AQRP Monthly Technical Report

PROJECT TITLE	Emission source region contribution to a high surface ozone episode during DISCOVER-AQ	**PROJECT #**	14-004
PROJECT PARTICIPANTS	Christopher P. Loughner and Melanie Follette-Cook	**DATE SUBMITTED**	4/9/2015
REPORTING PERIOD	**From:** March 1, 2015 **To:** March 31, 2015	**REPORT #**	9

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task

We analyzed satellite images to determine if satellites detected regional transport into the Houston metropolitan area during the September 25-26, 2013 air pollution event. In addition, we identified regions to select for an ozone source apportionment simulation based on back-trajectories. We also continued analyzing the updated CMAQ simulations with observations.

Preliminary Analysis

We analyzed OMI total ozone, OMI tropospheric NO2, MODIS AOD, and MOPITT total column CO for the September 24-26 period (Figures 1-12). No OMI or MOPITT data is available over the study region on September 25. Most of the ozone in the total ozone column is in the stratosphere, so therefore it is a poor indicator for surface air quality; no indication of regionally transported lower tropospheric ozone is present in the OMI data. Tropospheric NO2 values are between 2-4 molecules/cm2 over East Texas and most of Louisiana on September 24 and 26. With just two images available for our study period, one on September 24 and another on September 26, we do not see a satellite signal indicating NO2 was transported into Houston from other regions. AOD values were low throughout the air pollution episode, which is not surprising since this was an ozone air pollution event, not a PM2.5 event and no elevated dust or fire plumes were present over Houston. There is no indication of regionally transported CO into Houston from the MOPITT instrument. The sparseness of MOPITT total CO observations, both spatially and temporally, makes it difficult to detect regionally transported pollution into Houston.

Based on back-trajectories calculated from the 4 km WRF model initialized over LaPorte Sylvan Beach, we identified the following regions to select for an ozone source apportionment simulation: 1) Houston; 2) Dallas; 3) Beaumont; 4) Lake Charles; 5) marine areas; and 6) remaining areas. Back trajectories initialized at 2pm CST on September 25 indicate transport from Dallas entering Houston. Back trajectories initialized at 2pm CST on September 26 indicate air originating over Beaumont and Lake Charles being transported over the water and looping back inland over Houston.

In the previous report we showed comparisons and improvement in our updated CMAQ simulation with a horizontal resolution of 4 km with our original 4 km CMAQ simulation. Since then, a new 1 km CMAQ simulation completed and we began comparing this new run alongside the 4 km run and observations. Figures 13-15 show ozone comparisons between the 4 and 1 km simulations with P-3B observations on each DISCOVER-AQ flight day. The two simulations have similar biases on each flight day during the campaign.

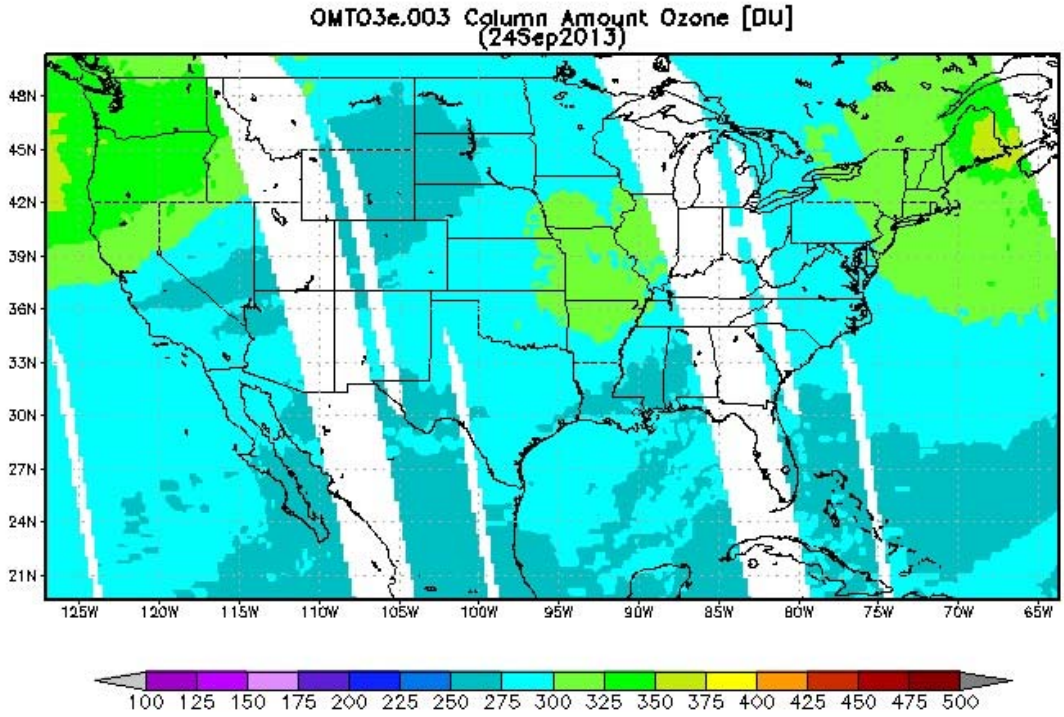

Figure 1: OMI total ozone column on September 24, 2013.

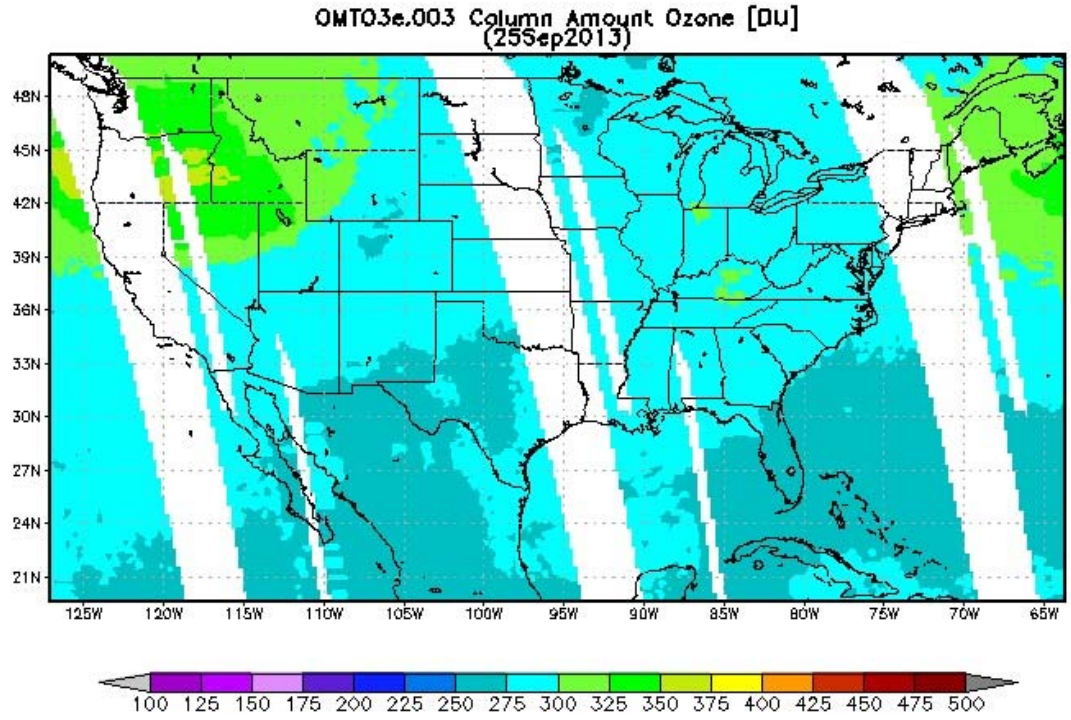

Figure 2: OMI total ozone column on September 25, 2013.

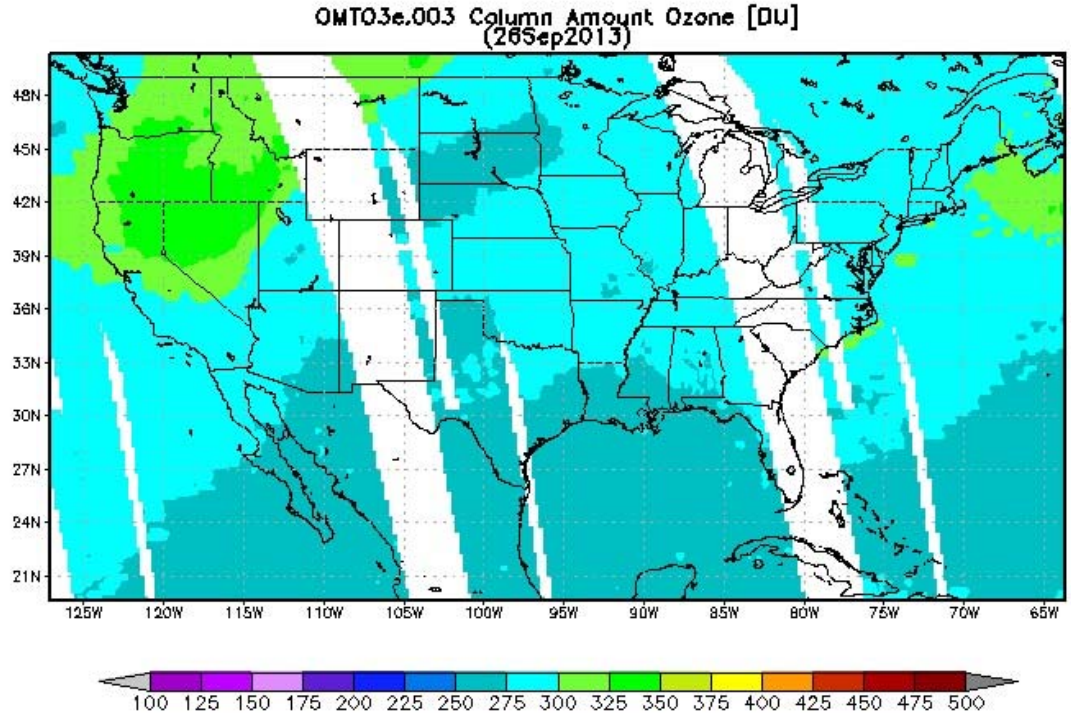

Figure 3: OMI total ozone column on September 26, 2013.

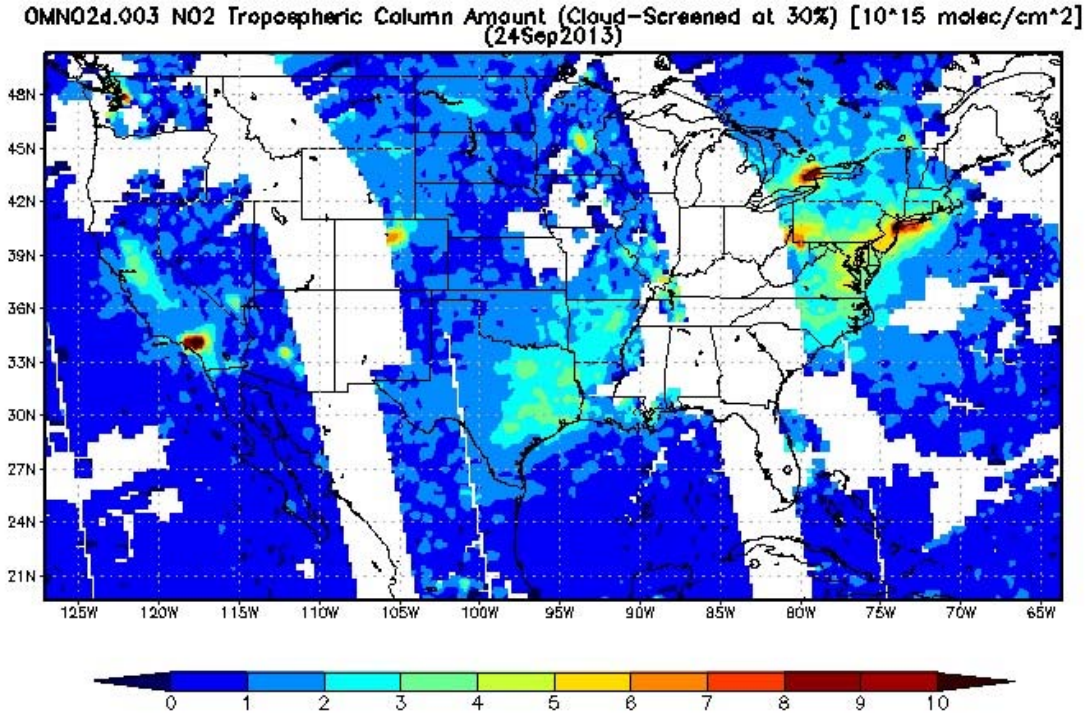

Figure 4: OMI NO2 tropospheric column on September 24, 2013.

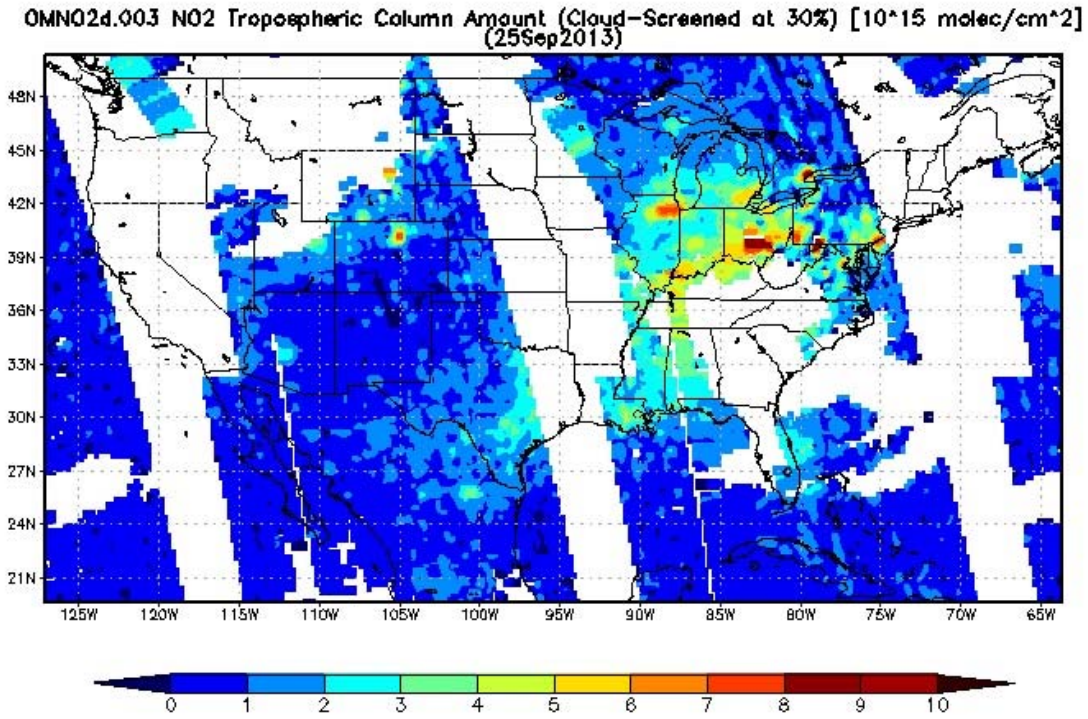

Figure 5: OMI NO2 tropospheric column on September 25, 2013.

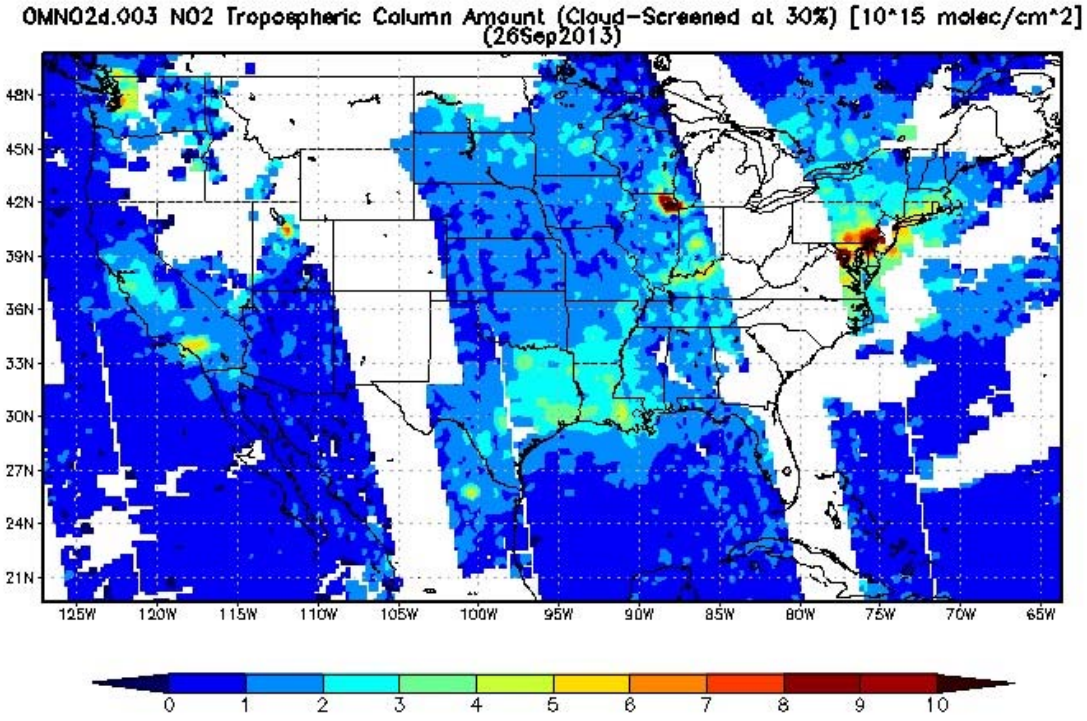

Figure 6: OMI NO2 tropospheric column on September 26, 2013.

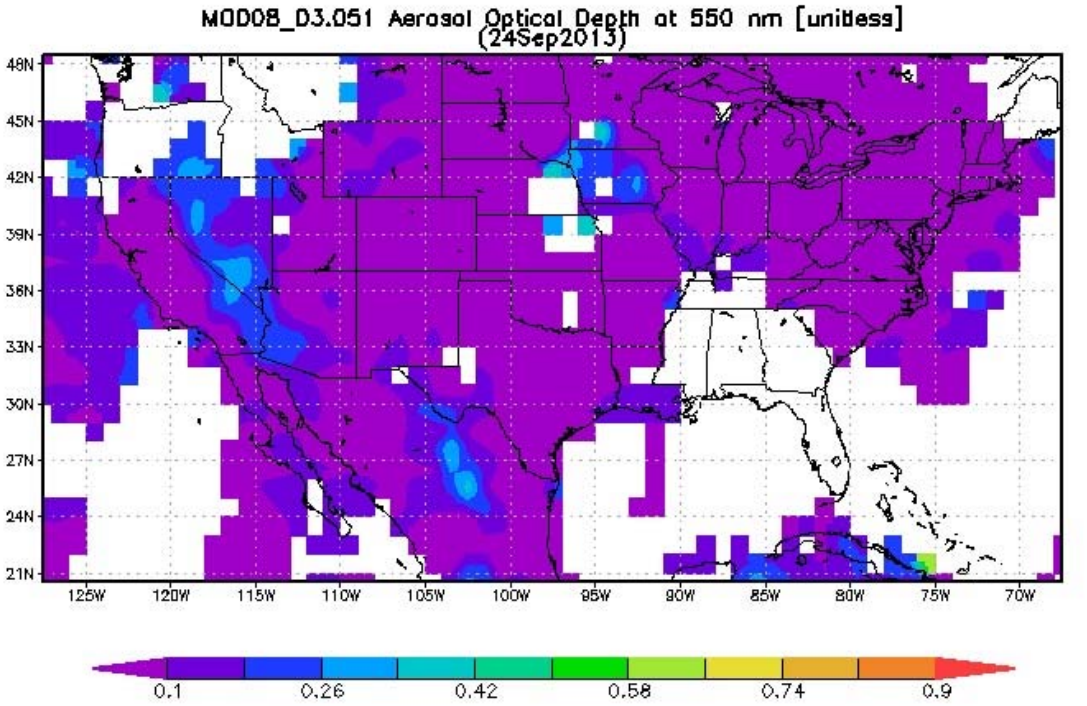

Figure 7: MODIS AOD on September 24, 2013.

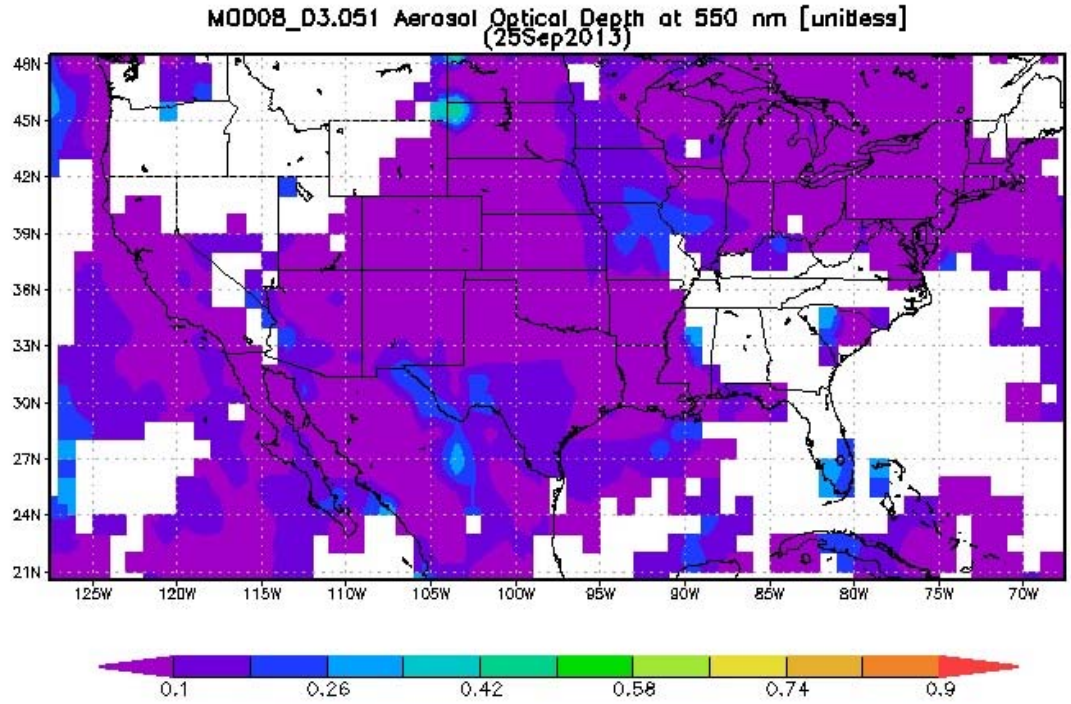

Figure 8: MODIS AOD on September 25, 2013.

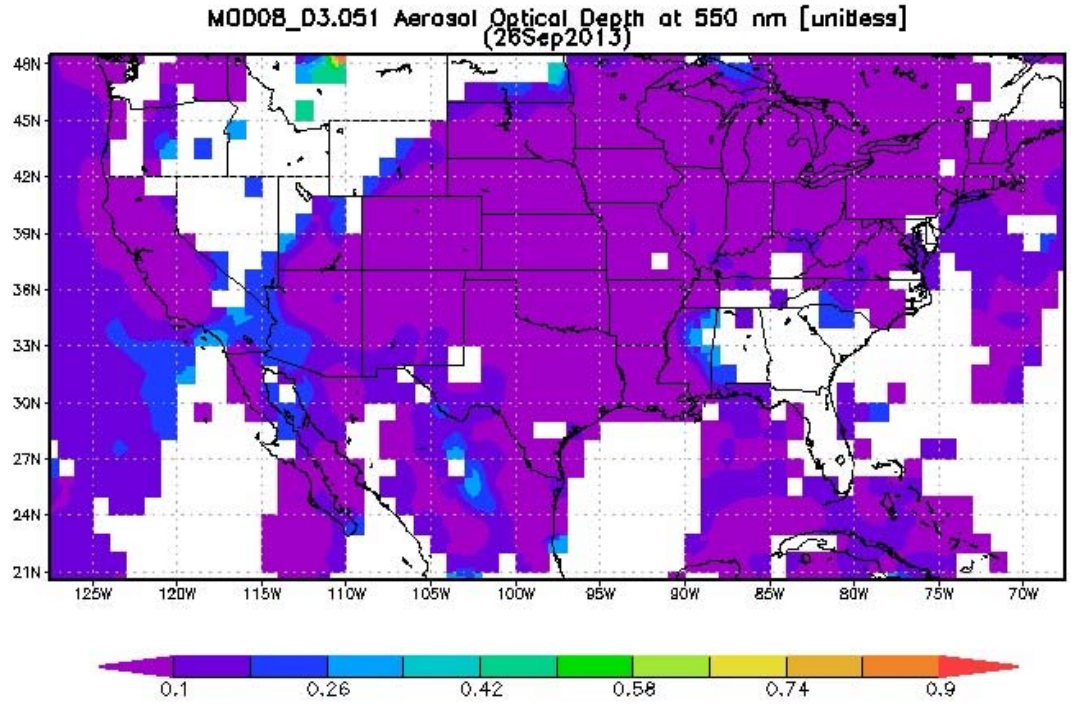

Figure 9: MODIS AOD on September 26, 2013.

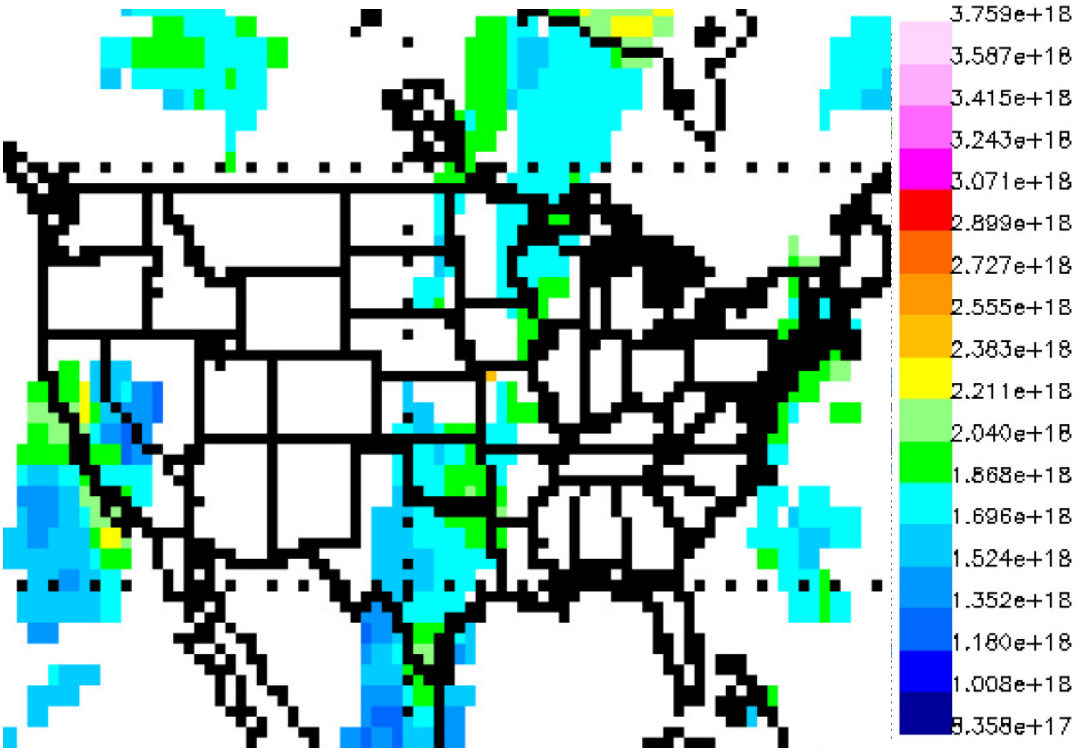

Figure 10: MOPITT total CO column on September 24, 2013.

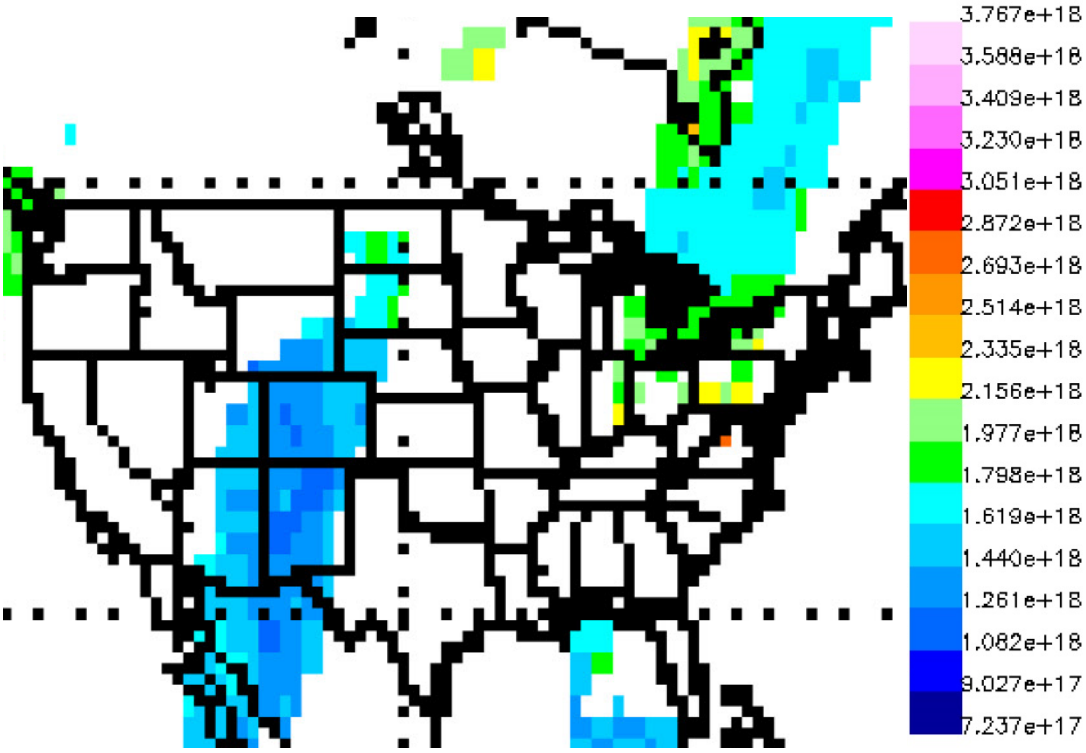

Figure 11: MOPITT total CO column on September 25, 2013.

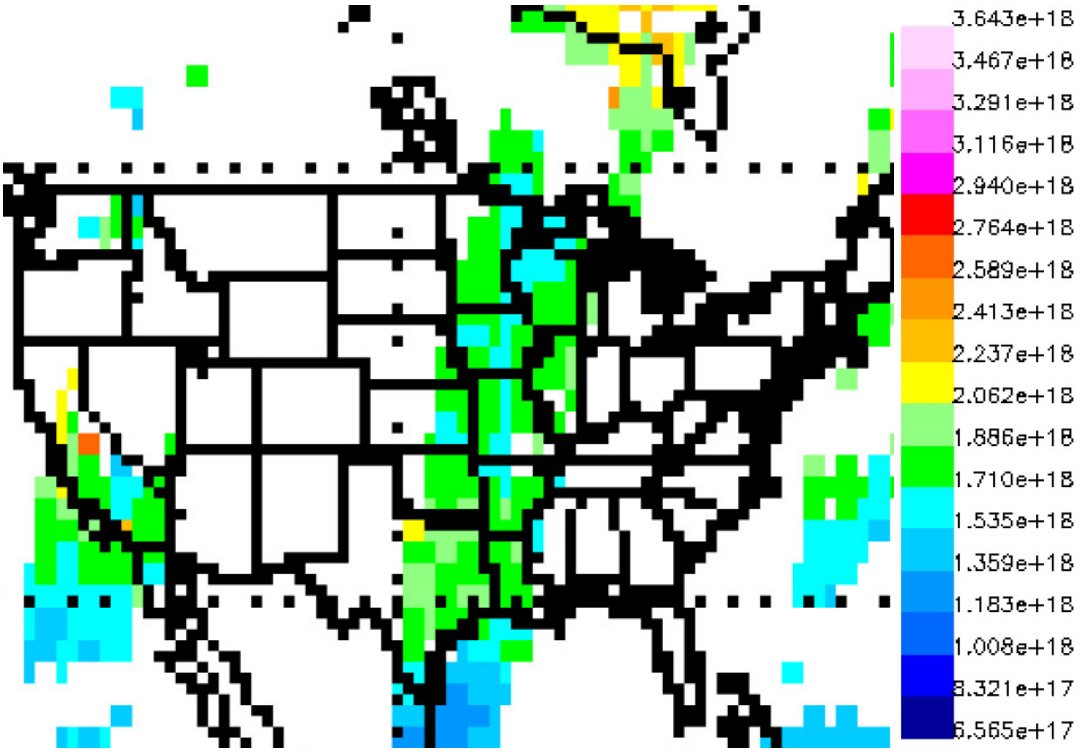

Figure 12: MOPITT total CO column on September 26, 2013.

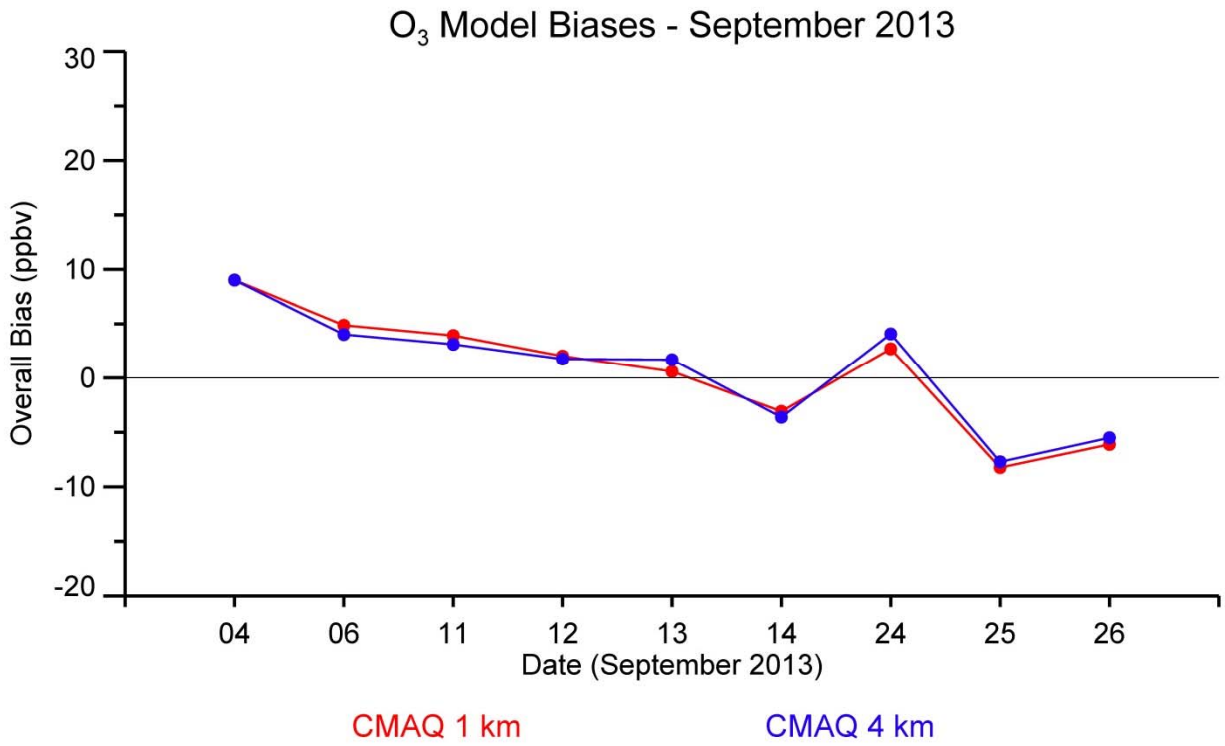

Figure 13: Average ozone model bias from the new 1 and 4 km CMAQ simulations as compared to P-3B observations on each flight day.

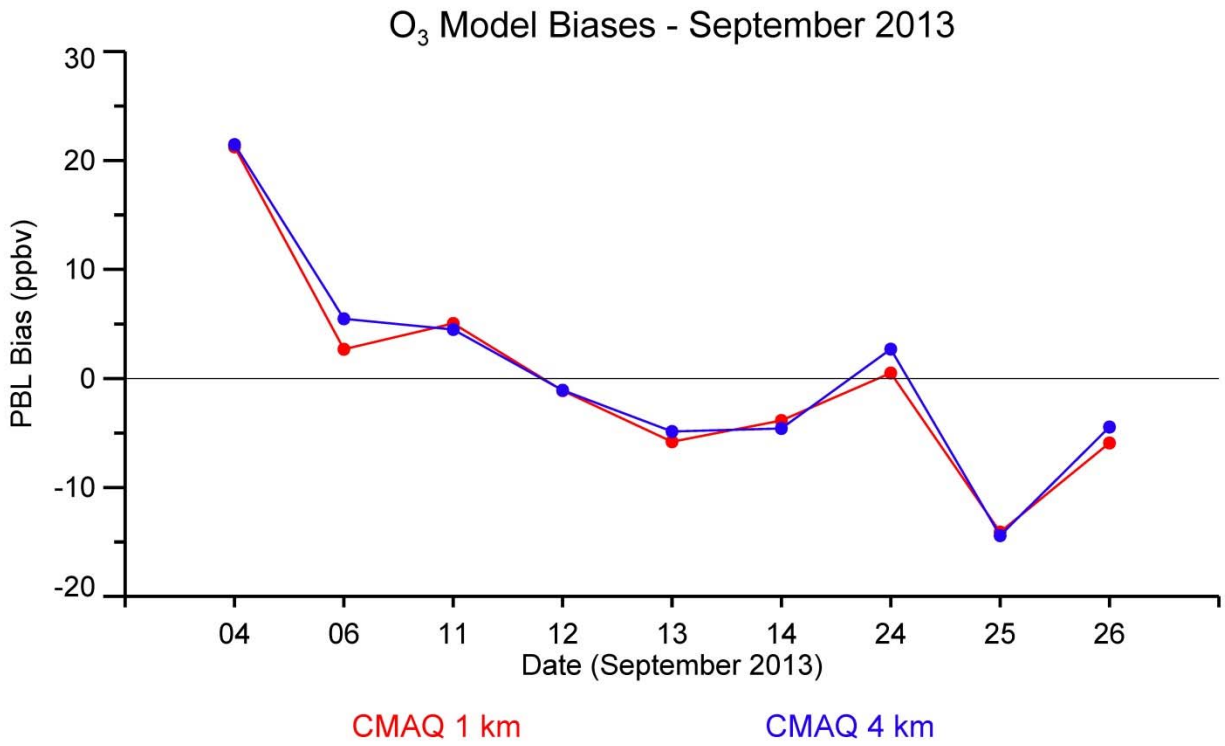

Figure 14: Average ozone model bias from the new 1 and 4 km CMAQ simulations as compared to P-3B observations on each flight day within the PBL.

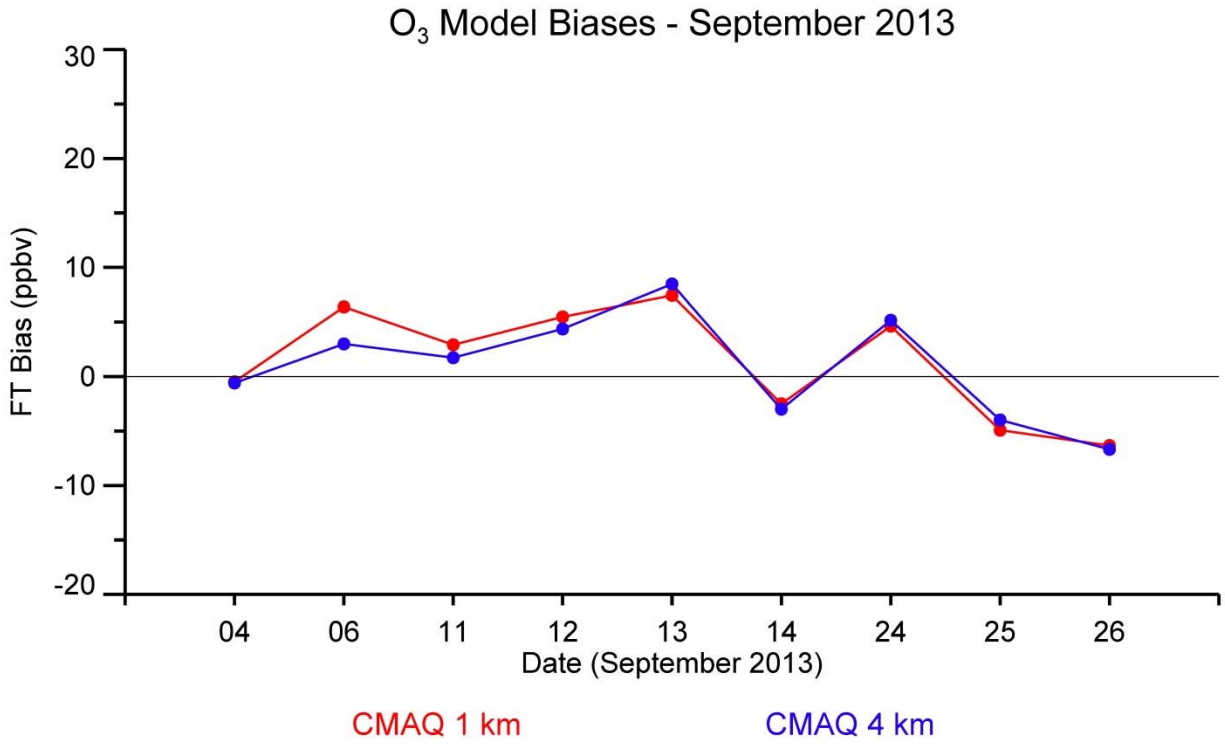

Figure 15: Average ozone model bias from the new 1 and 4 km CMAQ simulations as compared to P-3B observations on each flight day within the free troposphere.

Data Collected
None.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments
No problems encountered.

Goals and Anticipated Issues for the Succeeding Reporting Period
Set-up CMAQ simulation with ozone source apportionment and complete a statistical analysis between the CMAQ simulation and observations.

Detailed Analysis of the Progress of the Task Order to Date
We don't anticipate delays in the completion of this project.

Submitted to AQRP by: Chris Loughner

Principal Investigator: Chris Loughner