Texas Air Quality Research Program
Priority Research Areas
2018-2019

The goals of the State of Texas Air Quality Research Program (AQRP) are:

(i) to support scientific research related to Texas air quality, in the areas of emissions inventory development, atmospheric chemistry, meteorology and air quality modeling,

(ii) to integrate AQRP research with the work of other organizations, and

(iii) to communicate the results of AQRP research to air quality decision-makers and stakeholders.

For the 2018-2019 biennium, the priority areas for AQRP research are:

- **2017 San Antonio Field Study (SAFS) data analysis.** Measurements made during the 2017 SAFS have not been fully analyzed. The AQRP seeks projects to complete the analysis of the new measurement data to answer questions about the emission source categories that contribute to high ozone in San Antonio. Investigators are encouraged to collaborate and share data with other SAFS participants.
    - Which emission source categories affect ozone formation in San Antonio during May-June time periods and compare available data during other time periods that are above the current ozone standard concentration?
        - How much do the different source categories contribute to the peak concentrations observed?
        - How much do upwind source categories contribute?
        - Can contributing source categories be identified and quantified from measurement data alone?

- **Emissions inventory improvements for international sources likely to impact Texas**. Given the strong interest in quantifying international contributions to ozone, particulate matter, and haze in the U.S., concern with the accuracy of international emissions inventories has intensified in the last few years. Global inventories such as Hemispheric Transport of Air Pollution (HTAP) and Emissions Database for Global Atmospheric Research (EDGAR) are generally suitable for global scale modeling, but not for intermediate-range transport analyses (i.e. transport between neighboring or nearby countries), because many components lack the necessary spatial and temporal resolution and are often based on outdated information.
    - Significant improvements to the existing emissions inventories would be of great value to characterizing air pollution affecting Texas and the rest of the U.S. *Inventory improvements of greatest interest are for emission sources in Mexico, Central America, and the Caribbean, including both terrestrial and offshore emissions.*

- Projects should focus on multiple data sources to better characterize emissions inventories of multiple pollutants from multiple source categories. Specific focus should be on improving emissions estimates, and comparing the refined estimates to other emission data sources (e.g., HTAP, EDGAR). Currently, the TCEQ is directly funding a project to use satellite data to set constraints on the NO_x emissions inventory in Mexico. Proposed projects should not duplicate that work and should build upon it.

- **Sensitivity of modeling results to uncertainties in model inputs.** Develop new tools and methodologies or find innovative ways to apply existing tools, such as DDM, HDDM, Process Analysis, etc., to estimate the sensitivities of photochemical grid modeling results to uncertainties in model inputs. Projects should focus on the development of tools and applications that are easily portable and scalable. i.e., tools and applications that can be easily utilized by the modeling community for practical research and policy development purposes.
    - An example would be using higher-order decoupled direct method (HDDM) on a supercomputer or cloud-computing system to comprehensively investigate the effects of emissions and other uncertainties on photochemical grid modeling results. The immense computational demands of a near-comprehensive investigation of model uncertainties have made this type of investigation rare. Researchers should evaluate the uncertainties in modeled output due to uncertainties in emissions, chemical mechanism parameters, or other uncertainties identified by the project. The results of these model runs would be superior to brute force zero-out runs, which can have important inaccuracies due to the non-linearity of the model responses. Results from a large-scale sensitivity project could be used to determine how to prioritize future research projects to get the most benefit per research dollar.
    - The projects should focus on the impacts of uncertainties in multiple inputs, and how their interactions affect modeling results and in addition provide code to modify the model so that less powerful computing systems can use the full capabilities of the HDDM or develop other sensitivity analysis tools that are less resource-intensive.

- **El Paso projects** Although the area currently attains the ozone and particulate matter (PM) National Ambient Air Quality Standards (NAAQS), pollutant concentrations remain near the standards. Additional monitoring and data analysis would help understand the causes of high ozone and particulate matter that are sometimes observed. In addition, modeling El Paso is a challenge, due to the complex terrain, and the emissions from Juarez. Projects that would improve ozone and PM simulations in El Paso would be also useful.
    - Investigate how local meteorology in the El Paso airshed may impact pollutant transport, formation, and accumulation. Identify the meteorological conditions suitable for high ozone. Since El Paso's local meteorology is dominated by complex terrain and nocturnal inversions in the Rio Grande River valley, study of the vertical profiles of wind, temperature, and/or ozone would be useful.

- Deploy new monitoring technologies for quantifying particulate matter composition on a continuous or frequent basis (i.e. quicker than current filter methods). Instrumentation that could quantify elemental (black) and organic (brown) carbon would be particularly useful, so that researchers can determine when wildfires are playing an important role in El Paso pollutant concentrations. This project would be a proof-of-concept study.

- **Distinguishing between local and regional transport and ozone formation in southeast Texas, through analysis of the inertial oscillation that leads to clockwise rotation of wind direction in southeast Texas during ozone season**. High ozone forms in Houston on days with low synoptic-scale winds and mesoscale recirculation. Although there have been previous studies of the Gulf breeze, the bay breeze, the inertial oscillation, the growth of the boundary layer, and the low-level jet in the Houston area, there has not yet been a comprehensive synthesis of the available, relevant data and analyses that would allow the mesoscale and synoptic-scale wind and pollutant behavior to be properly explained. A better understanding of the synoptic and mesoscale processes affecting wind circulation during ozone season would allow investigators to distinguish between days dominated by local effects and those dominated by regional effects.
    - Analyze data from field campaigns in 2000, 2006, 2009, and 2013, including vertical wind and pollutant data, along with other datasets collected in the Houston area and throughout southeast Texas, and synthesize results to explain the role of mesoscale and synoptic-scale winds on pollutant concentrations in the Houston area.

- **Identify and evaluate new activity data inputs** (e.g., most recent 5 years) for mobile sources in Texas to improve existing emission inventories. New geolocation data sources are becoming increasingly available, and may be useful for improving emission inventories for on-road, non-road, commercial marine, and rail. The AQRP seeks projects to identify these new sources of activity data and apply them to existing inventories using new techniques or analytics. One critical consideration is protection of privacy. Therefore, data sources should not contain information that would allow identification of specific individuals. Additionally, analysis of the new technology data should compare existing activity data sets used by the State of Texas for developing emission inventories. This comparison should identify if the new activity data sets are potentially an improvement over those currently being used. The project should describe how are they better and what impact will their use have on state and regional emission inventories and quantify the improvement to the extent possible. This project is NOT seeking new data collection but currently available new technology data.
    - Example for non-road construction equipment: Is GPS location data currently available that could allow for identification of equipment to determine when and where they are in use?

- **Advance the understanding of the sensitivity** of Texas modeled ozone levels to soil NO emissions and changes in BVOC emissions. Studies should incorporate both data from mesoscale weather networks and modeling. Studies should offer concrete advice and guidance on how to accurately estimate biogenic soil NO emissions for photochemical grid modeling applications, along with the realistic error and broad cost estimates for such an approach or differences in approaches.

- **Perform high quality measurements of emission factors** for monoterpenes, isoprene, sesquiterpenes, and stress compounds for common eastern Texas vegetation types. The emphasis should be upon species/genera that are widely distributed in the eastern half of Texas but located in areas that could affect Houston, Dallas-Fort Worth, or San Antonio. There should also be greater emphasis upon species/genera for which there are little previous data. The measurements should be suitable for updating emission factors in biogenic VOC emission models.