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Ozone chemistry during high ozone event at semi-urban region, Shadnagar, in Southern India

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The high level of surface ozone (O_3) concentration is produced from the various complex chemical reaction of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) under varied meteorological conditions. It has severe effects on human health, vegetation, and as well on infrastructure. The guidelines value for surface ozone level was set 50 ppb for an 8-hours daily average by Indian National Ambient Air Quality Standard (INAAQS, 2009) and World Health Organization (WHO, 2005) for India and worldwide respectively. Identifying the primary source of high ozone events based on observation is challenging. The relationship of the surface measured O3 with carbon monoxide (CO) and water vapor content are useful to identify the possible source of origin for the increased O3 in the stratosphere, regional or local influence.

The continuous observation of O_3, NO_x, CO at 1 minute temporal resolution along with the meteorological parameter (1-hour temporal resolution) were taken during August 2014 to April 2017. All parameters were averaged to 8-hourly for further analysis. The high ozone events were identified based on exceeding the surface ozone concentration limit as discussed above (50 ppb). The relationship of the surface measured O_3 and CO ($\Delta O_3/\Delta CO$) and water vapor were used to explain the source of high ozone such as stratospheric origin and anthropogenic activity. The HYSPLIT's backward air mass trajectories of the height of 1000 meters for 120 hours were calculated for the site to understand the dispersion of the pollutants. During the high ozone event, the average concentration of O_3, NO_x, and CO was found to be 55.46 ppb, 5.19 ppb, and 0.180 ppb respectively which were lower than the normal conditions. The positive correlation of O_3 with CO ($\Delta O_3/\Delta CO$) and low water vapor mixing ratio (10.0 g/kg) indicate regional or local influence on observed high ozone events.

The high ozone events were explained based on the distribution of the ozone precursors such as NO_x, CO, and meteorological parameters such as relative humidity solar radiation, wind speed, and wind direction at local. The local high ozone concentration was supported by local chemistry such as the low concentration of CO and NO_x. The relationship between O_3 and CO was used to explain the source of high ozone events.