

## ANNEXURE-1

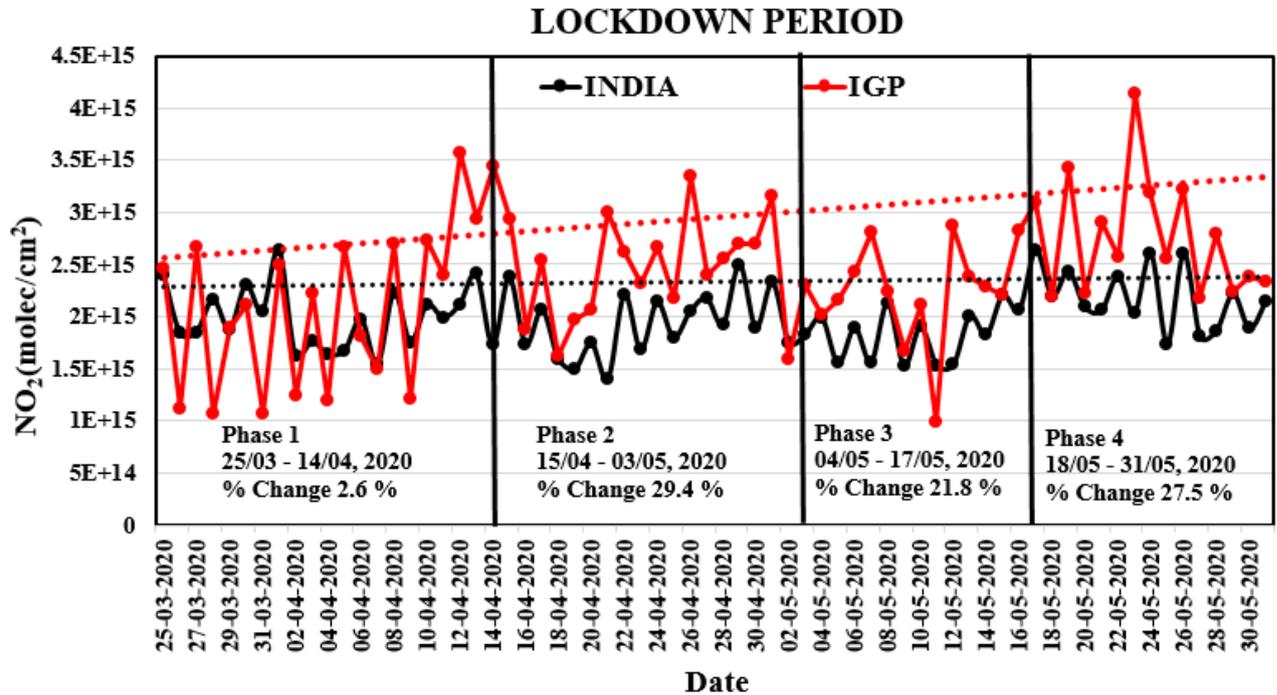


Figure S1. Comparison of NO<sub>2</sub> columnar concentration over India and IGP region. Black line shows India and Red line shows IGP during lockdown period from 25<sup>th</sup> March-31<sup>st</sup> May 2020. Black and red dash line shows trend of 2009-19 for India and IGP during the same period. Most of the points lies below the trendline. Percentage Change is the comparison between India and IGP for the lockdown period for 2020.

The nation wide lockdown is initiated in four phases in India they are Phase 1: 25 March 2020 – 14 April 2020 (21 days), Phase 2: 15 April 2020 – 3 May 2020 (19 days), Phase 3: 4 May 2020 – 7 May 2020 (14 days), Phase 4: 18 May 2020 – 31 May 2020 (14 days). Figure S1 shows the comparison between mean of columnar NO<sub>2</sub> concentration for 2009-19 with respect to 2020 lockdown period over India and IGP. IGP region of India is most densely populated area of the India any pandemic will have adverse effect. The results showed that from March 25- 31<sup>st</sup> May 2009-19, the mean tropospheric NO<sub>2</sub> concentration was 2.26

$\times 10^{15}$  molecule  $\text{cm}^{-2}$  over India, and it subsequently decreased by 15% during the entire lockdown period. Maximum reduction is seen during May in Phase 3. During 2019 for the same period the mean tropospheric  $\text{NO}_2$  concentration was  $2.38 \times 10^{15}$  molecule  $\text{cm}^{-2}$  for the same period. So, the concentration is 20% higher than  $\text{NO}_{2(2020)}$ . Hence it shows that the decreased tropospheric  $\text{NO}_2$  concentrations can be attributed to restricted anthropogenic activities during the lockdown. There is sharp decrease in  $\text{NO}_2$  concentration during the lockdown period. This can be explained by the fact that the emergency measures established by the Indian government like closure of industrial and transportation activities construction activities (reduced dust suspension), and travel restriction (inside and outside country). As a consequence, there is reduction in  $\text{NO}_2$  concentration from both industrial production and vehicle exhaust. Similarly, over IGP the mean (2009-19) tropospheric  $\text{NO}_2$  concentration was  $2.98 \times 10^{15}$  molecule  $\text{cm}^{-2}$ , and it subsequently decreased by 20 % during the entire lockdown period. During 2019 for the same period the mean tropospheric  $\text{NO}_2$  concentration was  $3.11 \times 10^{15}$  molecule  $\text{cm}^{-2}$  for the same period. So, the concentration is 23% higher than  $\text{NO}_{2(2020)}$ . IGP region of India shows maximum percentage change (+ 29.4 %) during Phase 2 with respect to India's mean  $\text{NO}_2$  concentration.

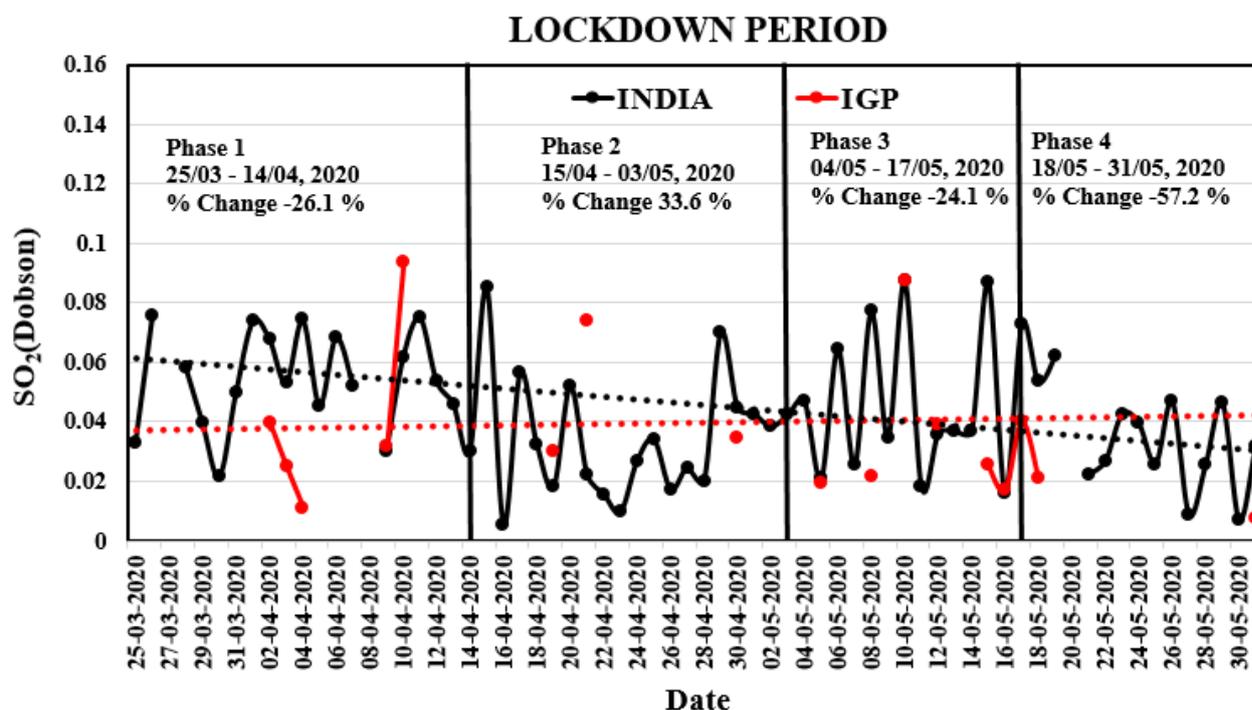


Figure S2 Comparison of SO<sub>2</sub> columnar concentration over India and IGP region. Black line shows India and Red line shows IGP during lockdown period from 25<sup>th</sup> March-31<sup>st</sup> May 2020. Black and red dash line shows trend of 2009-19 for India and IGP during the same period. 50% of the point lies below the trendline for both India and IGP. Negative values were discarded. Percentage Change is the comparison between India and IGP for the lockdown period for 2020.

Similarly, the mean SO<sub>2</sub> concentration over India and IGP is also evaluated during the lockdown period shown in Figure S2. Some of the mean columnar SO<sub>2</sub> concentration were discarded as they were negative. These values can be noise or signal error during retrieval. The results showed that during the same period of complete lockdown, the mean (2009-19) SO<sub>2</sub> concentration was 0.044 Dobson units over India, and it subsequently decreased by 1.75% during 2020. The maximum reduction (-28.3%) in SO<sub>2</sub> is seen during phase 2. Though, positive change (+25.3%) is seen during phase 3. This may be due to steps taken by government and other NGO's due to migrant movement from work place to native place as well some relaxation

by the government after 04<sup>th</sup> May 2020. These relaxations were inter/intra-district buses with 50% capacity, taxis with 1 driver and 2 passengers, shops/e-commerce dealing essential goods, private offices with 33% capacity, two-wheelers without pillion rider, four-wheelers with 1 driver and 2 passengers, inter-state movement of goods. When 2019 mean SO<sub>2</sub> concentration for the same period was compared, the reduction was around 20%. Hence it shows that the decreased SO<sub>2</sub> concentrations can be attributed to restricted anthropogenic activities (combustion of coal, petroleum, and chemical fuel emissions) during the lockdown. Similarly, over IGP the mean (2009-19) SO<sub>2</sub> concentration was 0.04 Dobson units, and it subsequently decreased by 20 % during the entire lockdown period. Only few (negative as well as missing values) values were retrieved over IGP region for 2019, so the immediate comparison with 2020 is discarded for SO<sub>2</sub>. Here, IGP region of India shows maximum percentage change (+33.6 %) during Phase 2 when compared with India's mean SO<sub>2</sub> concentration. The possible reasons for this can be as power plants are major sources of SO<sub>2</sub> emissions, some large plants in the which lies in IGP region have maintained a substantial level of activity, while others appear to have ceased entirely in other parts of India.

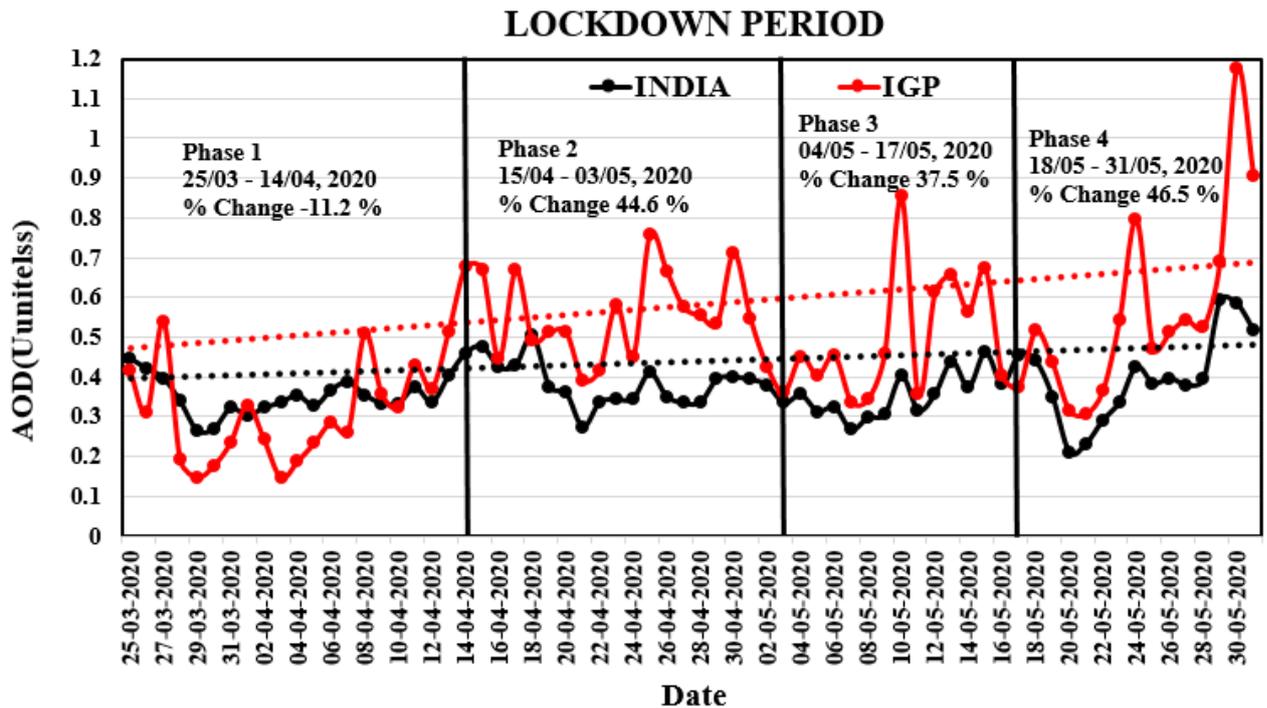


Figure S3 Comparison of AOD over India and IGP region. Black line shows India and Red line shows IGP during lockdown period from 25<sup>th</sup> March-31<sup>st</sup> May 2020. Black and red dash line shows trend of 2009-19 for India and IGP during the same period. Most of the points lies below the trendline for both India and IGP. Percentage Change is the comparison between India and IGP for the lockdown period for 2020.

Figure S3 shows the comparison between AOD obtained from MODIS for both India and Indian hotspot IGP. The mean AOD<sub>2020</sub> for India during the lockdown was 0.37 whereas it was 0.44 for AOD<sub>2009-19</sub>. So, the lockdown shows a reduction of around 16 % in AOD over India. The mean AOD<sub>2020</sub> for IGP during the lockdown was 0.48 whereas it was 0.59 for 2009-19. This shows a reduction of around 19 % in AOD over IGP. Though, IGP being the hotspot of India, the mean AOD concentration was 29.3% higher than India’s mean AOD. The maximum change (+46.5%) occurred during the phase 4 of lockdown.