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The radiative effects of anthropogenic aerosols on clouds over the Indo-Gangetic Plains

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The short period variability at sub-weekly scales in anthropogenic emissions as evidenced by weekend effect have been shown to have a profound effect on different climatic parameters in many parts of the globe. However, such variability is said to be non-existent or even reversed over the Indian region. We investigate over densely populated and highly polluted northern Indian region signature of anthropogenic activity on cloud parameters. Using ground based and space borne remote sensing observations of aerosol and cloud properties, we show that the aerosol loading reaches up to 20 % of its weekly mean values on working days. Using Clouds and the Earth's Radiant Energy System (CERES) derived radiative fluxes we observe that increased aerosol loading leads to increased atmospheric warming as evident from enhanced aerosol direct radiative effects (~2Wm-2) over a large area. This warming associated with anthropogenic aerosol may leads to modulation of cloud properties. Additionally, we analyzed cloud parameters such as Cloud Optical Depth (COD), Cloud Top Pressure (CTP), Cloud Top Temperature (CTT), Liquid Water Path (LWP) and Cloud Fraction (CF) observed from Moderate Resolution Imaging Spectroradiometer (MODIS) on board Terra and Aqua. It is found that high aerosol loading periods are the ones with optically thinner (lower COD) and wider (increased CF) clouds with lower cloud heights (increased CTT & CTP). That leads to reduction (~10-15 %) in shortwave and long wave cloud radiative effects. These anthropogenically induced short periods variability in the aerosol and cloud radiative effects on such a large scale has potential to alter the regional climate.