

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	8/15/2019
REPORTING PERIOD	From: 7/1/2019 To: 7/31/2019	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

Task 1: Synthesis of mesoscale wind structures in the synoptic-scale context

WRF model simulations were conducted for the selected three episodes (September 15-29, 2013; April 25-May 9, 2016; July 10-July 25, 2016). Back-trajectory analysis were performed using WRF predicted wind field using different boundary layer parameterization to investigate the capability of the WRF model in resolving the recirculation patterns.

Task 3: Analysis of the interaction of mesoscale winds and ozone formation during key episodes

Continued from last month's work, we performed CMAQ simulations for the three episodes (September 15-29, 2013; April 25-May 9, 2016; July 10-July 25, 2016) that are expected to have interactions between background wind and sea breeze and different contributions from fresh and aged pollutants. Base case simulations are completed and age-resolved simulations are currently underway.

Preliminary Analysis

In the WRF simulations, each of the utilized PBL schemes does not seem to reliably produce the expected sea breeze circulation. The magnitudes of the instantaneous perturbation winds are around the magnitudes one would expect to see for the sea breeze circulation, i.e. nonzero wind speed at or below order 101 meters per second. The various PBL schemes, when they demonstrate the ability to produce perturbation winds that veer in time, do not reliably produce a boundary layer column that shows a phase shift with height associated with a low-level complete circulation, but rather the upper and lower boundary layers frequently are in-phase with each other. Often the simulated wind direction does not match the theoretically expected wind direction for a sea breeze circulation, and the wind direction along the coast does not meaningfully differ from the wind direction at grid points away from the coast in inland Texas. This implies that the CMAQ model might be able to reliably resolve the recirculation patterns along the coast. The implication of this still needs to be analyzed. CMAQ model predicted O₃

concentrations were compared with all the sites in the 4-km CMAQ domain. The predictions agree best with observations for the September 2013 episode.

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 hope to complete all CMAQ simulations in August.

Detailed Analysis of the Progress of the Task Order to Date

Task 1 and 2 are completed. For Task 3, nested simulations need to be conducted for age distributions of O₃ and precursors.

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 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 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 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 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 No

Submitted to AQRP by Qi Ying, on August 15, 2018.

Principal Investigator

A handwritten signature in black ink, appearing to read "C. J. Gray", written below the printed title "Principal Investigator".