform a field survey of e-rickshaw routes and operations. Therefore, the objectives will be achieved by collecting data with smartphone applications, repetitive observations, and a questionnaire survey's limited application. In the case of objective (iii), optimal locations will be determined using a facility location-based model, and optimal charging station capacities will be determined by queueing theory-based simulation.

This quarter, the following progress has been made: i) Studying queueing theory and facility location problem-related theory and literature will help find optimal locations and designing e-rickshaw charging stations. ii) Learning simulation software to optimise queueing systems. iii) Simulating an M/M/1 queue using python programming language. This code will be modified to deal with real-life scenario.

**Project:** NASA Citizen Science Project Phase II

**PI:** Dr. Prakash Doraiswamy (RTI) and Dr. Pawan Gupta, NASA; India Partners: Prof Sagnik Dey (CERCA Coordinator) and Dr. Kartik Ganesan (CEEW)

**Objective:** This project aims to explore the use of low-cost sensors to measure air pollution through citizens engagement. Adequate ground-based measurements of air quality do not exist in most of the country. Satellite data are used to fill this gap, but satellites cannot provide data at nighttime. To provide the required temporal coverage at a minimum cost, low-cost sensors became very popular in the last few years. However, their durability and accuracy remain a question till date. In the first phase, the purple air sensors are tested in California and North Carolina, USA. In the second phase, the sensors are being deployed in India. The broad objectives of the project are:

1. To test the Purple Air sensors in the Indian condition
2. To explore the feasibility of these sensors in expanding the ground-based measurements
3. To engage citizens in hosting these sensors and enhance awareness
4. To evaluate satellite-based PM<sub>2.5</sub> estimates in data-scarce regions (e.g. small cities, rural areas, background area)

Before deployment, the sensors are calibrated against the CERCA BAM once in the winter season. Another round of calibration will be carried out in the summer season before deployment. The sensors will be deployed in several clusters covering urban-rural transect in the Indo-Gangetic Basin. Altogether, six clusters, one each in Punjab-Haryana, Delhi NCR, central UP, eastern UP, Bihar-Jharkhand and West Bengal, are chosen. In the first phase, the sensors will be deployed in Delhi NCR. All data will be made available to the general public through the purple air website from the day of deployment.

**Update:** Sensor Deployment work is in progress

**Project:** Developing Air Quality Management model for the Indo Gangetic Plains co-sponsored by World Bank

**PI:** Prof. Sagnik Dey, Centre for Atmospheric Sciences, CERCA IITD, World Bank, IIASA

**Objective:** To establish an Air Quality Management modelling network among states of Indo Gangetic Plain to support cost-effective AQM in the overall IGP region. The main elements of AQM modelling for the IGP would include methods and protocols monitoring, AQ monitoring, Emission inventory, Source apportionment, Health impacts, cost-effectiveness and AQM planning. AQMod to be hosted at CERCA IIT Delhi and would be responsible for coordinating the AQMod between the states/UT through a license agreement. A strategic Advisory Board with members from MOEFFCC, CPCB, NKN Coordinator, NITI Aayog, other ministries, experts, etc. would oversee the operations of the Modelling network. It is proposed to establish the AQMod in mid/late 2020 and in 2021, run a first annual model to provide inputs to state AQM plans and regional IGP AQM plans

**Update:** The project has started officially on 30 September, and Training sessions on the GAINS model has been commenced from 8 October by IIASA Team.

**Project:** Delhi City Science and Technology Cluster (Theme: Air Pollution)

**PI:** The proposal under the Delhi city cluster initiative was presented under the leadership of Prof. Sagnik Dey, CERCA coordinator, along with other institutions to the Principle Scientific Advisor office GOI.

**Objective:** The whole idea is to orient the existing efforts towards 'Aatmanirvar Bharat' concept - stronger academia-industry partnership, scaling up products from prototype to marketable, involvement of start-ups, infrastructure development, etc. so that as a community, we take leap towards self-reliance. The whole purpose of this next phase is to solve the problem and scope of new scientific research is bare minimum. The seed fund proposal focuses on the implementation of a clean air action plan.

**Update:** The project is at the final stages of approval and will have several components such as - point sources; awareness at educational Institutions; crop burning solution (crop diversification); real-time source apportionment.

## Recent Activities

### International Day of Clean Air for Blue Skies

We have organized a Webinar on "Clean Air Goals for India" on 7 September 2020 on the occasion of "International Day of Clean Air for Blue Skies". This Webinar's objective was to deliberate on the air pollution goals and policy perspectives for India through Technical sessions on Air Quality Measurement, Science and Mitigation Plans. This Webinar brings together various Domain Experts from the Government, Think Tanks, Academia, and Private sector and covered a range of topics such as Real-time PM Speciation and Gas Measurements, Source contribution to PM<sub>2.5</sub> pollution and solutions, Open Data Resources for Energy, Emissions, & Air Pollution Analysis in India, Looking beyond PM in India, Air-pollution climate interaction and co-benefit opportunities, Pursuing a clean air agenda during the COVID crisis, Citizen science, Roadblocks to clean air action plan implementation, Integrating health outcomes to policy.

### Climate Change and action

We are glad to announce that CERCA has expanded its scope of activities to undertake research projects on Climate change and more specifically:

1. To undertake research projects on impacts of climate change including identification of mitigation options that reduce the risk of longer-term climate change including promotion of international research and collaboration.
2. Build capacity for climate assessment through training, education and workforce development

As a first step towards this, CERCA has invited innovative research proposals on Carbon Footprint of Thermal Power Plants. Best proposal will be awarded a cash honorarium of INR 25000. The last date of the proposal submission is 31st October 2020.

Our broad objective is to promote scientific research for developing strategies to understand the root causes and implications of anthropogenic climate change and to build resilience to severe climate change impacts on the society through appropriate policy changes

### **CERCA Monthly Newsletter**

As part of CERCA public outreach policy, we have been reaching out to a wide section of our society through a weekly newsletter since 2018 providing the latest inputs on research on health effects of air pollution, actionable information on air quality data to the Government, Industry and to the Citizens at large for appropriate policy formulation, emerging clean air technologies including new measures/innovative initiatives from across the world to combat air pollution including thought leadership. We endeavor to involve more and more people across our communities in this significant initiative, thereby enhancing public understanding and participation in promoting Clean Air initiatives at the grass-root level. In line with this, we have now decided to change the frequency of this newsletter from weekly to monthly. This would allow us to include more impactful and qualitative information on clean air and climate change area. You can access all our newsletters on our website <https://cerca.iitd.ac.in/>.

### **CERCA opinion paper series**

We have started a CERCA opinion paper series as a part of our CERCA monthly newsletter in which we include opinion/discussion papers relevant to clean air and climate change research from our faculties/research scholars, local, regional and national level air quality analysis and findings, latest national and international research on emerging clean air technologies including thought leadership and policy discussion. Please find below links for our last quarter opinion papers:

[https://drive.google.com/file/d/1H671rKQzSc5Ui\\_2oyPDQqGV4w19kxHZA/view](https://drive.google.com/file/d/1H671rKQzSc5Ui_2oyPDQqGV4w19kxHZA/view)

<https://drive.google.com/file/d/1kbWu5xQ5Tdt4aA5zv8LEVUXvmdnNxfiE/view>

<https://drive.google.com/file/d/1xNClfZLcp0GKrRSGWQ0Tg0xOkYLozBA/view>

### **Research Publications**

1. Nirav L. Lekinwala, Ankur Bhardwaj, Ramya Sunder Raman, Mani Bhushan, Kunal Bali, Sagnik Dey, A framework for setting up a country-wide network of regional surface PM<sub>2.5</sub> sampling sites utilising a satellite-derived proxy – The COALESCE project India, Atmospheric Environment., Volume 234, 1 August 2020, 117544

**Summary:** A framework for setting up a country-wide network of regional surface PM<sub>2.5</sub> sampling sites utilising a satellite-derived proxy – "The COALESCE project, India Air quality management and assessment of aerosol climate effects over a large area require the strategic placement of regionally representative monitoring sites (RRMS) to capture the required information. Ground-based, fine particulate matter (PM<sub>2.5</sub>) concentrations measured for a long duration at high spatial resolution i.e. at several potential locations in a region help identify an optimal regionally representative site for the network. However, in the absence of long-term PM<sub>2.5</sub> concentrations with high spatial resolution, identification of RRMS is a

challenge. To identify RRMS for such situations, a novel methodology utilizing satellite-derived PM<sub>2.5</sub> is presented in this study.

Link: <https://www.sciencedirect.com/science/article/pii/S135223102030279X>

2. Shubham Sharma, Mengyuan Zhang, Anshika, Jingsi Gao, Hongliang Zhang, Sri Harsha Kota, Effect of restricted emissions during COVID-19 on air quality in India, Science of The Total Environment, Volume 728, 1 August 2020, 138878

**Summary:** The effectiveness and cost are always top factors for policymakers to decide control measures and most measures had no pre-test before implementation. Due to the COVID-19 pandemic, human activities are largely restricted in many regions in India since mid-March of 2020, and it is a progressing experiment to testify effectiveness of restricted emissions. In this study, concentrations of six criteria pollutants, PM<sub>10</sub>, PM<sub>2.5</sub>, CO, NO<sub>2</sub>, ozone and SO<sub>2</sub> during March 16th to April 14th from 2017 to 2020 in 22 cities covering different regions of India were analysed. Overall, around 43, 31, 10, and 18% decreases in PM<sub>2.5</sub>, PM<sub>10</sub>, CO, and NO<sub>2</sub> in India were observed during lockdown period compared to previous years. While, there were 17% increase in O<sub>3</sub> and negligible changes in SO<sub>2</sub>. The air quality index (AQI) reduced by 44, 33, 29, 15 and 32% in north, south, east, central and western India, respectively. This study gives confidence to the regulatory bodies that even during unfavourable meteorology, a significant improvement in air quality could be expected if strict execution of air quality control plans is implemented.

Link: <https://www.sciencedirect.com/science/article/pii/S0048969720323950>

### Social Media presence

We are active on social media via LinkedIn and Twitter. You can follow us for the latest updates on air quality, news highlights, and centre activities. You can also share your feedback and other relevant information on:

<https://www.linkedin.com/company/centre-of-excellence-for-research-on-clean-air/>

[https://twitter.com/CERCA\\_IITD](https://twitter.com/CERCA_IITD)

### Beta Attenuation Monitoring (BAM) at IIT Delhi

An air quality measuring equipment for continuous monitoring of ambient air quality has been installed at IIT Campus. This will enable further research on air quality as well as for calibrating other air quality monitoring equipment. CERCA is constantly collecting data from BAM and it is also displaying Live PM<sub>2.5</sub> data on IIT Delhi Digital Notice Board and on the website. For live data, visit: <https://home.iitd.ac.in/> or <https://cerca.iitd.ac.in/>



### CERCA Funding

We are very fortunate to receive funding from individuals and corporations committed to improving air quality and undertaking joint funding of projects with government organizations in clean air areas.

Media Stories

Home / Delhi News / 'Good' air days over as AQI starts to spike?

### 'Good' air days over as AQI starts to spike?

This year, clean air days could be all but over with forecasts showing heavy showers, which help wash away pollutants, are unlikely in the coming days and with the lifting of the 68-day lockdown to curb the spread of Covid-19, the scientists added.

Updated: Sep 16, 2020, 08:27 IST

Jyashree Nandi  
Hindustan Times, New Delhi



Experts also said the opening of several sectors and an increase of vehicles on the roads, too, have contributed to the shift in air quality. (PTI file photo)

After a spell of clean air and several days on which a clear blue sky was visible, seasonal changes and resumption of businesses and commercial activities are leading to meteorological conditions that aren't favourable to the dispersion of pollutants hanging over Delhi, scientists said.

Ads by Google  
Stop seeing this ad Why this ad?

This year, clean air days could be all but over with forecasts showing heavy showers, which help wash away pollutants, are unlikely in the coming days and with the lifting of the 68-day lockdown to curb the spread of Covid-19, the scientists added.

The national capital has recorded "moderate" air quality days (when the air quality index, or AQI, reads 101-200) for a week since September 9, with Tuesday's AQI standing at 144. In comparison, August recorded four "good" days (when AQI was 0-50) and 27 "satisfactory" days (when AQI was 51-100), as the air quality never slipped to the "moderate" level.

<https://www.hindustantimes.com/delhi-news/good-air-days-over-as-aqi-starts-to-spike/story-oUkPqabg9TZDqZuhFzVVcO.html>

<https://www.newindianexpress.com/cities/chennai/2020/sep/29/unlock-40-sees-chennai-topping-pollution-chart-among-southern-cities-2203529.html>

### IIT-Delhi, Bihar State Pollution Control Board sign MoU

Arunima Lal | TNN | Updated: Aug 9, 2020, 12:02 IST

✉ 🖨️ A- A+



An air quality monitoring station at Eco Park in Patna

PATNA: The Bihar State Pollution Control Board (BSPCB) has signed a memorandum of understanding with the IIT-Delhi to set up a geographical information system-based platform for air quality management.

Track the pollution level in your city

<https://timesofindia.indiatimes.com/city/patna/iit-delhi-bihar-state-pollution-control-board-sign-mou/articleshow/77437954.cms>

Traffic in Chennai is busy again after the government relaxed the lockdown (Express Archive Photo)

By SV Krishna Chaitanya  
Express News Service

CHENNAI: With the state government slowly easing COVID-19 lockdown norms to restore some normalcy, Chennai's pollution woes have returned. On Tuesday, the city's Air Quality Index (AQI) was 116, which was the worst among all major southern cities.

In comparison, Bengaluru recorded an AQI of 77, Hyderabad 73, Kozhikode 21 and Thiruvananthapuram 38. An AQI between 0 and 50 is considered 'good', 51 and 100 'satisfactory' and 101 and 200 'moderate'.

Chennai's air quality showed a positive shift in AQI during the lockdown compared to 2019. As per the Central Pollution Control Board (CPCB) analysis released recently, the city has reported improved AQI with 26 'good' days as against four such days in 2019.

The number of 'satisfactory' days reduced to 14 as against 31 in 2019 with more days shifting to the good category during lockdown and zero moderate days were reported as against five moderate days last year. In fact, Chennai had done fairly well during the lockdown compared to other cities in the country.

However, now with lockdown restrictions relaxed to a large extent, pollution is peaking once again. Alandur in Chennai has recorded poor air quality with the AQI breaching the 200 mark. At 3 pm, the AQI was 218 and PM2.5 concentration spiked as high as 500 µg/m3 (micrograms per cubic metre), which is extremely hazardous.

When contacted, Tamil Nadu Pollution Control Board (TNPCB) Chairman AV Venkatasubramanian told The New Indian Express that the state government was investing heavily on air quality monitoring.

Home / Cities / Delhi's air quality may enter 'poor' zone on Sunday

## Delhi's air quality may enter 'poor' zone on Sunday

Updated: Oct 03, 2020, 19:50 IST

Vatsala Shringi

<https://www.hindustantimes.com/cities/delhi-s-air-quality-may-enter-poor-zone-on-sunday/story-g1pGtq6vB9xw4cBzQs2HVJ.html>



**f** New Delhi: With a dip in mercury and farm fires picking up in the neighbouring Haryana and Punjab, Delhi's air quality may turn 'poor' by Sunday (October 4), government agencies have warned.



The last time this year Delhi's air quality was in the poor zone was in March.

As per Central Pollution Control Board's (CPCB) 4pm bulletin, Saturday's average AQI was 189 -- in the moderate zone, close to the poor mark (at 201).

So far this year, air quality has remained between good to moderate zones only. Overall, this year has so far seen cleaner air than 2019 with Covid-19 induced lockdown and a good monsoon keeping air quality under check.

On a scale 0-500, a value of 0-50 is considered 'good' (minimal health risk), 51-100 is 'satisfactory' (minor discomfort to sensitive people), 100-200 is 'moderate' (breathing