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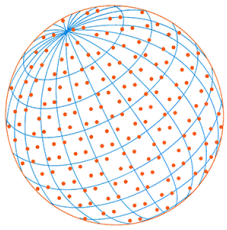

Aerosol and Air Quality Research

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Impacts of COVID-19 on Air Quality in India

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ABSTRACT

The COVID-19 pandemic spread all over the world in early 2020. India imposed a nationwide lockdown on March 25, 2020, for more than a month to contain the COVID-19 infection. During the nationwide lockdown, transport, industries, and commercial activities were suspended, except for essential services. We made a detailed analysis of the impacts of COVID-19 on air quality in India by using the data from more than 200 Continuous Ambient Air Quality Monitoring Stations (CAAQMS) and reported a change in the National Air Quality Index (NAQI), spatial distribution and concentration levels of PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and O_3 from January to April 2020 nationwide and in five major cities, namely, Delhi, Mumbai, Kolkata, Chennai, and Hyderabad. We defined the period between February 25 to March 24, 2020, as 'before lockdown' and March 25 to April 30, 2020, as 'during lockdown'. The NAQI and satellite visual maps of AOD, NO_2, CO, and SO_2 from January to April 2020 showed a significant decrease in air pollution levels in India. The average concentration levels of PM_{10}, $PM_{2.5}$, CO, NO_2, and SO_2 have decreased nationwide by 33, 34, 21, 47, and 21%, respectively, during the nationwide lockdown compared to their concentration levels before the lockdown. While comparing their concentration levels of the nationwide lockdown period with those observed in April 2019 at the same CAAQMS, it was found that the nationwide average concentration levels of PM_{10}, $PM_{2.5}$, CO, NO_2, and SO_2 were decreased by 53, 45, 27, 54, and 35%, respectively. The trends of decreasing air pollutants during the lockdown in five major cities were almost the same as nationwide. The concentration levels of O_3 have shown an increasing trend from January–April 2020 including during the nationwide lockdown. The COVID-19 has provided a rare opportunity for India for the collection of air pollution baseline data which could be useful in the formulation of air pollution reduction policies in the future.

Keywords: Air quality, Lockdown, COVID-19, Air quality index, Particulate matters

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1 INTRODUCTION

India is facing serious air pollution problems. The air quality in most Indian cities has been deteriorating over the past many years (WHO, 2016; Bernard and Kazmin, 2018; Chowdhury *et al*, 2019; HEI, 2019; Mishra, 2019). The emissions of air pollutants from anthropogenic sources, such as transport, industry, power generation, construction, residential, and commercial activities have been increasing significantly during the past many years (Guttikunda *et al*., 2014; Kurokawa and Ohara, 2020). Open burning of municipal waste and agricultural residuals are adding extra emission burden of air pollutants in the region which significantly deteriorates air pollution problems, especially during winter when stagnant meteorology promotes accumulation of air pollutants in the atmosphere (Badarinath *et al*., 2009; Rastogi *et al*., 2016; Kumari *et al*., 2017; Liu *et al*., 2018; Bray *et al*., 2019; Sawlani *et al*., 2019). Increasing air pollution in India is significantly impacting air quality, increasing disease burdens, and incurring economic loss (Bhome, 2012; Rizwan *et al*., 2013; Bunett *et al*., 2018; Gordon *et al*., 2019; Reddy and Roberts, 2019).

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) or commonly known as coronavirus disease 2019 (COVID-19) pandemic, emerged from the city of Wuhan, China, in December 2019, spread around the world in early 2020. Many countries imposed the lockdown