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COMPARISON OF OZONE PRODUCTION RATES AND EFFICIENCIES IN NASHVILLE AND PHOENIX

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Ozone production rates and efficiencies were calculated for Nashville and Phoenix using a steady state photochemical model constrained by measurements of the concentrations of precursor and product species, solar intensity, water vapor, and temperature. Under equivalent conditions of solar intensity and precursor concentrations, it was found that while the instantaneous O_3 production efficiency in the two cities is the same, the instantaneous rate is about a factor of two lower in Phoenix than it is in Nashville. Further calculations showed that the difference in O_3 formation rates in the two cities can be attributed to differences in the primary radical production rate. In both cities, about two thirds of the primary radicals come from the photolysis of O_3 followed by the reaction of excited state oxygen to form OH radicals. In Phoenix, the atmospheric water vapor concentration is only about 25% of the concentration in Nashville. This causes the primary radical production rate to be lower in Phoenix and is the principal cause of the lowered O_3 production rates. The low O_3 production rates in Phoenix coupled with the common observation of a deep boundary layer serve to limit the O_3 concentration in Phoenix relative to Nashville.