



Biogenic isoprene and implications for oxidant levels in Beijing during the 2008 Olympic Games

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As the host of the 2008 Summer Olympic Games, Beijing implemented a series of stringent, short-term air quality control measures to reduce the emissions of anthropogenic air pollutants. Large reductions in the daily average concentrations of primary pollutants, e.g., non-methane hydrocarbons (NMHCs) and nitrogen oxides (NO_x) of approximately 50% were observed at the air quality observatory of Peking University. Nevertheless, high levels of ozone were present during the control period. Although anthropogenic precursors were greatly reduced, the meteorological conditions in summer, including high temperature and light flux, are conducive to the production of large amounts of biogenic isoprene, which is extremely reactive. The diurnal pattern of isoprene showed daily maximum mixing ratios of 0.83 ppbv at noon and a minimum at night, reflecting its primarily biogenic properties. Using the ratio of isoprene to vehicle exhaust tracers, approximately 92% of the daytime isoprene was estimated from biogenic sources, and only 8% was attributed to vehicular emissions. In terms of OH reactivity and the ozone formation potential (OFP), biogenic isoprene with its midday surge can contribute approximately 20% of the total OFPs and 40-50% of the total OH reactivities of the 65 measured NMHCs during the midday hours. The discrepancy between decreased precursor levels and the observed high ozone was most likely caused by a combination of many factors. The changes in the partition among the components of oxidation products (O_3 , NO_2 and NO_z) and the contribution of air pollutants from regional sources outside Beijing should be two primary reasons. Furthermore, the influences of biogenic isoprene as well as the non-linearity of O_3 -VOC- NO_x chemistry are other major concerns that can reduce the effectiveness of the control measures for decreasing ozone formation. Although anthropogenic precursors were greatly reduced during the Olympic Games, the presence of sufficient biogenic isoprene and moderate levels of NO_x in conditions of high radiation flux and temperatures during midday hours can still have a significant contribution to midday and early afternoon O_3 .