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**	5/8/2015
REPORTING PERIOD	**From:** April 1, 2015 **To:** April 30, 2015	**REPORT #**	10

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 completed our statistical analysis of comparing the various WRF simulations and updated CMAQ simulations at 4 and 1 km horizontal resolution with P-3B measurements and ground monitoring stations. We also performed back-trajectories to display possible emissions source regions that may of impacted surface air quality in Houston during the September 25-26 air pollution event.

Preliminary Analysis

A statistical analysis of WRF 2 m temperature, 10 m wind speed, and 10 m wind direction from our original 4 km WRF simulation and 1st and 2nd iterative 4 and 1 km WRF simulations with surface measurements at AQS sites are shown in Tables 1-3. The 2nd iterative 1 km simulation performed the best statistically for 2 m temperature and 10 m wind speed and direction. The 1st and 2nd iterative 4 km WRF simulations have similar biases and errors for temperature and winds, suggesting little improvement is gained from the expense of a 2nd iterative simulation for a 4 km domain. However, the 2nd iterative 1 km WRF simulation gained significant improvement over the 1st iterative 1 km run. The 1st iterative 1 km simulation performed the worst out of the 5 simulations analyzed for wind speed and direction. The original 4 km simulation performed worse than the 1st and 2nd iterative 4 km simulations for temperature and wind speed and direction.

A statistical analysis of CMAQ surface ozone concentrations for the 2nd iterative 4 and 1 km simulations compared with AQS sites are shown in Table 4. The 4 km simulation performed slightly better than the 1 km simulation with respect to mean bias and normalized mean bias.

Back-trajectories calculated from the 2nd iterative 4 km WRF model output initialized over LaPorte Sylvan Beach on September 25 and 26 are shown in Figures 1 and 2. The September 25 back-trajectory shows transport from the Dallas metropolitan area and the September 26 back-trajectory shows transport from the Beaumont, TX / Lake Charles, LA area. Based on this analysis, 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.

	2 m Temperature (K)				
	Orig (4km)	Iter 1 (4 km)	Iter 1 (1 km)	Iter 2 (4 km)	Iter 2 (1 km)
MB	-0.8	-0.5	0.6	-0.5	-0.1
NMB	-0.2	-0.2	0.2	-0.2	-0.04
NME	0.4	0.4	1.0	0.4	0.4
RMSE	1.6	1.4	3.6	1.5	1.4

Table 1: Mean bias (MB), normalized mean bias (NMB), normalized mean error (NME), and root mean square error (RMSE) of 2 m temperature from the original 4 km WRF simulation and 1st and 2nd iterations of the 4 and 1 km WRF simulations for September 24-26.

	10 m Wind Speed (m/s)				
	Orig (4km)	Iter 1 (4 km)	Iter 1 (1 km)	Iter 2 (4 km)	Iter 2 (1 km)
MB	-0.8	-0.5	1.0	-0.5	-0.4
NMB	-21	-14	28	14	-12
NME	50	42	70	42	43
RMSE	2.2	1.9	2.9	1.9	1.9

Table 2: Same as Table 1, but for 10 m wind speed.

	10 m Wind Direction (deg)				
	Orig (4km)	Iter 1 (4 km)	Iter 1 (1 km)	Iter 2 (4 km)	Iter 2 (1 km)
MB	-39	3.2	43	3.1	-0.6
NMB	-562	47	633	45	-8.3
NME	1022	717	1367	713	727
RMSE	101	85	126	84	85

Table 3: Same as Table 1, but for 10 m wind direction.

	Surface Ozone (ppbv)	
	Iter 2 (4 km)	Iter 2 (1 km)
MB	2.1	2.9
NMB	6.4	8.9
NME	29	29
RMSE	13	12

Table 4: MB, NMB, NME, and RMSE of surface ozone concentrations from the 2nd iterative 4 and 1 km CMAQ simulations for September 24-26.

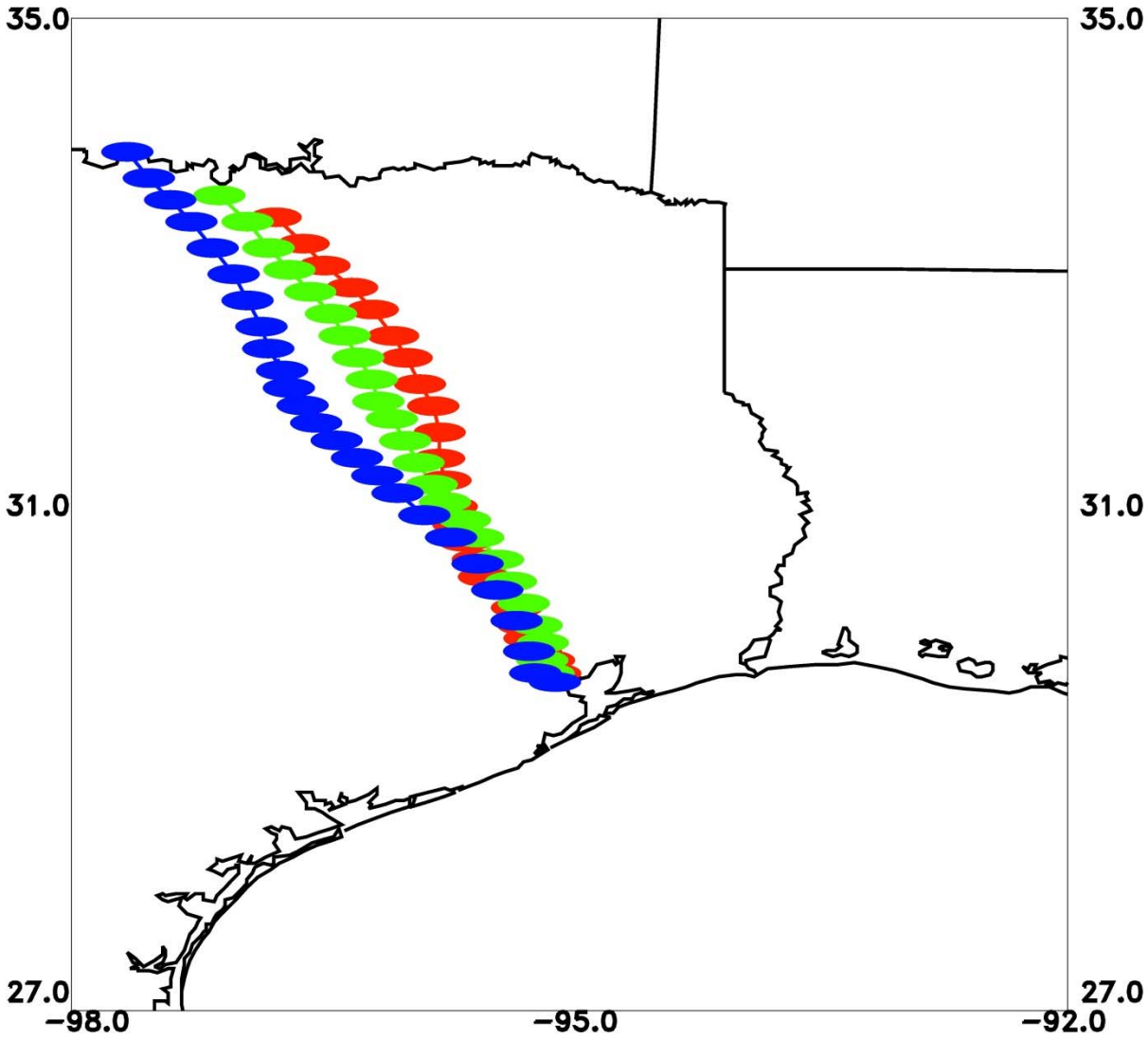

Figure 1: 24 hour back trajectories from 4 km WRF output initialized at 2 pm CST September 25 over La Porte Sylvan Beach at 0.5 km (red), 1.0 km (green), and 2.0 km (blue) AGL. Trajectories pass over Dallas.

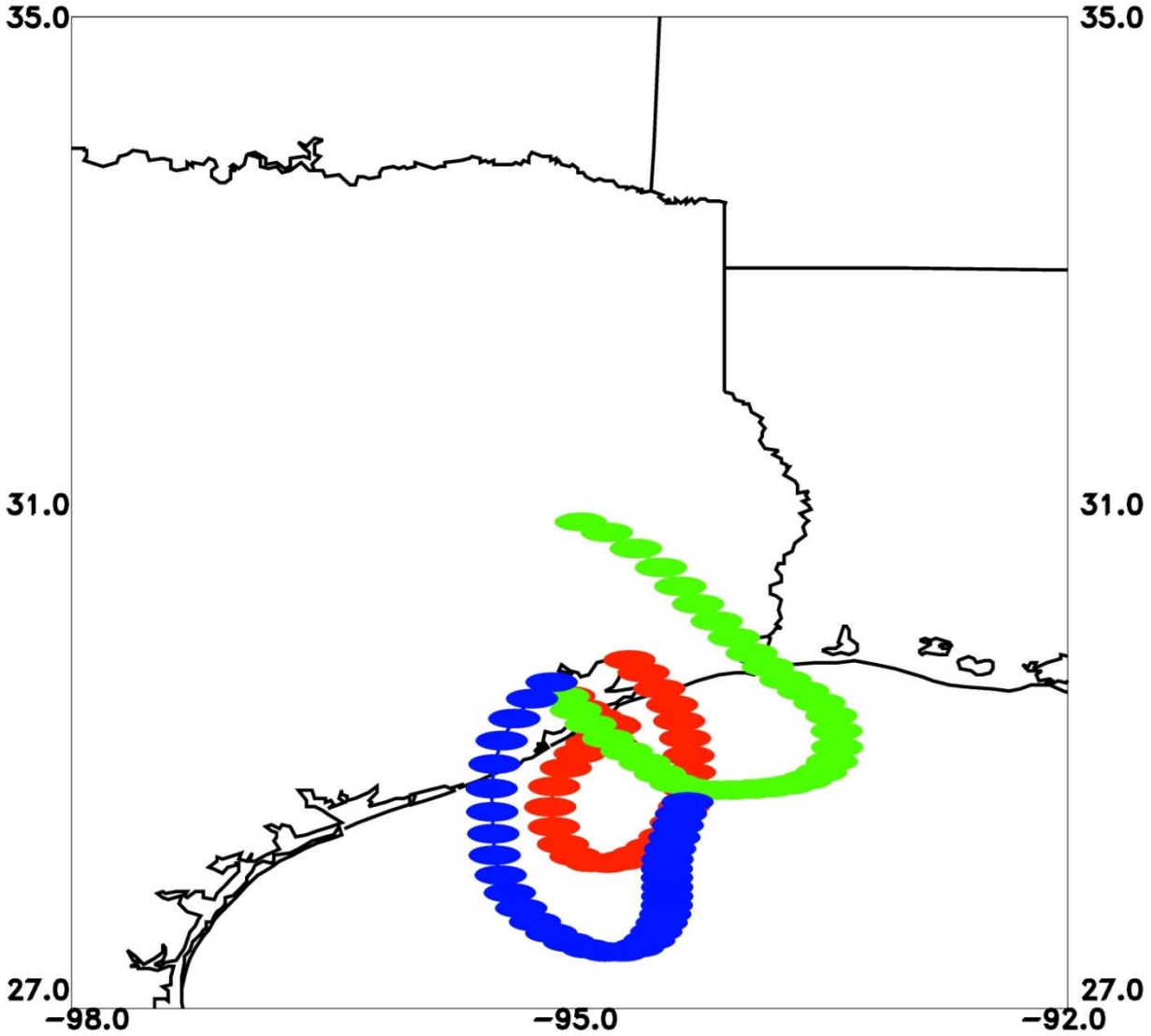

Figure 2: 33 hour back trajectories from 4 km WRF output initialized at 2 pm CST September 26 over La Porte Sylvan Beach at 0.5 km (red), 1.0 km (green), and 2.0 km (blue) AGL. Trajectories show recirculation of local air and transport from Beaumont, TX / Lake Charles, LA area.

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
Complete CMAQ simulation with ozone source apportionment for the following regions. Based on the analysis of this source apportionment run, we will then prepare to run CMAQ again with source apportionment for source regions that had a significant contribution to this ozone episode for individual source sectors (i.e., mobile, area, point source sectors). These ozone source apportionment runs will be run at a horizontal resolution of 4 km.

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