

# AQRP Monthly Technical Report

<b>PROJECT TITLE</b>	Characterization of Corpus Christi and San Antonio Air Quality During the 2020 Ozone Season	<b>PROJECT #</b>	20-003
<b>PROJECT PARTICIPANTS</b>	Robert Griffin, Rice James Flynn and Yuxuan Wang, UH Rebecca Sheesley and Sascha Usenko, Baylor	<b>DATE SUBMITTED</b>	10 June 2021
<b>REPORTING PERIOD</b>	<b>From:</b> 1 May 2021 <b>To:</b> 31 May 2021	<b>REPORT #</b>	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 15<sup>th</sup> of the month following the reporting period shown above.

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## Detailed Accomplishments by Task for reporting period

Work performed in this month was related to Task #2, campaign performance. The Mobile Air Quality Laboratory 2 (MAQL2) was deployed in San Antonio over the period of May 1 to May 19, 2021. From May 1 until May 12, 2021, the MAQL2 sampled in stationary mode near downtown. From May 13 until May 19, 2021, the MAQL2 sampled downwind of San Antonio (to the northwest), including at and near the campus of the University of Texas at San Antonio (for comparison to measurements made in 2017). For mobile measurements, drive plans were constructed the day before based on weather and air quality forecasts. During this entire period, all instruments were maintained, zeroed, and calibrated as appropriate and as needed; required field upgrades included a camera on the front of the inlet box and a new computer for the trace gas data acquisition. Daily data checks were performed. On May 19, 2021, the MAQL2 sampling ceased, and all instrumentation was moved back to Baylor University in Waco, TX. Additional work was performed for Task #3, data analysis, as described in the Preliminary Analysis section below.

Task #3 also includes three-dimensional modeling. Over the reporting period, this included continued implementation of larger-scale GEOS-Chem outputs as boundary conditions to drive the WRF-GC model and preparing emission files for the fine-resolution WRF-GC runs to be performed as part of this project. This work is a continuation of that reported last month.

## Preliminary Analysis

Data collected during both the current and the preceding reporting period have undergone ‘field-level’ analysis, which is aimed at ensuring appropriate operation of the instrumentation and enabling near real-time comparisons between instruments. Preliminary findings indicate that off-shore activities including shipping in the Gulf of Mexico and biomass burning in Central America impact the air quality being transported into the Texas coast at Corpus Christi. Local

emissions and chemical processing appear to affect strongly the air that is transported downwind in both San Antonio and Corpus Christi. The final QA/QC of these data was initiated during this reporting period and indicates excellent temporal coverage and minimal gaps in the data time series over the entire seven-week campaign.

Preliminary figures for trace gases from various periods of the campaign are shown below as illustrations of the type of data that has been generated; again, it must be emphasized that the data have not undergone final QA/QC so no statistical analyses are presented here. The figures show portable measurements in Corpus Christi on April 20, 2021 (Figure 1); an extended period of stationary measurements from April 8 through April 15, 2021, in Corpus Christi (Figure 2); and campaign mobile measurements to indicate the spatial scale of the mobile activities and the range/spatial variability of the concentrations observed (Figure 3).

Figure 1 shows the strong influence of wind direction (land/sea breeze) on pollutant concentrations in Corpus Christi, with a transition in wind direction and speed occurring at approximately 430am and again at approximately 830am. Note the corresponding changes in temperature (Temp), relative humidity (RH), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), ozone (O<sub>3</sub>), total reactive nitrogen (NO<sub>y</sub>), total nitrogen oxides (NO<sub>x</sub>), and nitric oxide (NO). The influence of local rush hour also can be observed after 7am in the NO<sub>y</sub>, NO<sub>x</sub>, and NO time series.

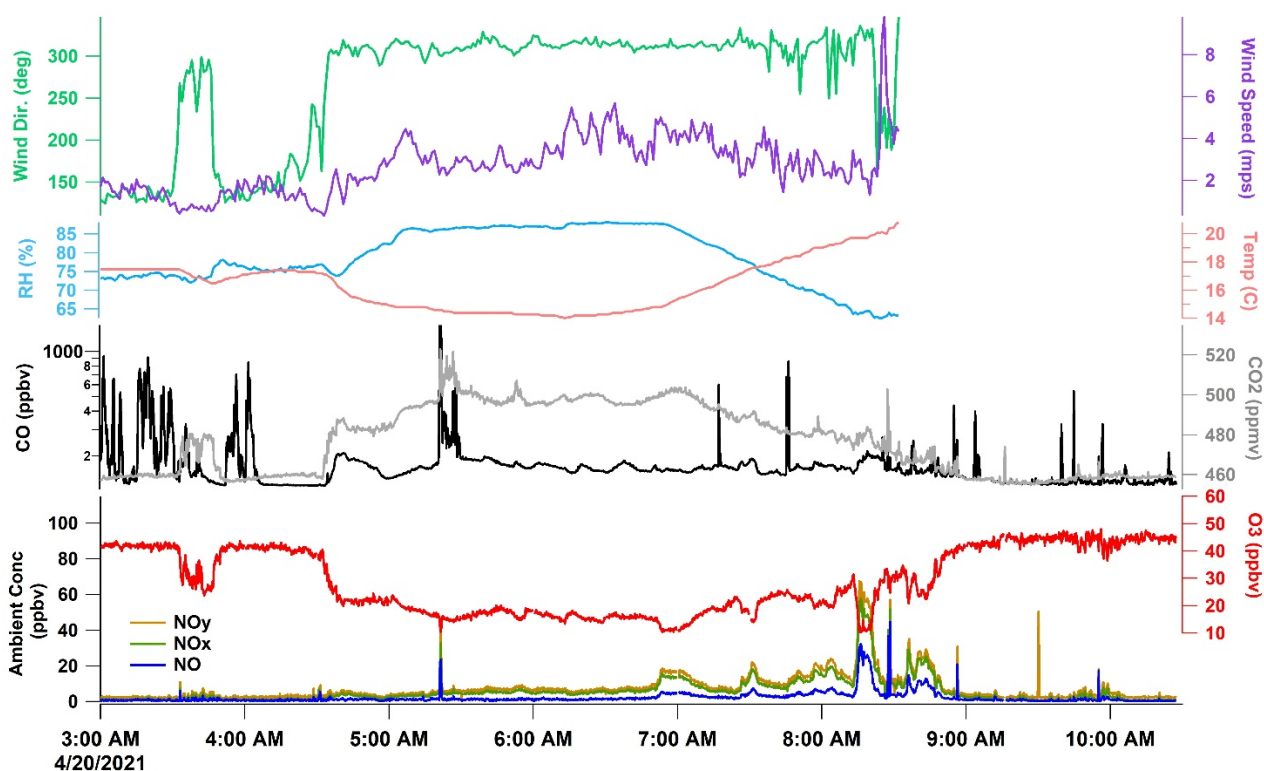


Figure 1. Trace gas and meteorological measurements made during the morning of April 20, 2021, in Corpus Christi during a Bay Breeze/Sea Breeze event.

Figure 2 shows the data time series for the same pollutants considered in Figure 1 but over a one-week period (April 8-15, 2021), during which the MAQL2 was stationary in Corpus Christi. The

time series for all six pollutants exhibit strong variability, with plumes obvious from large spikes in CO and CO<sub>2</sub>. The nitrogen-containing species show strong diurnal character, except on April 9 and 10, 2021 (a Friday and a Saturday), which show very low mixing ratios. The O<sub>3</sub> levels during this period are in the range of approximately 20 to 60 ppbv, values which do not indicate very strong photochemical activity or complete titration of O<sub>3</sub> during overnight periods.

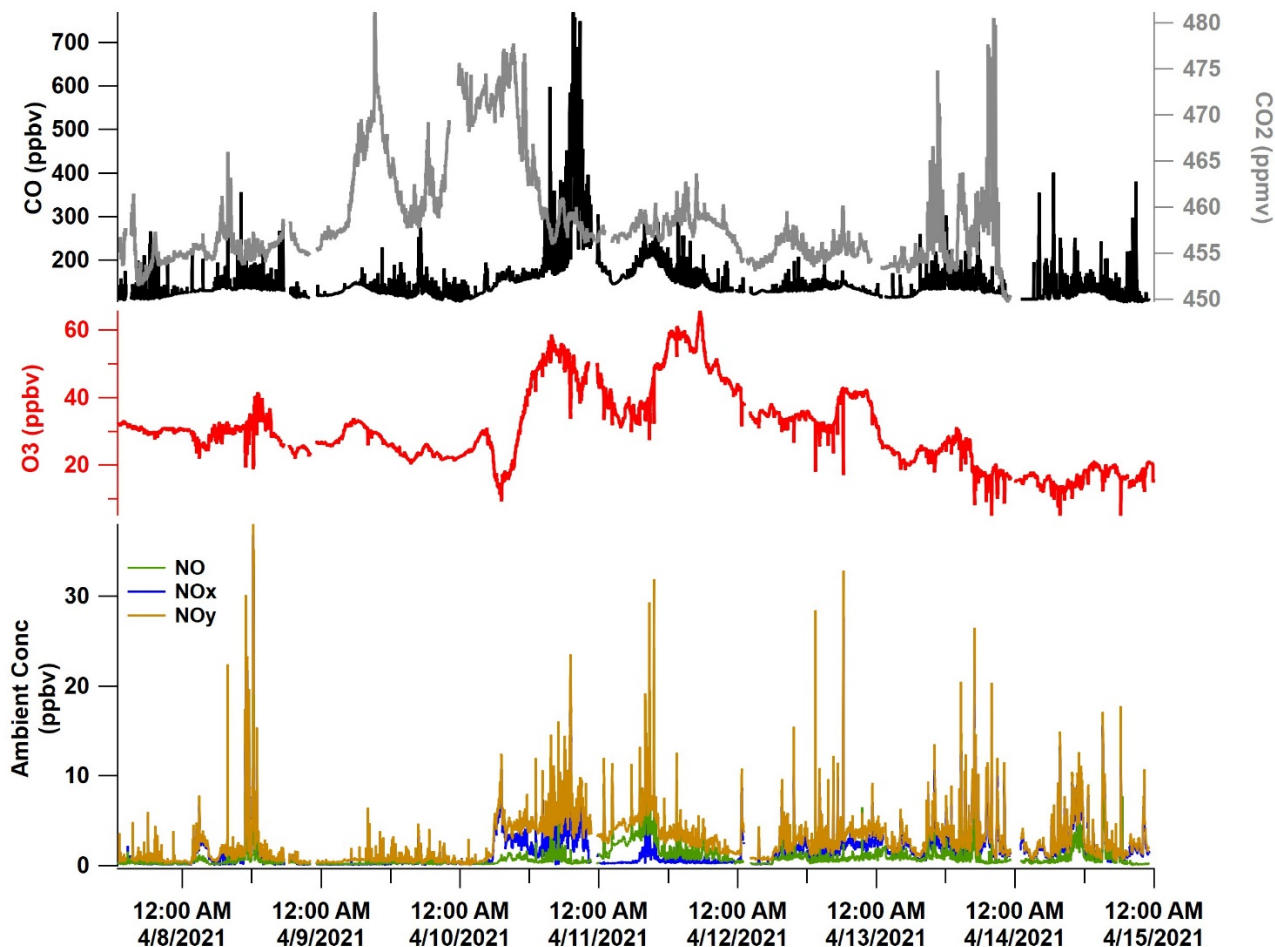


Figure 2. Trace gas measurements during an extended stationary period (April 8-15, 2021) in Corpus Christi.

Figure 3 shows the spatial extent of mobile operations across the entire campaign. The colored traces at the bottom right of the figure indicate the metropolitan Corpus Christi region, and those at the top left of the figure indicate the metropolitan San Antonio region. The ‘loops’ in the middle of the figure indicate areas in close proximity to the Eagle Ford Shale. As illustrative examples, the panels in Figure 3 show the range of all data collected during mobile operations. If data were collected at a given location more than once, the data showing the largest value are shown. The pollutant mixing ratios for all species (the same as shown in previous figures) show large ranges: 0 to 10 ppbv for both NO and total NO<sub>x</sub>, 0 to 25 ppbv for NO<sub>y</sub>, 0 to 60 ppb for O<sub>3</sub>, 100 to over 700 ppbv for CO, and 450 to 520 ppbv for CO<sub>2</sub>. It should be noted that these values include on-highway measurements. Figure 3 indicates that the concentrations of these specific compounds near the Eagle Ford Shale are very small.

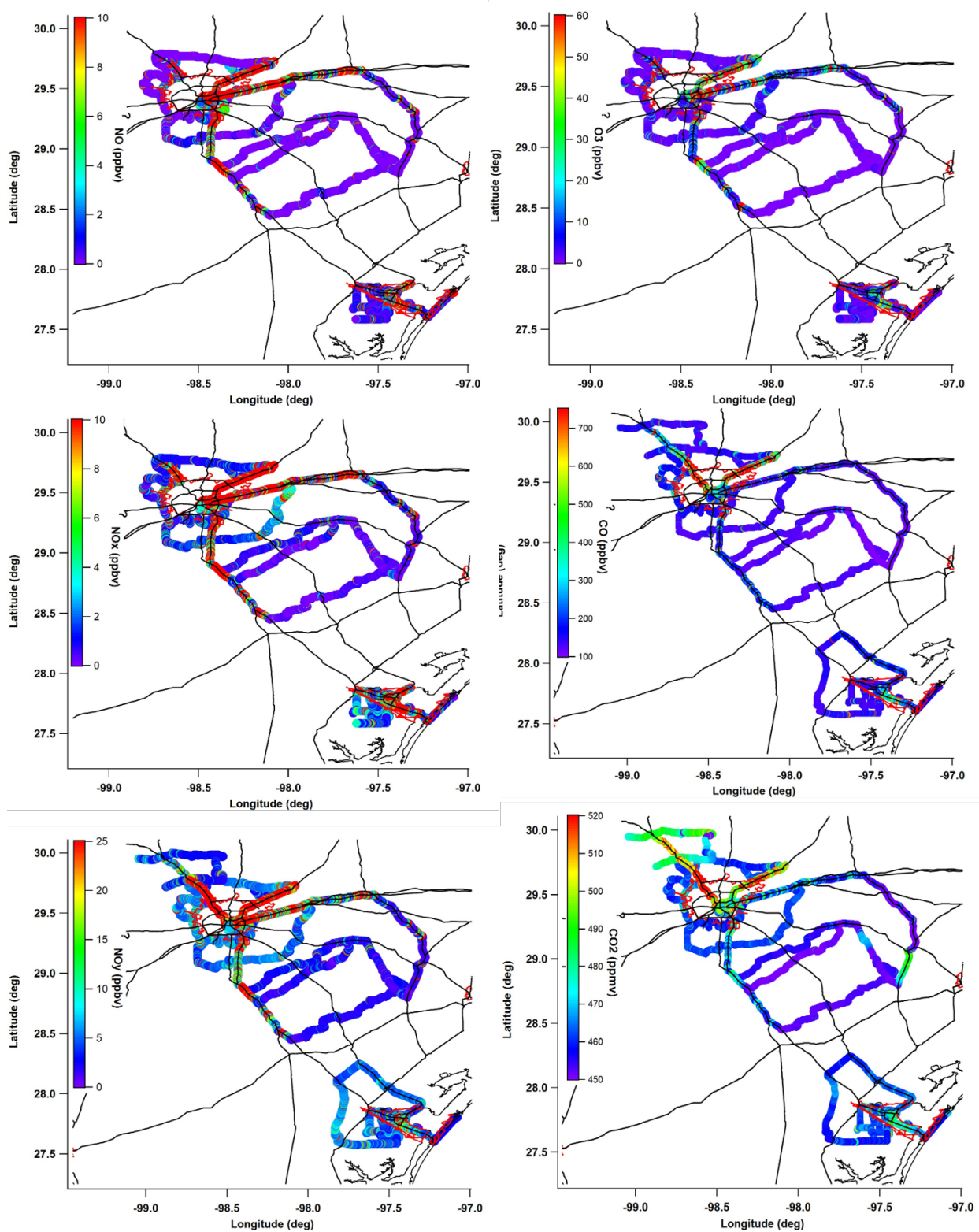


Figure 3. Trace gas measurements during mobile periods across the entire campaign.

## **Data Collected**

Seven weeks' worth of preliminary air quality measurements including particle size, composition and concentration; volatile organic compound composition and concentration; trace gas concentration; and meteorological parameters has been collected. During mobile measurements, GPS position data also were collected to allow assigning specific pollutant measurements at a given time to a given point in space.

## **Identify Any Problems or Issues Encountered and Proposed Solutions or Adjustments**

As referenced in the previous monthly reports, delays in finalizing task orders and issues associated with the COVID pandemic necessitated shifting the field work from fall 2020 to spring 2021. With approval from the AQRP, we adjusted and added to the scientific questions to be addressed using our field data analysis and modeling. Note that a few individuals from the Baylor group were forced to quarantine due to potential exposure to COVID-19. This resulted in some delays, but the group worked diligently to catch up. There also were delays caused by the winter storm that hit Texas in mid-February, preventing access to laboratories for essentially a week. The teams again worked hard to make up for that lost time. Baylor also experienced delays in receiving equipment and supplies; the most noticeable were the tower (3 weeks delay), TAPs (2 weeks delay), and PTR-MS heated sampling line (3 weeks delay). These delays were a result of COVID-related logistical hurdles (based on personnel communication with vendors). The team members worked extremely hard to be ready to deploy to the field as of April 1, which was done successfully.

## **Goals and Anticipated Issues for the Succeeding Reporting Period**

Model: Continue generation of appropriate input files for three-dimensional modeling efforts, continued training of researchers on use of the three-dimensional model, initial modeling runs on field campaign (April and May 2021) time periods.

Field: Continue in-depth data analysis

No issues are anticipated.

## **Detailed Analysis of the Progress of the Task Order to Date**

Given the late start and the approved change in project field work, we believe that our progress on the project has been appropriate. Tasks #1 (campaign preparation) and #2 (campaign performance) are complete. Task #3 (data analysis) will continue through 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 (ie: publications that cite the project) 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

Introduction to TRACER-MAP and the Mobile Air Quality Laboratory (MAQL2), with a case study from the Texas coast 2021, for presentation at the DOE ARM meeting. Already shared with and approved by TCEQ.

**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

**Have any personnel changes occurred that were not listed in the original proposal? If so, please include a detailed description of the personnel change(s) below.**

Yes       No

**Are any delays expected in the progress of the research? If so, please include a detailed description of the potential delay below.**

Yes       No

See response above regarding problems encountered. This is more a shift in timing as it will not impact our ability to complete the project by the scheduled end date, assuming no further delays associated with COVID-19. No further delays are expected.

**Describe any possible concerns/issues (technical or non-technical) that AQRP should be made aware of.**

None not addressed previously.

**Are you anticipating using all the available funds allocated to this project by the end date? If not, why and approximately what is the amount to be returned?**

**Yes**       **No**

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Submitted to AQRP by      Robert J. Griffin