

Impact of COVID-19 Control Measures on AOD and NO₂ and Variability in the Asian Monsoon Region

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Abstract

COVID-19 pandemic control measures drastically altered daily life, transportation, and economies worldwide, especially in the Asian monsoon region. This study examines how these changes impacted spatio-temporal variations of aerosol optical depth (AOD) and nitrogen dioxide (NO₂) levels using satellite and ground-based data across 14 Asian countries in the region. Satellite data were obtained from NASA's Terra and Aqua satellites (MODIS sensor for AOD) and the SENTINEL satellite (TROPOMI sensor for NO₂), with 1 km x 1 km resolution. Ground-based measurements were collected from various monitoring stations from January 1st, 2019, to December 31st, 2022. The analysis focused on four distinct periods of COVID-19 control measures: pre control measures, during control measures (Phase I and II), and post control measures. Results via satellite-based observation show a general decrease in AOD and NO₂ levels during control measures, indicating reduced emissions from transportation and industry. However, this reduction varied regionally where some areas in Thailand and Vietnam experienced increased pollution during the control measures. Despite slight reductions during control measures periods, ground-based observations indicate that PM_{2.5} concentrations in Islamabad, Pakistan, and Dhaka, Bangladesh, remain relatively high compared to other cities. Dhaka, Bangladesh, had the lowest NO₂ concentration during control measures for Phase I (5,50 ppb) and Phase II (13.7 ppb). Kuala Lumpur, Malaysia, showed the highest percentage changes between pre and during control measures (Phase I) for both PM_{2.5} (-35.0%) and NO₂ (-35.0%) levels among the cities studied. Correlation tests between satellite and ground-based data revealed strong consistency, validating the effectiveness of remote sensing for air quality monitoring. This study demonstrates the impact of COVID-19 control measures on air quality in the Asian monsoon region. This study findings emphasize the value of integrated monitoring for effective pollution management and highlight the need for sustained efforts to improve air quality.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

ACAM: Atmospheric Chemistry and the Asian Monsoon

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MANGO: Monsoon Asia and Oceania Networking Group