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Implications of intense forest fire over Uttarakhand during April 2022

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Uttarakhand is blessed with large forest resources which are prone to forest fires. The intense heatwaves supplemented by reduced soil moisture, provided favourable conditions for the forest fires over Uttarakhand during summer 2022 The active fire counts from the Visible Infrared Imaging Radiometer Suite (VIIRS) reported the total number of nominal (high) confidence fire counts of 1491 (29) and 7471 (118) over Uttarakhand during April 16-30, 2021, and April 16-30, 2022 respectively. This indicates that second half of April 2022 witnessed severe biomass burning event over Uttarakhand.

Forest fires act as a source of key pollutant gases and particulate matter which not only change the atmospheric composition but also lead to poor air quality which is detrimental to human health. In this study, we have attempted to understand the impact of these biomass emission episodes that affected the atmospheric composition of the region, especially during the period of 16-30 April 2022. For this purpose, we followed the bottom-up approach adopted by Fire Inventory from NCAR (FINNv1) to develop a biomass emission inventory at 1 km resolution using Moderate Resolution Imaging Spectroradiometer (MODIS) derived Thermal Anomalies/Daily Fire product, Land Cover Type (LCT), and Vegetation Continuous Fields (VCF). This inventory is then provided as an input to Weather Research and Forecasting with Chemistry (WRF-Chem) model to simulate meteorological conditions and atmospheric chemistry. Validation of model output is done with the latest available satellite data to access the model performance. Further, the model simulations were performed with and without the biomass burning emissions to quantify the contribution of Uttarakhand forest fire on CO and NO_2 distribution over this region during April 2022.

The model simulation with biomass burning emission estimates the average total column density (TCD) of 7.78 ($\pm$ 2.67) x 10^{-5} mol/m^2 for NO_2 and 5.86 ($\pm$ 2.30) x 10^{-3} mol/m^2 for CO which is an increase of over 38.9 % and 56.9 % respectively for the same period with no biomass burning emissions included in the model. A net positive increase in O_3 concentration was also observed. The vertical profile analysis shows that polluted air plumes rise to the mid-tropospheric levels (~ 500 hPa). Detailed results will be presented.