Monthly Technical Report

PROJECT TITLE	Constraining NO$_x$ Emissions Using Satellite NO$_2$ Measurements Over The Southeast Texas	**PROJECT #**	14-014
PROJECT PARTICIPANTS	University of Houston	**DATE SUBMITTED**	5/8/2015
REPORTING PERIOD	**From:** Apr. 1, 2015 **To:** Apr. 30, 2015	**REPORT #**	1
	University of Houston	**Invoice #** N/A	**Amount** $0.00

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

1. Preparation of NEI2011 over Southeast Texas is finished. The QA/QC over the region has also been finished.
2. Finished CMAQ simulations (with NEI2011) and calculated statistics.
3. OMI NO$_2$ for 09/2013 compared to new CMAQ results.

CMAQ Statistics Using NEI 2011

We have finished a set of CMAQ simulation with NEI 2011 over Southeast Texas. The meteorology is "No-Objective Analysis (OA)" case – no OA has been implemented. Another set with OA should be finished very soon. The statistics is shown below.

The statistics for ozone is shown in Table 1. The statistics are based on CAMS data.

Table 1 Statistics of hourly surface ozone

Case	N	Corr	IOA	RMSE	MAE	MB	O_M	M_M	O_SD	M_SD
No-OA	33308	0.74	0.79	14.6	12.0	9.3	24.4	33.7	16.5	14.2

- N – data points; Corr – Correlation; IOA – Index of Agreement; RMSE – Root Mean Square Error; MAE – Mean Absolute Error; MB – Mean Bias; O – Observation; M - Model; O_M – Observed Mean; M_M – Model Mean; SD – Standard Deviation
- Units for RMSE/MAE/MB/O_M/M_M/O_SD/M_SD: ppb

Emission QA/QC

We have checked the NEI2011 emission inventory prepared for CMAQ and found it to be reasonable. Plots of monthly mean SMOKE emissions (four sector) based on National Emission Inventory (NEI) 2011 is provided below. The Figure 1 showed NO emissions for Biogenic and mobile emissions, while NO_x emissions for two other sources. Point sources are integrated from surface to the 27th vertical layers.
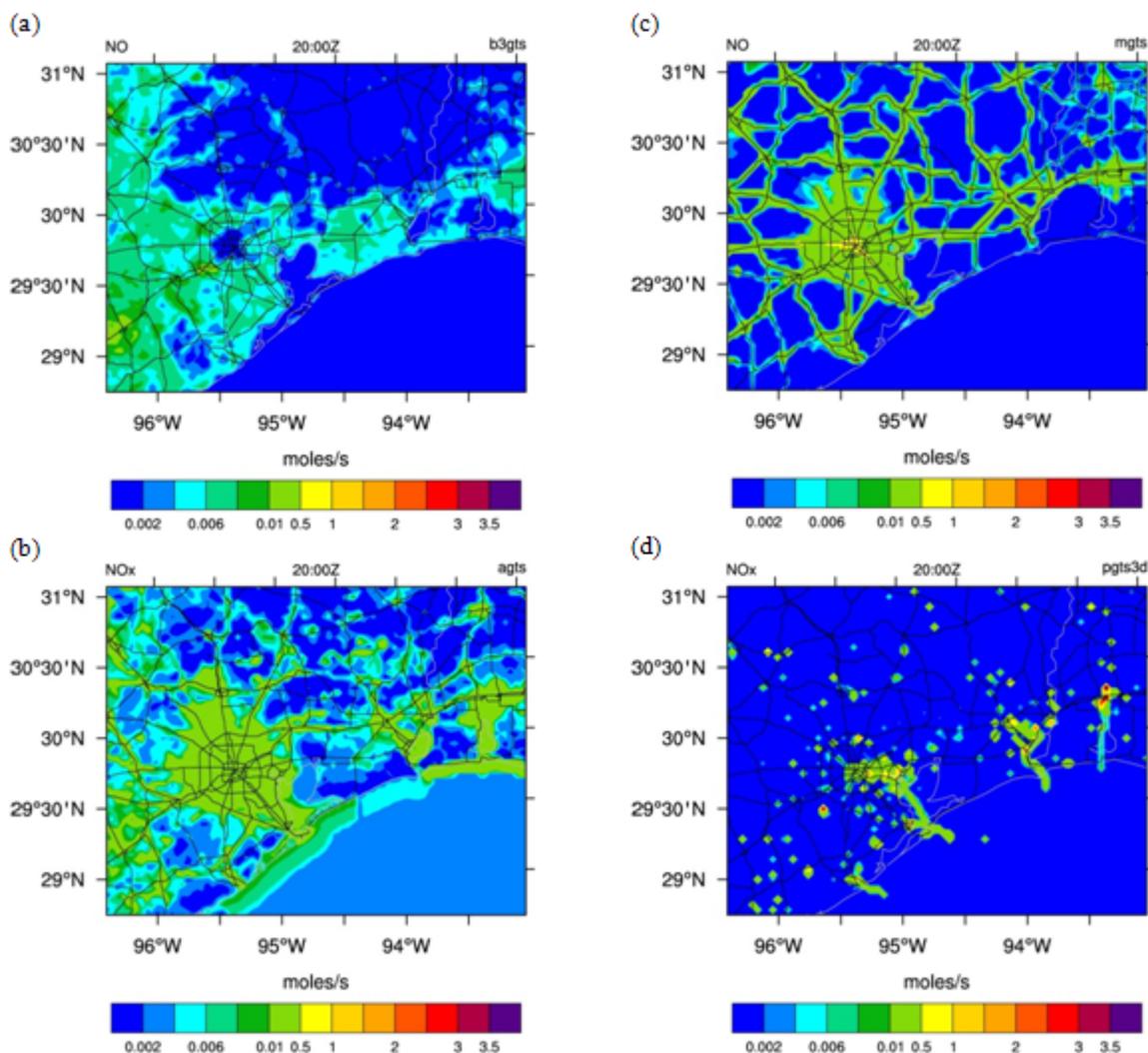

Figure 1: Monthly mean SMOKE four sector emissions based on National Emission Inventory (NEI) 2011: (a) biogenic (b) area (c) mobile (d) point source.

CMAQ and OMI NO₂ Comparison

After simulating CMAQ model by using NEI-2011 emissions, we once again removed the influences of a priori gas profile from OMI with new outputs and projected the resultant tropospheric OMI NO_2 on the same longitude-latitude grid defined in the model.

The results of tropospheric CMAQ NO_2 and OMI were shown in Figure 2. It demonstrated that simulated CMAQ NO_2 columns overpredicted in urban regions, but underpredicted in suburban/urban regions. This coincided with previous studies (e.g., Choi 2014) that simulated

CMAQ NO₂ columns with former emission inventory (i.e., NEI-2008) overestimated and underestimated NO₂ emission in urban and rural regions respectively. It seems that the CMAQ modeling with new emissions (NEI-2011) had a better performance to simulated NO₂ columns. However, still the discrepancies should be adjusted by inverse modeling.
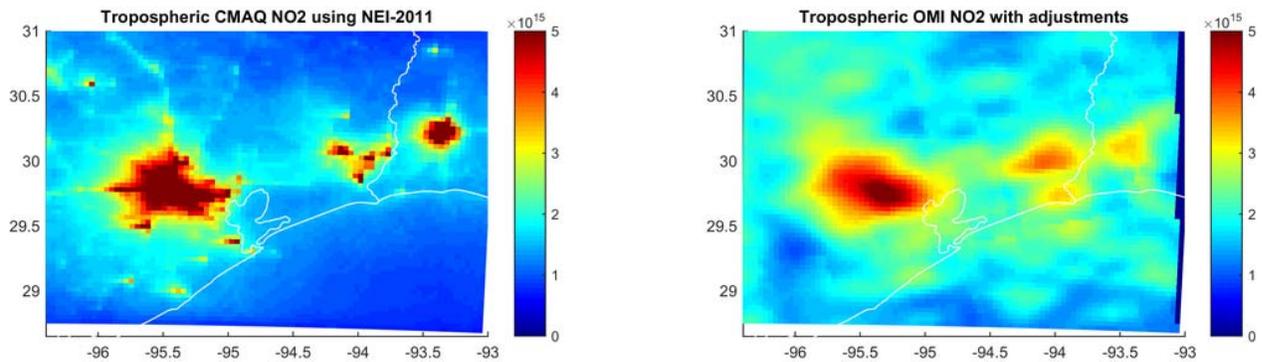

Figure 2: Comparison between CMAQ modeled NO₂ columns (average over September of 2013), left; and OMI NO₂ columns, right

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments

We have not encountered any problems in April.

Goals and Anticipated Issues for the Succeeding Reporting Period

We expect to finish new CMAQ evaluation using CAMS and aircraft data in May. Also, we plan to finish setting up an inverse modeling system and get posteriori NO_x emissions.

Detailed Analysis of the Progress of the Task Order to Date

The completion of each of the project tasks and the draft and final reports are expected to be on the schedule from the Work Plan schedule.

Submitted to AQRP by: Yunsoo Choi

Principal Investigator: Yunsoo Choi