MOPITT CO and MOZART for MIRAGE-Mex

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Simulations with MOZART (Model of Ozone and Related Tracers) and CAM (Community Atmosphere Model) will be run to assist in the planning and analysis of the MIRAGE-Mex measurements, and to study the impact of pollution from Mexico City on the global environment. Inverse modeling of the MOPITT (Measurements of Pollution in the Troposphere) CO data will be used to determine optimized emissions for Mexico from satellite data.

Pre-Campaign

We will use CAM to examine the sensitivity of the outflow from Mexico City on the global scale at various resolutions, from approximately $.5^{o}$ x $.625^{o}$ km^2 to 4^{o} x 5^{o} km^2. We will use two types of simulations to examine this sensitivity: 1) CAM with diagnostic tracers; 2) CAM with chemistry.

Climatological boundary conditions from MOZART simulations for previous years will be provided for WRF-Chem simulations.

During

We will process the MOPITT data at NCAR in near real-time. Using an expedited data protocol, MOPITT data for the regions of interest will be transferred from NASA and the Level 2 CO retrievals made available within about 9 hours from the measurement time. Operational processing, which depends on the availability of the MODIS cloud mask product, will provide global CO distributions within about 4 days. Maps of the CO distributions for each day for the regions of interest will be produced along with several day data-composites. MOPITT uses a cross-track scan, and in the absence of persistent cloud cover, the instrument achieves close to global coverage in 3 days. However, a single day's data are often sufficient to identify CO plumes, as can be seen on the MOPITT INTEX-A campaign data website, which will be augmented for INTEX-B, at http://www.eos.ucar.edu/mopitt/INTEX/.

Chemical forecasts from the NCAR global chemical transport model MOZART-4 (Model of Ozone and Related Chemical Tracers, http://gctm.acd.ucar.edu/mozart) will be run and the results made available through our website. A continuous simulation at T42 (2.8°x2.8°), with full chemistry, will include assimilation of the near-real-time MOPITT CO retrievals. A second continuous high resolution (0.5^{o} x 0.625^{o}) tracer simulation will include a number of CO tracers of Asian industrial, biomass burning in Asia and Central America, Siberian wildfires and US emissions. Each day, branch forecast runs of approx. 4 days will be run at high resolution to show the prediction of the CO tracers.

Since biomass burning events have the potential to produce a large perturbation to the climatological CO distribution carried forward in the assimilation, the CO emission inventory will be updated for the forecast runs based on MODIS fire counts. The MODIS Rapid Response products include fire counts for the past 48 hours and 7 days, available through the University of Maryland Web Fire Mapper website (http://maps.geog.umd.edu/maps.asp). These fire count data, along with landcover and vegetation data from satellite will be used in the ACD fire emissions model.

Plots of the near-real-time MOPITT CO, the Assimilation product, and high resolution Forecasts will be posted on an ACD website.

Post-Campaign

Inverse modeling will be performed using MOPITT CO from 2006 with MOZART simulations driven with NCEP meteorology for 2006, and the best bottom-up estimates of emissions for Mexico. Optimized emissions of CO will be determined for January through April for Central America, using a technique recently developed for estimating emissions from the Alaska fires last summer. The difference between MOPITT CO and the simulated CO from Mexico will be used to improve the CO emission estimates for Mexico.

Boundary conditions from MOZART simulations for the period of the campaign will be provided for WRF-Chem simulations.

The evolution of pollution plumes on the regional to global scales will be studied in MOZART. Comparisons with measurement data and WRF-Chem simulations will be made.

Simulations at different resolutions will be run to provide a link between regional and global scales. These will allow us to examine the sensitivity of the model solution to topography, boundary layer chemistry, plume chemistry etc. We will particularly emphasize the impact on the large scale distributions of OH, cloud condensation nuclei, and ozone.

The impact of the US, and other regions, on Mexico will be quantified with these simulations.

The ecological impact of Mexican emissions will be studied through coupling with the Community Land Model in CAM.