Photochemical and Lagrangian transport study of the Mexico City plume during the 2006 Megacities and their Impact on the Regional and Global Environment (MIRAGE) Period

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Many chemical species emitted into the atmosphere are removed principally by reaction with the HO radical. The relative proportions of species with differing HO reactivity will tend to change over time as they are differentially removed through exposure to HO. Thus changes in the proportions of species with differing reactivity can be used to infer the exposure to HO integrated over the time between release of pollutants into an air mass and the time of observation of the chemical composition of that air mass. This exposure is some times thought of as a chemical clock but a clock which runs faster when HO concentrations are higher. WRF meteorological fields will be used to calculate air mass trajectories for each flight day of the C-130. Back trajectories were initialized at the aircraft location and time and tracked back several days. These trajectories give an indication of when air was last influenced by various characteristic pollution sources such as Mexico City, the Tula refinery or volcanic venting. Knowing the likely source of certain pollutants will enable various photochemical clocks calculations to be performed that can be compared with Lagrangian estimates of travel time and direct in situ observations of HO radicals. WRF-Chem chemical fields will be sampled in a similar manner to the C-130 flights and will be used to test the concept of the chemical clock and identify any significant differences between chemistry near Mexico city as observed from the C-130 and simulated with WRF-Chem. This information will be used to organize aircraft observations according to the time since last influenced by the Mexico City pollution sources. As this time becomes longer it is expected that the concentrations of primary pollutants will decrease as a result of atmospheric processes including mixing, chemical loss, uptake onto particulate matter, deposition and washout. WRF-Chem chemical fields will be sampled in a similar manner to the C-130 flights and will be used to test the concept of the chemical clock and identify any significant differences between chemistry near Mexico city as observed from the C-130 and simulated with WRF-Chem.