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THE PHOTOCHEMICAL FORMATION OF OZONE: RESULTS FROM THE 1994 HENDERSONVILLE STUDY

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Chemical and meteorological data were collected at a ground station set up at Hendersonville, 13 km north-northeast of downtown Nashville, TN, during the 1994 Southern Oxidants Study from 22 June to 19 July. The ozone concentrations observed during daytime hours (600 to 1800 LST) averaged 41 ppbv (±22 ppb_v, 1 σ) while they typically dropped to half the amount at night (22±13 ppbv, 1800-600 LST) showing the diurnal variation of an urban environment. A steady state gross ozone production rate $P(O_3) = j(NO_2)[NO_2]-k[NO][O_3]$ is calculated based on the measurements of $[NO_2]$, [NO], and $[O_3]$. The first order photolytic rate constant for NO_2, $j(NO_2)$ is derived from in situ UV measurements from an Eppley radiometer. For $j(NO_2)$ levels greater than 0.005 s^{-1} the gross O_3 production rate observed in the air masses passing the site averaged 38 $ppb_v h^{-1}$, but were highly variable (±55 $ppb_v h^{-1}$). This variability reflects the inhomogeneity of sampled air masses and the applicability of the above $P(O_3)$ calculation. Northerly and westerly flow is predominantly subject to biogenic NMHC processing shown by the measured MPAN concentrations revealing average O_3 production rates of about 30 $ppb_v h^{-1}$. Southerly flow is subject to anthropogenic NMHCs and NO_x from local sources resulting in a gross O_3 production rate of 40 to 70 $ppb_v h^{-1}$ depending mainly on local influences. A case study of the period around 1 July 1994, when ozone reached the maximum observed 1hour average of 124 ppb_v at an observed increase ($d[O_3]/dt$) of 20 $ppb_v h^{-1}$, is used to discriminate such influences. Ozone data from the NOAA WP3 aircraft are used to investigate the spatial extent and time evolution of ozone formation during this period.

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