

Title of the Study: “Study on impact of COVID 19 Lockdown Phases on the spatial variability of Aerosols over India”.

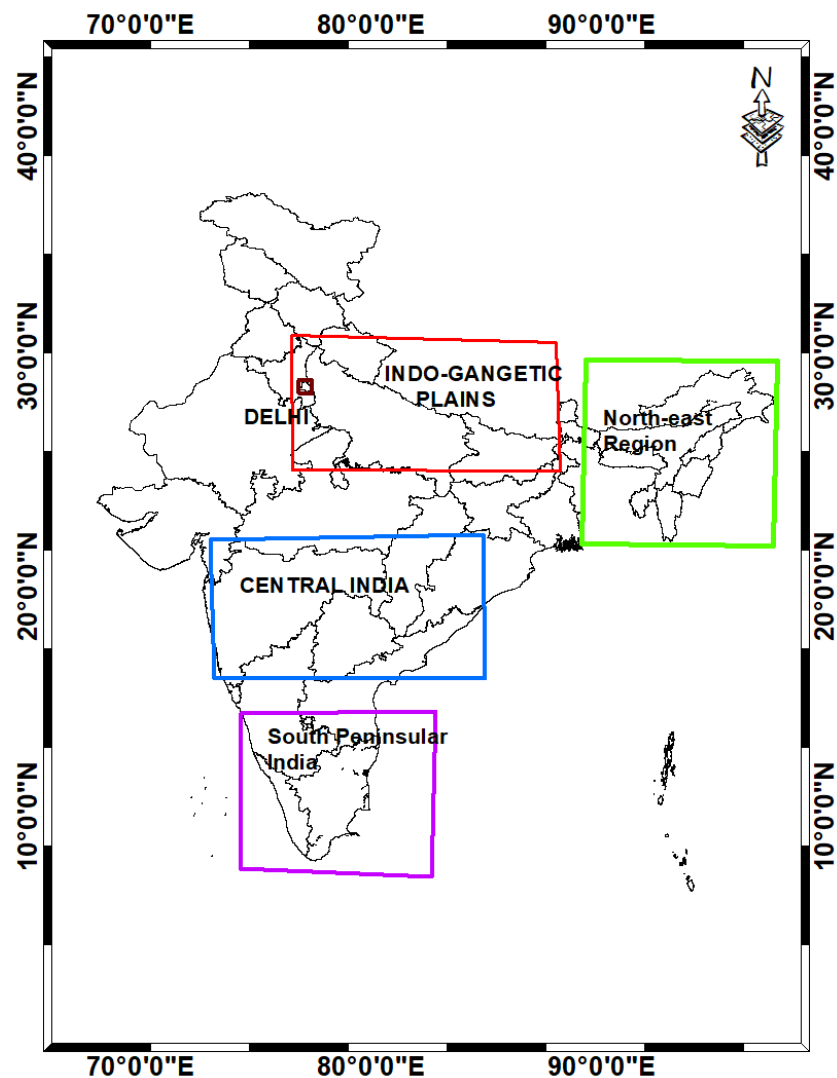
Summary of the Assignment

Aerosol Optical Depth (AOD) is the measure of aerosols (e.g., urban haze, smoke particles, desert dust, sea salt) distributed within a column of air from the instrument (Earth's surface) to the top of the atmosphere. Aerosol optical depth (AOD) can be used as an alternative index for the estimation of particulate matter (PM) present in the atmosphere. Exposure to PM has significant harmful effects on human health. The presence of aerosols in the atmosphere can influence the climate system by absorbing and reflecting solar radiation. The onset of covid 19 pandemic and consequent lockdowns in India, made a huge impact on air quality, one such impact is aerosols distribution over India. In this study, the spatial distribution of MODIS derived AOD over the India is analysed for 6 different period which comprises of Pre-lockdown (PL), 4 lockdown (LD1.0 to LD4.0) and 1 unlock (UL) phases spanning from January to June of 2020. In addition, for the comparison purpose and to understand the AOD distribution pattern over India during preceding years ie. 2018 and 2019, the AOD anomaly map is created for 6 different periods. From the analysis, it is clear that there was increased build-up of AOD over northern and eastern part of India during PL 2020. The average AOD is observed in this region is found to be greater than 0.8. The anomaly map also shows the considerable increase of AOD, depicted by positive anomalies in the North and eastern parts, when no restriction was imposed. As the Lockdown Progressed during its first trimester, the AOD buildup significantly reduced during 2020 LD1. The anomaly map also shows significant decrease in the northern and eastern regions of India, while Maharashtra, Telangana, Orissa shows bit increase in AOD values compared to the previous years.. The lockdown period from LD1.0 to LD4.0 significantly reduced the AOD concentration, which is observed from the analysis. It is also noted that reduction in aerosols over the north and Indo-Gangetic plains is caused by the closure of industrial activities during the different lockdown phases. With, the onset of unlock process, the aerosols over the northern and Indo-Gangetic plains increased gradually. However, the south Peninsular India, the lockdown impacts on the aerosol's distribution is not conveyed clearly as compared to the Northern and Indo-Gangetic Plains. In order to understand, the regional variability of AOD, the anomaly values of 2018 and 2019 are spatially averaged over the different region, namely Delhi, Indo-Gangetic Plains, North-east

states, Central India and south Peninsular India. From the analysis, there is significant reduction in AOD values in the year 2020 compared to 2018 and 2019, which is denoted by positive values.

Study Area.

The world air quality Report (2019) have identified that out of 30 polluted cities worldwide ,21 is present in the India. The study region in the study includes entire India as whole. Further, 5 different regions are also defined (Figure 1). central India, south Peninsular India, Indo-Gangetic Plain, Delhi and adjacent regions and north-east region to understand the regionalized impact of covid 19 lockdown on the concentration of the AOD.



Data Used

Satellite-based observations provide information over the larger spatial domain, in contrast to ground-based observation. Moreover, satellites-based observation provides systematic

retrieval of aerosol optical properties on the global and regional scale .Satellite-based monitoring can be considered to complement a ground monitoring station, especially in regions with a limited number of monitors.

MODIS products are available in different processing levels (level 1.0—geolocated and calibrated, level 2.0—derived geophysical data products, and level 3.0—gridded time-averaged products) and collections. The data used were of level 3, gridded products of collection 5.1. MODIS Atmosphere gridded product (MYD08_M3) for Aqua was taken from the NASA website (<https://ladsweb.modaps.eosdis.nasa.gov/search/>) for 18 years (2003–2020).

Key Points

- During 2020 PL period, there was considerable increase in the AOD over the northern and Indo-Gangetic plains.
- With the onset of lockdown, there was significant decrease in the AOD concentration over the northern and Indo-Gangetic plains.
- The significant reduction in AOD over the northern and Indo-Gangetic plains can be attributed to the closure of industrial activities.
- However, the south Peninsular India, the lockdown impacts on the aerosols distribution is not conveyed clearly as compared to the Northern and Indo-Gangetic Plains.
- The quantitative analysis, during the lockdown phases of 2020, there was reduction of aerosols concentration compared to lockdown period of 2018 and 2019.

