AQRP Monthly Technical Report

PROJECT TITLE	A synthesis study of the role of mesoscale and synoptic-scale wind on the concentrations of ozone and its precursors in Houston	PROJECT #	18-010
PROJECT PARTICIPANTS	Qi Ying, John Nielsen-Gammon	DATE SUBMITTED	7/9/2019
REPORTING PERIOD	From: 6/1/2019 To: 6/30/2019	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

Task 1: Synthesis of mesoscale wind structures in the synoptic-scale context
Dr. John Nielsen-Gammon generated and examined trajectories for all the high ozone episodes in 2013 and 2016 (2012 had no profiler data). Based on those, Dr. Nielsen-Gammon chose episodes for further study and simulation based on the following criteria: ozone concentrations, multiple-day episodes, variety of background wind, and availability of other field observations. Dr. Gammon's postdoc David Coates completed the WRF simulations for the 3 episodes selected by Dr. Gammon. The two 2016 cases use the GFS FNL 0.25 degree resolution reanalysis data. The 2013 case was based the 1 degree resolution GFS FNL data.

Task 3: Analysis of the interaction of mesoscale winds and ozone formation during key episodes
CMAQ model-ready emissions are generated using SMOKE v3.7, which runs on the basis of EPA's NEI 2011v6.3 platform. We plan to regenerate the emissions using the 2014 and 2017 NEI for these episodes when time permits but currently we will use the 2011 emissions due to time constrains. Gridding surrogate profiles in U.S. and neighbor countries (Canada and Mexico) are generated by Spatial Allocator v4.3.1. The emissions of all three cases are processed with SAPRC07 mechanism speciation profile, which is updated to SPECIATE v4.5*. Emissions processing is split into 15 sectors including area, point, onroad, and biogenic emission sources, as well as 4 sectors of emissions from Canada and Mexico. Sector details are shown in the table. Point source sectors are processed to produce 3-D layered emission files, which contain 10 layers emission. Onroad mobile emission source is generated based on emission inventory pre-calculated by MOVES2014a model. Biogenic emissions process includes gridded land use – BELD v4.1, BIOSEASON, and biogenic emission factor files for input to BEIS v3.6.1 model. All emission sectors except biogenic sector are merged to generate final 3-D emission files for CMAQ running.

Preliminary Analysis

Based on the analysis of the wind profiler data, the following three episodes were selected. They all involve multiple stations exceeding the 8-hour standard, feature prominent wind rotation, but differ dramatically in the wind direction and shear. Thus, they should have different interactions between the background wind and sea breeze as well as different contributions from fresh and aged pollutants.

Case 1: September 25-26, 2013
Case 2: May 6-7, 2016
Case 3: July 21-22, 2016

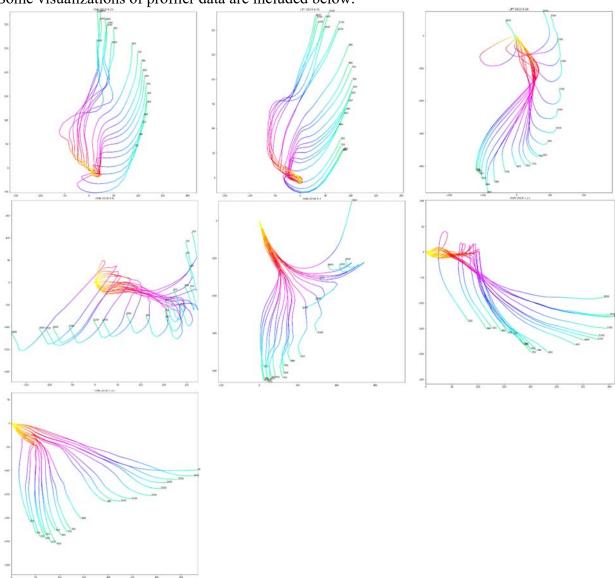Some visualizations of profiler data are included below.

Figure 1 24-hour back-trajectories ending at selected monitoring sites for the selected modeling episodes (color-coded by time). The level (m agl) of each back-trajectory is labeled on the trajectory endpoint.

Data Collected

No additional data were collected during this period.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments
None to report.

Goals and Anticipated Issues for the Succeeding Reporting Period

We plan to complete additional CMAQ simulations to analyzed the contributions of fresh and polluted pollutants in the next reporting period.

Detailed Analysis of the Progress of the Task Order to Date

Task 2 (source and age resolved model development) has been completed. Tasks 1 and 3 are currently underway. For Task 1, preliminary wind profiler analysis is completed and for Task 3, emissions have been generated and CMAQ simulation is currently underway. We believe that sufficient progress has been made in order to complete the project on time.

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

___Yes   _X__No

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

___Yes   __X_No

Do you have any bibliographic publications related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

___Yes   _X__No

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).
___Yes   _X__No

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

___Yes   _X__No

Submitted to AQRP by Qi Ying, on July 9, 2018.

Principal Investigator