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The weekend effect within and downwind of Sacramento – Part 1: Observations of ozone, nitrogen oxides, and VOC reactivity

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Abstract. Day-of-week patterns in human activities can be used to examine the ways in which differences in primary emissions result in changes in the rates of photochemical reactions, and the production of secondary pollutants. Data from twelve California Air Resources Board monitoring sites in Sacramento, CA, and the downwind Mountain Counties air basin are analyzed to reveal day of week patterns in ozone and its precursors in the summers of 1998–2002. Measurements of non-methane hydrocarbons are available for the summers of 2001–2003 at three of these sites and NO_x at six of these sites for the full time period. This routine monitoring data is complemented by data sets of ozone and nitrogen oxide concentrations obtained in the summers of 2001 and 2003 at three sites in the region and comprehensive measurements of VOC reactivity at two sites in 2001. Daytime concentrations of nitrogen oxides (NO_x≡NO+NO₂) are approximately 35% lower on weekends at all the sites, whereas the VOC reactivity changes by less than 10%. All six sites in the Sacramento Valley have higher 8-h maximum average ozone on the weekend and are more likely to exceed the national standard of 85 ppb on the weekend. In contrast, all the sites in the Mountain Counties are less likely to exceed the federal ozone standard on the weekend. Analysis of the day-of-week trends in odd oxygen show that the weekend effect of ozone within Sacramento is strongly influenced by NO sources close to the monitoring sites. This suggests that ozone measurements from monitoring sites close to highways, including two rural locations, may not be representative of the regional abundance, and lead to underestimates of long term exposure for humans and ecosystems.

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