

AQRP Monthly Technical Report

PROJECT TITLE	Spatial Mapping of Ozone Formation near San Antonio	PROJECT #	17-032
PROJECT PARTICIPANTS	Ezra Wood	DATE SUBMITTED	6/8/2017
REPORTING PERIOD	From: 5/1/2017 To: 5/31/2017	REPORT #	6

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 “Recruit Post-doc” has been accomplished. Additionally, Jessica Pavelec, a 4th year chemistry major at Drexel, started work in on April 3. Both the post-doc and undergraduate participated in the May field deployment in the greater San Antonio area.

Task 2 “Laboratory preparation” has been completed. Both the ECHAMP peroxy radical sensor and TD-CAPS organic nitrate instrument were tested in the laboratory, prepared for field deployment, and integrated into the Aerodyne Mobile Laboratory (AML). The main obstacle encountered was electrical noise encountered in the CAPS systems initially at Aerodyne during the integration. This noise was resolved in San Antonio.

Task 3 “Field Deployment” was completed from May 8 – 31 in and around San Antonio. The Aerodyne mobile laboratory deployed to the following three sites: 1. University of Texas at San Antonio (Northwest of the city), 2. Floresville, and 3. Mathis (near Corpus Christi). The Drexel ECHAMP and TD-CAPS instrument

Preliminary Analysis

Ozone production rates were calculated using the preliminary NO and peroxy radical measurements using the equation below:

$$P(O_3) \text{ (ppb/hr)} = k_{HO_2+NO}([HO_2]+[RO_2])[NO] \quad \text{Eq 1.}$$

where k_{HO_2+NO} is the bimolecular rate constant for the reaction between HO_2 and NO , which forms NO_2 (and O_3 following photolysis).

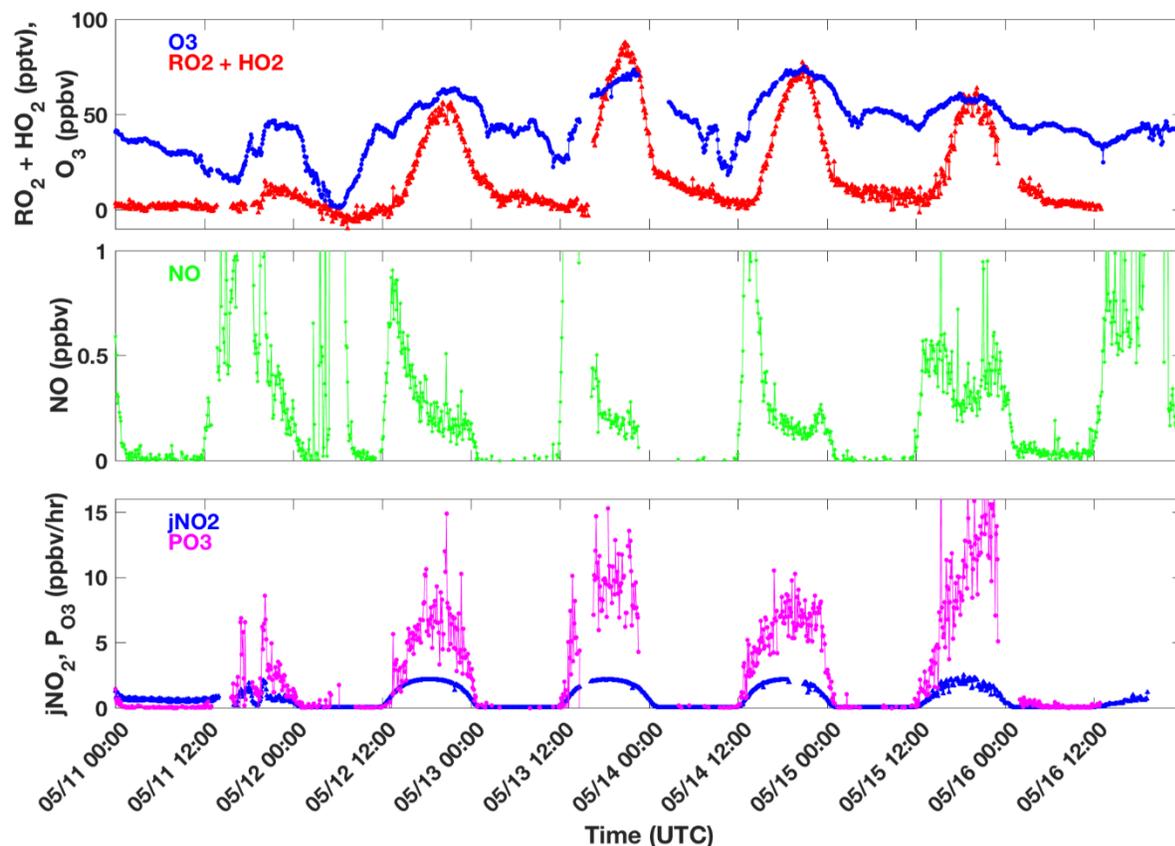
An example of these values from several days at the UTSA site are shown in the following section.

Data Collected

Total peroxy radicals ($[HO_2] + [RO_2]$) were successfully measured on almost all days (at least 80%), with occasional “down-time” due to instrument calibrations or instrument problems. Measurement of alkyl peroxy radicals only by using a nafion pre-inlet to selectively scrub HO_2 and hydroxy alkyl peroxy radicals was attempted twice. The first time was not useful due to emissions from upwind lawnmowing activity. The second time gave “odd” results that cannot be interpreted until we have conducted follow-on laboratory tests.

The TD-CAPS system for quantifying organic nitrates was challenged by low mixing ratios of alkyl nitrates and the difficulty of measuring these compounds on top of a time varying NO_2 concentration, which forms the background signal for the measurement. For the last few days of the field measurements this instrument switched to measuring the sum of peroxyacyl nitrates and alkyl nitrates, i.e. total organic nitrates, rather than just alkyl nitrates, in order to attain higher signal-to-noise ratios. Initial results are successful, with mixing ratios of 0.5 to 1 ppb of organic nitrates.

The graph below shows the preliminary $RO_2 + HO_2$, O_3 , NO , jNO_2 , and calculated $P(O_3)$ values from the first deployment at UTSA. $P(O_3)$ values were typically below 15 ppb/hr. Given the low NO mixing ratios (less than 0.5 ppb during the day) it is likely that ozone production was NO_x -limited during these days, but this will require confirmation by follow-up analysis.



Identify Problems or Issues Encountered and Proposed Solutions or Adjustments

Overall the quality of the RO₂ + HO₂ data is good, though follow-up calibrations in the laboratory at relative humidity values above 50% will help to reduce the measurement uncertainty.

Goals and Anticipated Issues for the Succeeding Reporting Period

The follow-on calibrations will be conducted during the month of June, with a goal to finalize the May dataset by August.

Detailed Analysis of the Progress of the Task Order to Date

Task 1 “Recruit Post-doc”, Task 2 “Laboratory Preparation”, and Task 3 “Field Deployment” have been completed. Task 4 “Follow-up laboratory work” and Task 5 “Data work-up and analysis” will commence in June. Task 6 “Project Reporting and Presentation” are partially complete but will continue until the end of the project.

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

Ezra Wood,
Principal Investigator