Scanning Actinic Flux Spectroradiometer (SAFS)

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The Atmospheric Investigations and Measurements (ARIM) group at NCAR will deploy the Scanning Actinic Flux Spectroradiometer (SAFS) instruments on the NCAR C-130 for the airborne phase of the MIRAGE/INTEX-B field intensives. The SAFS instruments determine wavelength dependent actinic flux from 280-420 nm. The actinic flux in combination with the absorption cross section and quantum yield molecular data will be used to calculate the photolysis frequencies of multiple photochemically important molecular processes, including O3, NO2, HONO, CH2O, H2O2, CH3OOH, HNO3, PAN, CH3NO3, CH3CH2NO3, and CH3COCH3.

The Mexico City environment contains large concentrations of gas phase pollutants and aerosols that can dramatically perturb the radiation environment and therefore the local photochemistry. In situ measurements of the photolysis frequencies of photochemically important molecules will be critical to understanding the polluted megacity atmosphere and the resulting processing of the plume advected from the city environs. Ozone production in the megacity plume will be dependent on the radiation environment encountered by the plume as it is advected out of the city and diluted. Measurements of actinic flux and aerosol size distributions and composition can be used to determine the impact of the aerosols on photolysis and oxidant production rates. The airborne measurements of radiation and aerosol concentrations, size distributions, and extinctions will allow for stringent testing of radiative transfer models used to study regional and global impacts of megacity pollution.

The SAFS measurement is based on a 2π steradian hemisphere hemispherical quartz light collector, a double monochromator, and a low dark current photomultiplier. The monochromator employs dual 2400 G/mm gratings which produce a 1 nm FWHM spectral resolution and very low straylight. The instrument package on the aircraft includes two independent, but time synchronized (IRIG-B) spectroradiometer systems to measure the up- and down-welling fluxes in a 10 second scan time. Summing these produces the spherically integrated actinic flux.

The spectral response of the SAFS will be determined in the ARIM optical calibration facility equipped with precision radiometric power supplies and multiple NIST traceable 1000W quartz tungsten halogen lamps. Secondary lamp standards will be employed in the field to calibrate the systems before each aircraft flight. Mercury line calibrations will also be performed to track the wavelength accuracy.