The weekday/weekend ozone differences induced by the emissions change in Guangzhou megacity of China

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Guangzhou, one of China’ s megacities, is beset with frequent occurrence of atmospheric photochemistry events in summer and autumn. In this study, weekday/weekend mixing ratios of ozone (O_3) and the O_3 precursors of non-methane hydrocarbons (NMHCs) and nitrogen oxides (NOx) were recorded at Guangzhou Panyu Atmospheric Composition (GPACS), a comprehensive site in Guangzhou, during the summer (June, July, and August) and autumn (September, October and November) of 2011. In both summer and autumn, weekday/weekend O_3 differences in the morning and at midday largely depend on how much the O_3 precursors are affected by anthropogenic emissions. In the mornings (6:00–9:00 LT), pollutants (i.e. NOx and NMHCs) were more strongly influenced by vehicular emissions in autumn than in summer. In autumn, O_3 titration and lower NOx on weekends in NMHCs-limited regimes lead to more rapid O_3 production, which resulted in the O_3 weekend effect during autumn morning. No O_3 weekend effect occurred on summer mornings because O_3 formation was in a NOx-limited regime, although O_3 titration still existed. At midday (10:00–16:00 LT), the increase of biogenic NMHCs emissions reversed the sensitivity of O_3 production from NMHCs-to NOx-sensitive. The weekday/weekend diurnal pattern of vehicular sources was the same at midday, more intense other human industrial activities in autumn not only gave rise to the higher mixing ratios of high-reactive anthropogenic NMHCs (e.g. aromatics) on weekdays, but also could affected the temperature in the city, leading to higher isoprene mixing ratio on weekdays. All these factors are likely to contribute to the O_3 weekday effect in autumn. Meanwhile no weekday O_3 effect occurred in summer due to the low-intensity industrial anthropogenic activities. Our results show that high-reactive NMHCs and NOx control can be effective for reducing peak O_3 mixing ratios in Guangzhou. Further investigation based on numerical models is required to reach more robust conclusions.

Keywords: Emissions change, Weekday/ weekend ozone, Guangzhou

