Geophysical Research Abstracts
Vol. 15, EGU2013-13695, 2013
EGU General Assembly 2013

Combining active and passive remote sensing from research aircraft with atmospheric models to evaluate NO_x emission fluxes and O_3 formation in the Los Angeles Megacity

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Ozone (O_3) and nitrogen dioxide (NO_2) are two important components of air pollution. We have measured vertical column amounts of NO_2, and vertical profiles of O_3 and wind speed by means of measurements of solar stray light by CU Airborne MAX-DOAS, and active remote sensing using the NOAA TOPAZ lidar, and the University of Leeds Doppler lidar aboard the NOAA Twin Otter research aircraft. A total of 52 flights (up to 4 hours each) were carried out between May 19 and July 19 2010 during the CalNex and CARES field campaigns. These flights cover most of California. The boundary layer height was measured by TOPAZ lidar, and trace gas concentrations of NO_2 and O_3 were integrated over boundary layer height. These column integrated quantities are then combined with direct wind speed measurements to quantify directly the pollutant flux across the boundary, as defined by the flight track. By tracking the pollution fluxes during transects that are flown upwind and in various distances downwind of a NO_x emission source, the NO_x emission rate, and the ozone formation rate are quantified. These pollutant fluxes are calculated here for the first time exclusively based on measurements (i.e. without need to infer wind speed from a model). These fluxes provide constraints to quantify localized NO_x emissions, and are being compared with WRF-Chem model simulations.