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Trend of Ozone Pollution in Beijing

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In the past five years, while the average $PM_{2.5}$ concentration decreased by around 35% under the strong pollution control measures in major cities in China, ozone (O_3) pollution becomes an emerging problem. Here, we show our study on the tropospheric O_3 variation and its driving force in Beijing in the past decade. According to the observations at an urban site in Beijing (PKUERS), the average O_3 concentration in August has increased by 2.1 ppb (4%) $yr^{-1}$from 2005 to 2016. In contrast, concentrations of nitrogen oxides (NO_x) and reactivities of volatile organic compounds (VOCs) have decreased by 1.5 ppb (5.5%) yr^{-1} and 4.2 s^{-1}(6.2%) yr^{-1}, respectively. In the meantime, the decrease of particulate matter and thus the aerosol optical depth leading to enhanced solar radiations close to the ground. The observed photolysis frequencies of NO_2(JNO_2) was increasing 2%yr^{-1}. The leighton ratio, i.e., [O_3] [NO]/(JNO_2[NO_2]) shows a clear diurnal variation following that of photochemical age, indicating the ozone production in urban Beijing is mainly controlled by local photochemical processes. Further studies on the relation between O_3, NO_x, and JNO_2 leading to the conclusion that the reduction of NO titration and the enhancement of JNO_2 are the major causes for the increase of O_3concentration. An EKMA plot for summer noontime conditions of Beijing was produced by an observation based box model. It is found that urban Beijing is located in the VOC-control region. However, the observed slope of kNO_2 v.s. kNMHCs is much higher than that which is in favor of O_3 reduction. Therefore, we suggest that more strict VOCs control strategy shall be taken in the future in order to metigate the O_3 pollution in Beijing.