Scanning Actinic Flux Spectroradiometer Measurements during MIRAGE

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Photochemical reactions provide the driving force for much of the chemistry in the atmosphere. The in situ rates of these photolysis reactions are important in understanding production and loss terms for ozone, cycling of atmospheric nitrogen oxide species, and odd hydrogen production. Scanning Actinic Flux Spectroradiometer (SAFS) instruments were deployed on the NCAR C-130 and NASA DC-8 research aircraft during the MIRAGE mission. The SAFS measured the wavelength dependent up and downwelling actinic flux from 280 to 420 nm. Photolysis frequencies of atmospherically important molecules (including O3, NO2, HONO, N2O5, CH2O, H2O2, CH3OOH, HNO3, PAN, CH3NO3, CH3CH2NO3 and CH3COCH3) were calculated from the measured actinic flux spectra and established absorption cross section and quantum yield data. Flight tracks flew above, below and through intense aerosol plumes. Anthropogenic aerosols can have large effects on the actinic radiation transmitted to the surface, thus perturbing clear sky boundary layer photochemistry. Comparisons of the photolysis frequencies determined with the NCAR Tropospheric Ultraviolet and Visible (TUV) radiative transfer model and the SAFS instruments demonstrate differences in this complex radiation environment. The modeled and measured photolysis frequencies agree quite well with the clear sky measurements.