

Uncertainty of Operating Smaller Number of Ambient Monitoring Stations: Indian Cities from 2015 to 2023

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Abstract

The Air Quality Index (AQI) is an important tool for communicating the quality of air in the cities as health-related alerts. India adopted a methodology in 2014 using six categories ranging good air days to severe days and started to release daily bulletins from 2015. We analyzed the data released between 2015 and 2023. During this period, the number of unique cities in the bulletins increased 12-fold from 22 to 271, the average number of stations increased 15-fold from 31 to 469, and the average number of stations per unique city increased 20% from 1.4 to 1.7. In India, winter months (December to February) continue to be worse than the summer and monsoonal months (June to September) for most of the Northern cities. Between 2015 and 2023, the average number of days reporting $PM_{2.5}$ as the conditional pollutant halved, against an equivalent increase in reporting PM_{10} . Ozone and carbon monoxide had constant presence over summer months. While the number of cities and their overall monitoring capacity increased, 80% of the cities in 2023 only reported data from one monitoring station, which reduces the mathematical confidence and increases unreliability in representing urban activities. In 2023, only 15 cities operated more than 5 stations - a representative sample size for any city, allowing to cover one location each at residential, commercial, industrial, roadside, and background sites. The margin of error in reporting AQI from 2, 5, and 37 monitoring stations is 12.7, 3.2, and 2.0 times the standard error of the mean, respectively. In this presentation, we explore the ways to reduce this uncertainty and improve the representativeness of the ambient monitoring efforts in India.

Early Career Scientist

NO, I am not an early career scientist.