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MEASUREMENTS OF O_3, NO_X AND VOCs DURING SUMMER IN BEIJING, CHINA

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Abstract

Measurements were taken for Ozone (O_3) and its precursors simultaneously from June to August 2008 in Beijing. We analyzed the spatial and temporal variability of O_3 and its precursors and the roles of the precursors in O_3 formation. The results suggest that O_3 mixing ratios are higher in rural areas than in urban areas. Highest mixing ratios of VOCs were alkanes, followed by aromatics; alkenes and biogenics were present at lower mixing ratios. Because of their relatively high reactivities, aromatics and alkenes play dominant role in O_3 formation. NO and NO_2 mixing ratios are lower during weekends because of reduced automobile traffic, resulting in the formation of higher amounts of O_3 during weekends; average O_3 mixing ratio on weekends was higher than on weekdays. Changes in NO_x emissions on the weekends may be the chemical cause of this ozone "weekend effect". Based on the control measurements in 2008, O_3 mixing ratios at noon are higher in BVCM (Before the Vehicle Control Measures) than in DVCM (During the Vehicle Control Measures); NO and NO_2 mixing ratios are lower in DVCM than BVCM. Mixing ratios of alkanes, aromatics, alkenes, and biogenics were lower by 34.5%, 31.1%, 21.4%, and 7.4%, in DVCM than in BVCM, respectively. The Ozone Isopleth Plotting Package (OZIPR) model is applied to assess the sensitivity of O_3 formation to the presence of nitrogen oxides (NO_x) and volatile organic compounds (VOCs). Results from OZIPR simulations of a reduction in VOCs or NO_x mixing ratios, indicate that an increase in VOCs would result in an increase in O_3, whereas a reduction in VOCs would reduce O_3 mixing ratios. The influence of NO_x is exactly the opposite: increasing the mixing ratio of NO_x would result in a decrease in O_3 mixing ratios. It can be concluded that there is a VOCs/NO_x ratio, approximately 8 and lower NO_x mixing ratios in this urban area would lead to an increase in O_3 mixing ratios.

Key words: Beijing, nitrogen oxides, ozone, volatile organic compounds

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