Regional and Global Megacity Impacts:
A comparison of boundary layer and free troposphere aerosols over Mexico, the Gulf of Mexico, and the Eastern North Pacific

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During March 2006 both the NASA/UND DC-8 and NSF/NCAR C-130 aircraft were used to characterize natural and anthropogenic aerosols over Central Mexico and the Gulf as part of MILAGRO. In late April and early May the same aircraft were used to characterize airmasses over the remote Eastern North Pacific (20-60N, 120-180W) as part of INTEX.

The upper troposphere (6-12 km) over Mexico and the Gulf was found to be relatively pristine compared to mid-latitudes. Anthropogenic tracers such as CO, ozone and refractory (>300oC) aerosol number were low (~75 ppbv, <40 ppbv, ~80-150 cm^{-3}) reflecting the well aged nature of the airmasses; a combination of long-range transport over the sub-tropical Pacific, and dilution due to inter-hemispheric exchange. The continental boundary layer over Mexico was heavily influenced by anthropogenic pollution from Mexico City as well as regional biomass burning. This results in a near-surface doubling of median CO, and median refractory CN number 10-40 times the values measured in the upper free-troposphere. Few episodes of deep convection were observed during MILAGRO. However, anthropogenically influenced boundary layer and lower free troposphere air was transported from Mexico City toward the Gulf of Mexico forming a 1-2 km deep transitional layer above the marine boundary layer. The marine boundary layer over the Gulf is heavily influenced by both anthropogenic and biomass burning emissions from the United States and Mexico.

The upper troposphere over the North Pacific was found to be influenced by pollution and dust transported from Asia. Median concentrations of CO, ozone and refractory CN (~125 ppbv, ~60 ppbv, ~100-200 cm^{-3}) were elevated compared to the values observed over Mexico and the Gulf. Measurements in the Pacific MBL ranged from relatively pristine to polluted due to the entrainment of Asian pollution and dust from the lower troposphere.

Vertical profiles of gas and aerosol phase tracers are compared with an emphasis on in-situ measurements of the aerosol size distribution, chemistry, optical properties and the increase in light scattering as a function of relative humidity [f(RH)]. The events are put into a broader context through the use of models and satellite imagery.