Airborne Observations of Aerosols over Mexico City and the Western Gulf Region

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In collaboration with the University of Hawaii, NASA Langley deployed an extensive suite of in situ sensors aboard the University of North Dakota DC-8 during the INTEX-B mission to characterize the microphysical and optical properties of aerosols and clouds. Specific measurements included total and nonvolatile particle number densities, dry and ambient coarse particle size distributions, wavelength dependent scattering and absorption coefficients, and cloud liquid water content and particle size distributions. In addition, aerosol composition and profiles of aerosol backscatter were recorded aboard the DC-8 by the University of New Hampshire (Jack Dibb) and NASA Langley (Ed Browell, PI), respectively.

The five local flights conducted during the Houston phase of INTEX-B provided an opportunity to characterize air mass composition and aerosol properties over and downwind of Mexico City. As expected, results indicate that air trapped within the Mexico City Basin is highly polluted with emissions arising from a variety of sources. For example, extremely dry conditions coupled with relatively high winds produced airborne dust that generally elevated coarse aerosol loadings throughout the basin. The aircraft also frequently sampled smoke plumes from vegetation fires that were burning on the hillsides and mountain peaks surrounding the city. In addition, industrial activities and vehicular traffic gave rise to elevated concentrations of aerosol precursors, soot, and volatile aerosol species. The superposition of these sources resulted in the prevalence of a highly absorbing aerosol haze that significantly reduced visibility and air quality.

The Mexico City Plume was typically contained within a 2.5-km thick boundary layer that infrequently vented to the overlying free troposphere. However, air masses sampled over the western Gulf of Mexico exhibited evidence of urban pollution as a variety of trace species were enhanced in off-shore plumes observed downwind and at about the same elevation of the city. Marine air near the US coast was also impacted by pollution transported from southeast Texas. Air masses from this region were also enhanced in soot and small aerosols, a significant amount of which arose from oil refineries and energy production facilities.