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Abstract
Using Total Ozone Mapping Spectrometer (TOMS) Aerosol Index (AI), Tropospheric Ozone Residual (TOR), lightning flashes from TRMM satellite and NCEP/NCAR reanalysis clouds (low and high cloud cover) data during the period 1979-1992, the influence of aerosol concentration on the clouds, tropospheric ozone and lightning has been brought out for pre-monsoon and summer monsoon seasons over the Indo-Gangetic Plain (IGP) region in India. Increasing tendency of AI observed during the study period suggest that aerosol loading over the IGP region significantly increased due to anthropogenic activities, because of about 600 million people, nearly 1/6th of word population are mostly lying in the rural areas, depending on the various hydrological and agricultural resources over the region. In addition, meteorological conditions in this region are favorable for accumulation of large amount of aerosols by transportation from north-west desert India/Pakistan and the Arabian Peninsula. Therefore, it is well known that IGP region is one of the most polluted in the world in terms of gasses and aerosol loading. During pre-monsoon season, when aerosol loading is more, high cloud cover show increasing trend and found to be positively correlated with the AI. On the other hand, low cloud covers shows decreasing trend and found to be anti-correlated with the trend in AI. We argue that increasing aerosol loading enhances the CNN over the region and in turn forced to alter the microphysical properties of the clouds by reducing the size of the cloud droplets. During summer monsoon season, aerosol shows increasing trend but their effect have not been seen significantly attributed the role of relative humidity to change the ratio of condensation and evaporation of cloud drop. Marine aerosol effect from the coastal region of Bay of Bengal may also been observed. The combine positive effects of thermodynamics and aerosols on lightning flashes are found to be increasing trend over the region where aerosol loading is more. Similarly, increasing trend in tropospheric ozone has also been observed. It is quite consistent with the observed trends in coal and petroleum consumption, and NO_x and CO emissions in India during the study period. The quality of correlation between TOR and AI suggested that tropospheric ozone appeared to be influenced by the increased anthropogenic activities. During recent period (2005-2010), the similar features have also been observed over the region.