AIR QUALITY RESEARCH PROGRAM

Texas Commission on Environmental Quality
Contract Number 582-10-94300
Awarded to The University of Texas at Austin

Annual Report

September 1, 2012 through August 31, 2013

Submitted to

David Brymer
Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, TX 78753

Prepared by

David T. Allen, Principal Investigator
The University of Texas at Austin
10100 Burnet Rd. MC R7100
Austin, TX 78758

October 4, 2013

Texas Air Quality Research Program

Annual Report

September 1, 2012 – August 31, 2013

Overview

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.

On April 30, 2010, the Texas Commission on Environmental Quality (TCEQ) contracted with the University of Texas at Austin to administer the AQRP. For the 2010-2011 biennium, the AQRP had approximately $4.9 million in funding available. Following discussions with the TCEQ and an Independent Technical Advisory Committee (ITAC) concerning research priorities, the AQRP released its first request for proposals in May, 2010. Forty-five proposals, requesting $12.9 million in research funding were received. After review by the ITAC for technical merit, and by the TCEQ for relevancy to the State's air quality research needs, the results of the reviews were forwarded to the AQRP's Advisory Council, which made final funding decisions in late August, 2010. A total of 15 proposals were selected for funding. As of November 30, 2011, all projects have been completed. Final reports on all but one project have been posted to the AQRP website.

In June 2011, the TCEQ renewed the AQRP for the 2012-2013 biennium. Funding of $1,000,000 for the FY 2012 period was awarded in February 2012. An additional $1,000,000 for the FY 2013 period was awarded in June 2012. At the same time an additional $160,000 was awarded for FY 2012, to support funding for two specific air quality projects recommended by the TCEQ. A call for proposals was released in May 2012. Thirty-two proposals, requesting $5 million in research funding were received. The proposals were reviewed by the ITAC and the TCEQ. The Advisory Council selected 14 projects for funding. Contracts have been signed with each organization and work plans have been approved, Task Orders are in place and work has begun on all projects.

In June 2013, the TCEQ renewed the AQRP for the 2014-2015 biennium via Amendment 9 of the Grant. At this time the TCEQ also awarded an additional $2,500,000 in FY 2013 funds to the AQRP. 10 % of these funds were allocated for Project Administration, and the remaining funds were allocated to the Research program. Initiated by the renewal, the AQRP developed the FY 2014/2015 research priorities and submitted them to the ITAC for input and to the TCEQ for review. A RFP is planned to be released in October 2013.

BACKGROUND

Section 387.010 of HB 1796 (81^{st} Legislative Session), directs the Texas Commission on Environmental Quality (TCEQ, Commission) to establish the Texas Air Quality Research Program (AQRP).

> Sec. 387.010. AIR QUALITY RESEARCH. (a) The commission shall contract with a nonprofit organization or institution of higher education to establish and administer a program to support research related to air quality.
>
> (b) The board of directors of a nonprofit organization establishing and administering the research program related to air quality under this section may not have more than 11 members, must include two persons with relevant scientific expertise to be nominated by the commission, and may not include more than four county judges selected from counties in the Houston-Galveston-Brazoria and Dallas-Fort Worth nonattainment areas. The two persons with relevant scientific expertise to be nominated by the commission may be employees or officers of the commission, provided that they do not participate in funding decisions affecting the granting of funds by the commission to a nonprofit organization on whose board they serve.
>
> (c) The commission shall provide oversight as appropriate for grants provided under the program established under this section.
>
> (d) A nonprofit organization or institution of higher education shall submit to the commission for approval a budget for the disposition of funds granted under the program established under this section.
>
> (e) A nonprofit organization or institution of higher education shall be reimbursed for costs incurred in establishing and administering the research program related to air quality under this section. Reimbursable administrative costs of a nonprofit organization or institution of higher education may not exceed 10 percent of the program budget.
>
> (f) A nonprofit organization that receives grants from the commission under this section is subject to Chapters 551 and 552, Government Code.

The University of Texas at Austin was selected by the TCEQ to administer the program. A contract for the administration of the AQRP was established between the TCEQ and the University of Texas at Austin on April 30, 2010 for the 2010-2011 biennium, and was renewed in June 2011 for the 2012-2013 biennium. Consistent with the provisions in HB 1796, up to 10% of the available funding is to be used for program administration; the remainder (90%) of the available funding is to be used for research projects, individual project management activities, and meeting expenses associated with an Independent Technical Advisory Committee (ITAC).

RESEARCH PROJECT CYCLE

The Research Program is being implemented through a 9 step cycle. The steps in the cycle are described from project concept generation to final project evaluation for a single project cycle.

1.) The project cycle is initiated by developing (in year 1) or updating (in subsequent years) the strategic research priorities. The AQRP Director, in consultation with the ITAC, and the TCEQ, develop research priorities; the research priorities are released along with a Request for Proposals.

2.) Project proposals relevant to the research priorities are solicited. The Request for Proposals can be found at http://aqrp.ceer.utexas.edu/ .

3.) The Independent Technical Advisory Committee (ITAC) performs a scientific and technical evaluation of the proposals.

4.) The project proposals and ITAC recommendations are forwarded to the TCEQ. The TCEQ evaluates the project recommendations from the ITAC and comments on the relevancy of the projects to the State's air quality research needs.

5.) The recommendations from the ITAC and the TCEQ are presented to the Council and the Council selects the proposals to be funded. The Council also provides comments on the strategic research priorities.

6.) All Investigators are notified of the status of their proposals, either funded, not funded, or not funded at this time, but being held for possible reconsideration if funding becomes available.

7.) Funded projects are assigned a Project Manager at UT-Austin and a Project Liaison at TCEQ. The project manager at UT-Austin is responsible for ensuring that project objectives are achieved in a timely manner and that effective communication is maintained among investigators involved in multi-institution projects. The Project Manager has responsibility for documenting progress toward project measures of success for each project. The Project Manager works with the researchers, and the TCEQ, to create an approved work plan for the project.

   The Project Manager also works with the researchers, TCEQ and the Program's Quality Assurance officer to develop an approved Quality Assurance Project Plan (QAPP) for each project. The Project Manager reviews monthly, annual and final reports from the researchers and works with the researchers to address deficiencies.

8.) The AQRP Director and the Project Manager for each project describe progress on the project in the ITAC and Council meetings dedicated to on-going project review.

9.) The project findings are communicated through multiple mechanisms. Final reports are posted to the Program web site; research briefings are developed for the public and air quality decision makers; and a bi-annual research conference/data workshop is held.

Steps 1 – 9 have all been completed for the initial (2010-2011) biennium. Steps 1 – 6 have been completed for the 2012 – 2013 biennium, and steps 7 and 8 are in progress. A summary of the 2012-2013 activities is described in the Project Timeline section of this report.

Independent Technical Advisory Committee (ITAC)

The AQRP funding is used primarily for research projects, and one of three groups responsible for selecting the projects is the Independent Technical Advisory Committee (ITAC). The ITAC, composed of up to 15 individuals and alternates with scientific expertise relevant to the Program, is charged with recommending technical approaches, and establishing research priorities. Initially, the ITAC was to meet at least twice per year at locations rotating between Austin, Dallas and Houston. As the Program proceeded, it was more efficient for the ITAC to meet once in Austin and as needed via conference call/webinar. Generally, the meetings in Austin are dedicated to new project review, reviewing progress on funded projects, and reviewing the Program's strategic plan.

Members of the ITAC consist of the TCEQ Project Director (or designee), representatives with air quality expertise from research institutions with extensive expertise in air quality research in Texas. The members of the ITAC are drawn from Texas universities active in air quality research, national laboratories that have participated in air quality studies in Texas, and institutions that have expertise not available in Texas and that have participated in air quality studies in Texas. The members of the ITAC are listed in Table 1.

As the ITAC membership is intentionally drawn from air quality researchers who have experience in Texas; these researchers and their colleagues will likely have interest in responding to the requests for research proposals issued by the AQRP. This raises potential confidentiality and conflict of interest issues, and the contract between TCEQ and the University of Texas requires that the AQRP shall maintain and implement an appropriate written policy on conflict of interest. Specifically for the ITAC, all members are required to certify:

> *Confidentiality:* As a member of ITAC I understand that I will have access to proposals submitted to the Air Quality Research Program. Subject to any legal requirements, I agree to keep the information in these proposals confidential until the selection process is completed and it is appropriate to release information to the public. I understand that there may be certain information that comes to me in my role as a member of ITAC that retains its confidential nature even after the process is concluded. I also understand that I will review said proposals and may have access to the reviews made by other ITAC members. I agree to keep these reviews and the identity of the reviewers confidential until such time as this information is released to the public. (NOTE: For the reviews and reviewers, this information may never be released.)

> *Conflict of Interest:* As a member of ITAC, I agree that I will not evaluate, comment on, or vote on proposals in which I or my home institution is involved, including but not limited to, any financial interest, or in which I have another form of conflict of interest. I understand that ITAC members with conflicts of interest must leave the meeting room or the conference line when a proposal with which they have a conflict is discussed, voted on or otherwise being considered. I understand that I must recuse myself from participating in or attempting to influence at any time the ITAC's or the AQRP Council's consideration or decision concerning such proposals. I agree to bring any issues concerning a possible conflict of interest to the attention of the Director of the Air Quality Research Program or the TCEQ Project Director. If there is a question of interpretation regarding whether a conflict of interest exists, I agree that the decision regarding whether a conflict of interest exists will be made by the Director of the Air Quality Research Program or the TCEQ Project Director.

All members of the ITAC agreed to abide by these conflict of interest and confidentiality provisions prior to participating in the review of proposals.

Table 1: Members of the Independent Technical Advisory Committee

Name	**Title**	**Organization**
David Allen	Gertz Regents Professor in Chemical Engineering	The University of Texas at Austin
Peter Daum	Head, Atmospheric Science Division	Brookhaven National Lab
Mark Estes	Senior Air Quality Scientist Air Modeling and Data Analysis Section	Texas Commission on Environmental Quality
Fred Fehsenfeld	Senior Scientist, Cooperative Institute for Research in Environmental Sciences	University of Colorado - Boulder
Sarwar Golam	Research Physical Scientist, Atmospheric Modeling and Analysis Division, Office of Research and Development	U.S. Environmental Protection Agency
Robert Griffin	Associate Professor, Civil and Environmental Engineering	Rice University
Tho (Thomas) Ching Ho	Chairman, Dan F. Smith Dept. of Chemical Engineering	Lamar University
Kuruvilla John	Professor of Mechanical and Energy Engineering Associate Dean for Research and Graduate Studies	University of North Texas
Barry Lefer	Associate Professor, Department of Earth and Atmospheric Sciences	The University of Houston
John Nielsen-Gammon	Professor and Texas State Climatologist Center for Atmospheric Chemistry and the Environment	Texas A&M University
David Parrish	Program Lead, Tropospheric Chemistry, NOAA/ESRL/Chemical Sciences Division	National Oceanic and Atmospheric Administration
Jay Turner	Associate Professor of Energy, Environmental and Chemical Engineering	Washington University in St. Louis
William Vizuete	Associate Professor, Gillings School of Global Public Health	The University of North Carolina at Chapel Hill
Christine Wiedinmyer	Scientist II, Atmospheric Chemistry Division	Nation Center for Atmospheric Research
Greg Yarwood	Principal	Environ

TCEQ Relevancy Review

Once the ITAC has reviewed and ranked research project proposals according to technical merit, they are submitted to the TCEQ for a relevancy review. The TCEQ reviews proposals for relevancy to the State's air quality research needs. TCEQ approval is required for a project to receive funding from the Program.

Advisory Council

The final group responsible for selecting AQRP research projects is the Advisory Council. The Council consists of up to 11 members, all residents of the State of Texas. Two Council members with relevant scientific expertise are nominated by the TCEQ. As defined in the AQRP contract, up to four members of the Council can be county judges from the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) non-attainment counties. Additional members include government officials from Texas Near-Non-Attainment Areas active in air quality management. The purpose of the Council is to give final approval to projects recommended by the ITAC and TCEQ, and to provide guidance on the Strategic Plan. At least one meeting in Austin is dedicated to new project selection. Additional meetings, either in person or via webinar, and email updates are dedicated to providing summaries of on-going projects and review of the strategic plan.

Table 2: Members of the Advisory Council

Name	**Title**	**Organization**
Ramon Alvarez	Senior Scientist	Environmental Defense Fund
Daniel Baker	Senior Consultant in Air Quality	Shell Global Solutions
Sam Biscoe	County Judge	Travis County
Jeff Branick	County Judge	Jefferson County
Edward M. Emmett	County Judge	Harris County
Ralph B. Marquez	Former TCEQ Commissioner	Environmental Strategies and Policy
Keith Self	County Judge	Collin County
Kim Herndon	Assistant Director Air Quality Division	Texas Commission on Environmental Quality
TCEQ 2	Pending appointment by TCEQ	

PROJECT TIMELINE

This section will discuss the activities that took place in support of the AQRP. In the period covered by this report, two primary activities took place:

- FY 2012 – 2013 Projects begun
- Additional funding for FY 2013

September 2012 – November 2012

At the end of fiscal year 2012 a new set of proposals had been reviewed and selected for funding. Activities during the first quarter of fiscal year 2013 focused on contracting with the institutions where the research projects would be performed and working with investigators to develop the project Work Plans. Several of the proposals that were selected for funding came from institutions that had received AQRP funding in the prior biennium. Because Master Agreements were already in place with these organizations, the AQRP was able to issue amendments, decreasing the amount of time spent on contract negotiations. For those organizations that were new to the AQRP, new Master Agreements were negotiated. At the end of this quarter, all but one of these organizations (the home institution for 3 of the research projects) had completed the Master Agreement contracting process. Also, all but 3 of the projects had submitted Work Plans for review. (The Work Plan consists of the Project Plan, Budget and Justification, and Quality Assurance Project Plan (QAPP).)

December 2012 – Feb 2013

During this period the remaining contract completed negotiation and 13 of 14 work plans had been approved, with work starting on 10 projects. Projects were assigned funding from either fiscal year 2012 or 2013, with one project assigned partial funding from fiscal year 2011. This allowed the AQRP to fully expend all FY 2011 Research funds.

March 2013 – May 2013

The third quarter of the year saw the full execution of the final contract and all work plans fully approved with work started. Project managers continued to work with principal investigators to ensure that all project goals are met, as well as all reporting and invoicing requirements.

June 2013 – August 2013

The fourth quarter of the year saw the continuation of research project activities. As this period was in the middle of the research project cycle, ensuring that all reporting and invoicing requirements were met was the primary focus. With the renewal of the program for FY 2014 and 2015, Project Administration developed research priorities for the next RFP. The ITAC provided input into these priorities and they were submitted to the TCEQ for review.

Discover AQ

In September of 2013, the DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality) program deployed NASA aircraft to make a series of flights with scientific instruments on board to measure gaseous and particulate pollution in the Houston, Texas area. The purpose, for NASA, of this campaign was to better understand how satellites could be used to monitor air quality for public health and environmental benefit.

To complement the NASA flight-based measurements, and to leverage the extensive measurements being funded by NASA to better understand factors that control air quality in Texas, ground-based air quality measurements were made simultaneously by researchers from collaborating organizations, including research scientists and engineers funded wholly or in part by the AQRP and the TCEQ. Because of the opportunity to leverage NASA measurements, projects related to DISCOVER-AQ were a high priority for the 2012-2013 biennium.

RESEARCH PROJECTS

Research Projects for FY 2010-2011 are now completed. All projects have submitted final invoices and those invoices have been paid. The Final Report for each project, with the exception of one, is posted on the AQRP website at http://aqrp.ceer.utexas.edu/projects.cfm.

A summary of the projects approved for funding for FY 2012-2013 follows.

Project 12-004	**STATUS: Active - March 1, 2013**

DISCOVER-AQ Ground Sites Infrastructure Support

University of Texas at Austin – Vincent Torres

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Raj Nadkarni

Funding Amount: $1,691,944

Executive Summary

In the summer of 2013, the DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality) program deployed NASA aircraft to make a series of flights with scientific instruments on board to measure gaseous and particulate pollution in the Houston, Texas area. The purpose of this campaign, for NASA, was to improve the use of satellites to monitor air quality for public health and environmental benefit.

To complement the NASA flight-based measurements, and to leverage the extensive measurements being funded by NASA to better understand factors that control air quality in Texas, ground-based air quality measurements were made simultaneously by researchers from collaborating organizations, including research scientists and engineers funded wholly or in part by the AQRP and the TCEQ. Multiple ground sites were expanded or established to accommodate the instrumentation brought to Houston by research collaborators. This project centralized and coordinated the site infrastructure preparation for the ground sites identified for expansion to support DISCOVER-AQ Houston 2013.

The scope of work for this project began with meeting with and/or contacting appropriate DISCOVER-AQ and TCEQ personnel and determining how many and which ground sites will be used for the study. Once sites were determined, assignment of instrumentation to each site followed. Next, to accommodate the instrumentation and the associated support equipment and supplies that were located at the selected ground sites, site improvements were made; site access/use agreements, ground (site pad) preparation, installation of utilities (electrical and communication) and security fencing, and rental of temporary buildings to accommodate instrumentation that must be located in conditioned space were all performed. During the intensive measurements period of the campaign, some limited support was required by the ground-based researchers should problems arise with the site accommodations. At the end of the campaign, each of these sites will be decommissioned and restored to their original condition or a condition required by the property owner.

Project Update

Throughout the year, the logistics team continued obtaining cost information for proposed site improvements, primarily electric utility modifications/upgrades, fencing modifications, and the addition of scaffolding to accommodate instrumentation that were added for DISCOVER-AQ, and supporting the TCEQ in obtaining site access agreements for the ground sites selected. As site access was obtained for each of the sites, purchase orders for site modifications that were required were submitted and issued. Additionally, TCEQ reassigned the responsibility for obtaining site access agreements for the four met profiler sites (Fayette County, Texas A&M, Smith Point and Danciger) to this project. The Danciger site was later changed to the Wharton Airport site. UT obtained site access agreements for these sites also. Approval and funding was obtained to issue a purchase order for the four met profilers that were used during the study at these four sites.

Site preparations were completed at all sites and then the logistics team ensured that as research teams installed equipment at a site, the site logistics were as planned and that all utilities were operating as requested.

The Aeronet and Pandora instruments began collecting data in late July and the four profiler sites (Smith Point, Texas A&M, Fayette County, and Wharton) were all operational and collecting data effective August 26. As of the end of the quarter, all research teams had installed their equipment and were ready for the start of the study.

Work to be performed in the next quarter will focus on providing support as needed for logistics in September during the measurement campaign phase of the study and decommissioning of the sites in October and November.

Project 13-005 **STATUS: Active – January 15, 2013**

Quantification of industrial emissions of VOCs, NO_2 and SO_2 by SOF and mobile DOAS during DISCOVER AQ

Chalmers University – Johan Mellqvist
University of Houston – Barry Lefer

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – John Jolly

Funding Amount: $177,553
($129,047 Chalmers, $48,506 UH)

Executive Summary

Mobile remote sensing by SOF and mobile DOAS will be carried out in the Houston ship channel (HSC) area during September 2013. In this manner vertical columns will be obtained of VOCs (alkanes, alkenes), NH_3, NO_2, SO_2, HCHO and particles as inferred from aerosol optical depth. The optical remote data will be complemented by wind profile measurements. The data collected will have great value of its own to be applied for future ozone modeling since a good understanding of the emission variability and changes in the total emissions in the HSC will be obtained by comparison to similar studies in 2006, 2009 and 2011 [Mellqvist 2007; 2009; 2010 and Rivera 2010]. The emission data will be compared to available emission inventories and categorized in various industrial types.

Equally important, the measurements will complement the NASA Discover AQ campaign which will run in the HSC area during the targeted month. NASA will then fly a high altitude aircraft (B200) equipped with optical sensors measuring columns of SO_2, NO_2, HCHO and aerosol profiles (LIDAR). They will utilize a low flying airplane (P-3) that will make spirals in the vicinity of two ground stations in the HSC, to validate the high altitude measurements.

The spatial column data of NO_2, SO_2, and HCHO from the mobile DOAS will be directly comparable to the column data measured by the high altitude NASA aircraft, hence providing a performance evaluation data set across the whole ship channel. Secondly, by carrying out emission measurements of VOCs, NO_2, SO_2 and HCHO around the HSC, especially upwind the two sites, it will be possible to interpret the spiral measurements by the NASA P-3 and the high altitude measurements by the B200 more comprehensively. The combined airborne and ground based data set has potential to be used for modeling of the ozone in the HSC area. This project will support the AQRP priority research area: Improving the understanding of ozone and PM formation and emission characteristics in the Houston area through supplementary measurements to the NASA Discover-AQ campaign September 2013.

Project Update
During the period June 1 to August 31 the study team has carried out logistical and scientific planning of the campaign together with the University of Houston and participation in web meetings about NASA DISCOVER-AQ.

The SOF instrument was rebuilt by extending the solar tracker and it was fitted into a custom made cooled Zarges box. The mobile DOAS was improved by adding a scanner, making it possible to measure multiple angles while driving.

The SOF and mobile DOAS system was shipped to Houston in mid August and then it was installed in a Toyota Tundra at the University of Houston together with other equipment.

Figure 1. SOF and mobile DOAS system installed in a Toyota Tundra, here parked outside the Ellington field on Media day. Sep 2.

Project 12-006 **STATUS: Active – February 8, 2013**

Environmental chamber experiments and CMAQ modeling to improve mechanisms to model ozone formation from HRVOCs

University of California - Riverside – Gookyoung Heo
Texas A&M University – Qi Ying

AQRP Project Manager – Elena McDonald-Buller
TCEQ Project Liaison – Ron Thomas

Funding Amount: $146,259
($101,765 UC-R, $44,494 TAMU)

Executive Summary

Using reliable atmospheric chemical mechanisms in regulatory models is necessary to formulate effective air quality policies for controls of secondary air pollutants such as ozone (O_3). It is well known that alkenes are a major contributor to radical and O_3 formation in Southeast Texas due to their high emissions and their high reactivities. Particularly, in Harris County, Texas, seven alkenes (ethene, propene, 1,3-butadiene, 1-butene, isobutene, trans-2-butene, and cis-2-butene) are classified as Highly Reactive Volatile Organic Compounds (HRVOCs), and HRVOC emissions have been regulated by Texas Administrative Code, Title 30, Part 1, Chapter 115 (TCEQ, 2102). However, condensed chemical mechanisms commonly used for air quality modeling in the U.S. are designed to model O_3 formation from typical urban ambient volatile organic compound (VOC) mixtures but are not designed to model O_3 formation under atmospheric conditions significantly influenced by highly variable HRVOC emissions that are dominated by a small number of VOC species. Therefore, a chemical mechanism that can be used to simulate O_3 formation from both urban emissions and industrial HRVOC emissions needs to be developed to accurately assess the impact on O_3 formation of regular and episodic HRVOC emissions from industrial sources in Southeast Texas. However, lack of environmental chamber data useful for mechanism evaluation is a critical obstacle to developing reliable mechanisms for the HRVOCs. Among the 7 alkenes regulated as HRVOCs in Southeast Texas, robust chamber data for mechanism evaluation are available only for ethene and propene. The situation is even worse for the higher molecular weight non-HRVOC alkenes. Thus, this study will develop more robust chemical mechanisms for the HRVOCs and non-HRVOC alkenes that are better suited for use under atmospheric conditions influenced by HRVOC emissions, and evaluate and update the initially proposed mechanisms by designing and carrying out environmental chamber experiments for the HRVOCs and non-HRVOC alkenes for which existing data are inadequate. The effect of the mechanism modifications on air quality predictions in Southeast Texas will be evaluated by carrying out 3-dimensional air quality modeling with the Community Multiscale Air Quality modeling system (CMAQ), using both existing mechanisms and the updated and more explicit mechanisms developed in this work.

Project Update

During June 1, 2013 to August 31, 2013, this project carried out 6 additional environmental chamber experiments using a large indoor environmental chamber at the University of California at Riverside to produce experimental data useful to improve atmospheric reaction mechanisms leading to ozone formation for five Highly Reactive Volatile Organic Compounds (HRVOCs; 1,3-butadiene, 1-butene, isobutene, trans-2-butene, and cis-2-butene) and five non-HRVOC alkenes (1-pentene, 1-hexene, trans-2-pentene, cis-2-pentene, and 2-methyl-2-butene). After analysis of experimental data of the 25 experiments (50 reactor runs) carried out for this project, relatively reliable experimental data (36 reactor runs in total) were selected and used for evaluating and improving mechanisms for the 10 alkenes. These newly obtained chamber experimental data as well as the information on kinetic and mechanistic reaction parameters for the 10 alkenes gathered by literature review was used to develop improved reaction mechanisms that can be used in CMAQ modeling by researchers at Texas A&M University. We developed and implemented emission speciation rules (i.e., rules to map emissions into model species in the chemical mechanism) to prepare emissions data to carry out 3-dimentional air quality modeling with the Community Multiscale Air Quality Modeling (CMAQ) system and carried out preliminary CMAQ simulations for this project with two versions: a relatively detailed version (SAPRC-11D) and a relatively compact version (SAPRC-11L). In September and October, 2013, we will further improve and test mechanisms using chamber experimental data and the improved mechanisms will be used for CMAQ modeling after implementation into CMAQ.

All funds allocated to the project will be used upon the project completion.

Project 12-011	STATUS: Active – January 17, 2013

Investigation of Global Modeling and Lightning NOx Emissions as Sources of Regional Background Ozone in Texas

ENVIRON International – Chris Emery

AQRP Project Manager – Elena McDonald- Buller
TCEQ Project Liaison – Jim Smith

Funding Amount: $77,420

Executive Summary

The production, transport, and fate of tropospheric ozone are highly dynamic processes with contributions from a multitude of anthropogenic and natural sources spanning spatial scales from local to global. The US Environmental Protection Agency (EPA) requires the use of regional photochemical models to demonstrate that local emission control plans will achieve the federal standard for ground-level ozone. As the ozone standard is lowered, sources contributing to uncontrollable "background" ozone become more significant and must be more accurately accounted. In response, regulatory modeling applications have employed continuously larger domains to explicitly include sources over broader portions of the continent. Regional models now include worldwide contributions by deriving boundary conditions from global models. As global models continue to emerge and improve, their contributions to background ozone as represented in regional models need to be evaluated.

The Texas Commission on Environmental Quality (TCEQ) uses the Comprehensive Air quality Model with extensions (CAMx) for research and regulatory photochemical modeling. Two popular global models have been routinely coupled to CAMx: the Goddard Earth Observing System - Chemistry model (GEOS-Chem), developed and distributed by Harvard University, and the Model for OZone and Related chemical Tracers (MOZART), developed and distributed by the National Center for Atmospheric Research (NCAR). A newer global model called AM3, which is the atmospheric component of the CM3 global coupled atmosphere-oceans-land-sea ice model, is developed by Princeton University and the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory (GFDL).

In this project, ENVIRON International Corporation will develop boundary condition inputs for CAMx utilizing output from all three global models (GEOS-Chem, MOZART, and AM3). The sensitivity of simulated ozone to regional boundary conditions will be investigated. We will develop quantitative comparisons of these global models with respect to their ability to provide accurate and reasonable boundary conditions for regional downscaling, particularly as it applies to regulatory ozone modeling.

Project Update

Task 1: Evaluation of Global Modeling Products Over North America

All work under this task was completed in June-July. Output from the AM3, GEOS-Chem, and AM3 global models were processed to supply boundary conditions for the CAMx regional model. ENVIRON completed an evaluation of global model performance against rural CASTNET surface ozone measurements, with a focus on the south-central US. All global models performed similarly, exhibiting large over predictions of surface ozone in the summer and early fall months.

We also developed new software to compare ozone sounding measurements from the NOAA ozonesonde network and from the Houston 2008 Tropospheric Ozone Pollution Project to the global and regional model ozone profiles. Comparisons of monthly-mean observed and modeled profiles were completed at four ozonesonde locations: Houston, Huntsville (Alabama), Boulder (Colorado), and Trinidad Head (California). All models performed well in simulating the monthly-mean tropospheric ozone profiles, but differed in their characterization of ozone at stratospheric altitudes.

Task 2: Global-Regional Model Coupling and Performance Comparison

CAMx modeling was performed for the period April through October 2008 on a continental-scale domain with 36 km grid spacing and a regional domain covering the south-central US with 12 km grid spacing. Details of the modeling configuration are described in the project Work Plan. CAMx was run with boundary conditions developed from the output of all three global models and results were inter-compared and evaluated against the same surface CASTNET data and ozonesonde profiles as was performed for the global models.

CAMx ozone performance at the rural CASTNET sites paralleled the global model results in that all model runs tended to over predict ozone in the summer and early fall months, but with less bias than the global models (Figure 1). Little difference in ozone performance resulted from use of the three different sets of boundary conditions. This suggests that for this specific modeling dataset, the CAMx model performance is more sensitive to the characterization of regional emissions and meteorology within the domain and is not particularly sensitive to boundary conditions. More detailed analyses of these CAMx results are on-going and will be documented in the project final report.

No technical issues have been encountered during the course of this project. Most technical work has been completed and the final project report is in preparation. We expect to deliver a first draft of the report to the AQRP in October. The project remains on schedule for completion by November 30.

All funds allocated to the project are intended to be used by 11/30/2013.

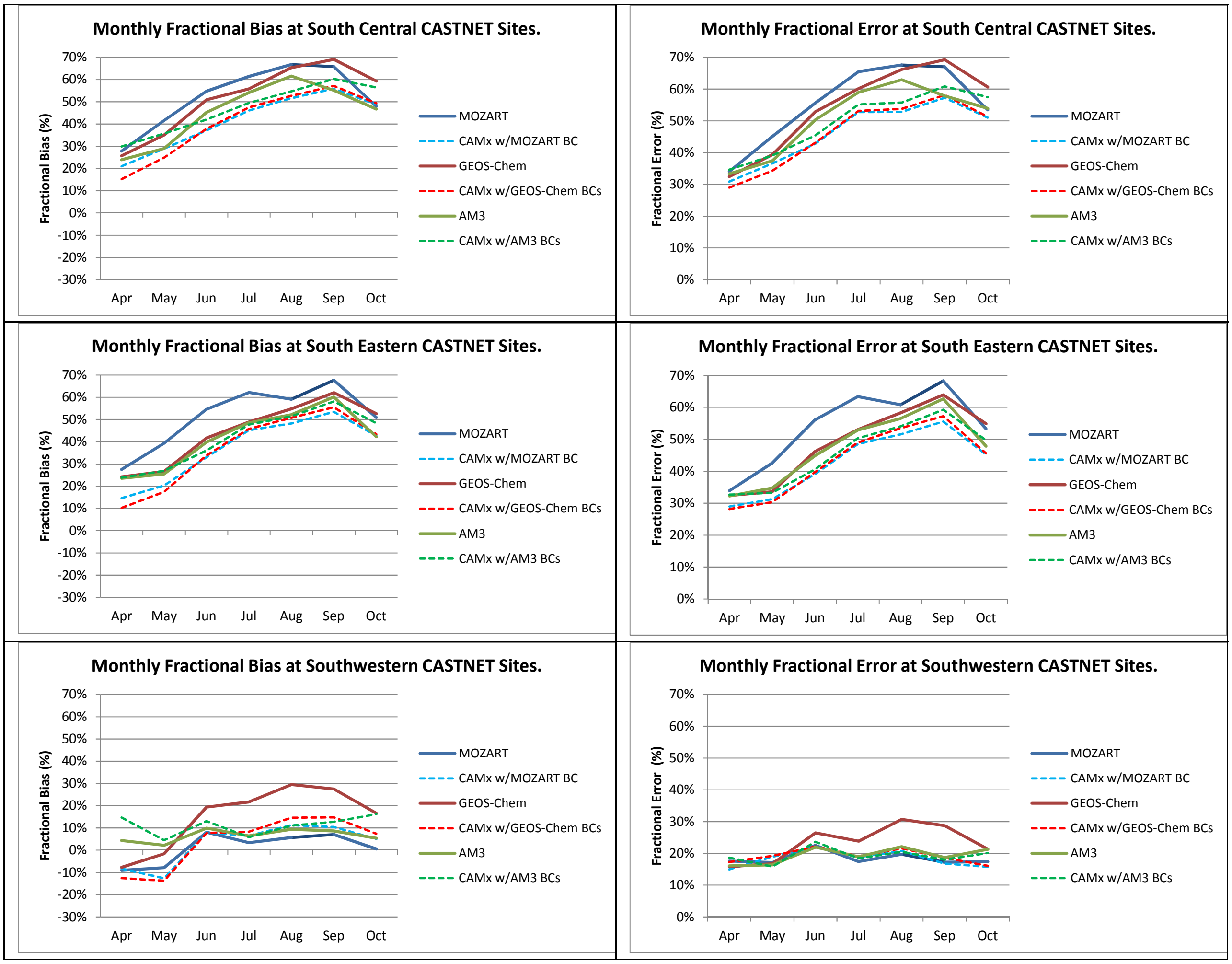


Figure 1. Monthly fractional bias (left) and error (right) for three global models (solid lines) and three corresponding CAMx runs (dashed lines) against 6-hourly CASTNET ozone data in the south-center (top), south-east (center), and south-west (bottom) US.

Project 12-012 **STATUS: Active - December 19, 2012**

Interactions Between Organic Aerosol and NOy: Influence on Oxidant Production

University of Texas at Austin – Lea H. Ruiz
ENVIRON International – Greg Yarwood

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Mark Estes

Funding Amount: $148,835
($79,461 UT Austin, $69,374 Environ)

Executive Summary

In rural areas where emission rates of NO_x ($NO + NO_2$) are relatively low, ozone formation can be sensitive to secondary NO_x sources such as decomposition of organic nitrates ($R\text{-}ONO_2$). AQRP project 10-042 provided experimental evidence for NO_x production when organic nitrates degrade by OH reaction and photolysis. Implementing NO_x production from OH reaction with organic nitrates causes regional ozone increases that are large enough to affect model agreement with ozone observations. This implies that organic nitrates are less available to NO_x recycling than previous experiments suggested. We are investigating the hypothesis that uptake of organic nitrates into secondary organic aerosol (SOA) reduces the amount of NO_x recycled by organic nitrate photolysis and OH reaction.

The first task in this project is to add the uptake of organic nitrates by SOA to the Comprehensive Air quality Model with extensions (CAMx). The conceptual model of Perraud et al. (2012) is followed, in which organic nitrate molecules stick to aerosol surfaces and become irreversibly buried by accretion of SOA. Results of this initial modeling work is then used to design laboratory chamber experiments in which organic nitrates are formed from the oxidation of VOCs in the presence of NO_x and the distribution of organic nitrates between the gas and particle phases is observed. New chemistries and mechanisms inferred from the experimental data are then tested by including them in a box model of the chamber experiments before they are implemented in CAMx. Finally, the partitioning of organic nitrates between the gas- and particle phase is observed in natural aerosol by conducting ambient measurements near Houston.

Project Update

In this quarter we conducted CAMx simulations to test updates to the CB6r1 (Carbon Bond 6 revision 1) chemical mechanism using a box model version of CAMx which we developed last quarter. We compared simulations using the latest update to the CB6 chemical mechanism to ambient data collected at ground level (by TCEQ) and aloft (during INTEX-A). In order to obtain reasonable agreement between measured and observed concentrations of ozone it is necessary to assume that multifunctional nitrates are not available for NOx recycling. This could indicate that the organic nitrates are irreversibly incorporated in aerosol.

With our instrumentation now complete, we conducted experiments on the photolysis of organic nitrates and on their rate of reaction with the hydroxyl radical (OH). We also conducted experiments on the formation of organic nitrogen compounds in the gas and particle phases when VOCs are oxidized by OH in the presence of NOx. In all experiments we detected organic nitrogen compounds in the gas and particle phases.

We have started the ambient measurement campaign in Conroe. We arrived in Conroe on Aug. 22 and had enough time to set up and calibrate instrumentation before the initial start of the campaign on September 1. Since then we have been collecting data almost continuously, and we have detected organic nitrogen compounds in the gas and particle phases.

All funds allocated to the project are expected to be used by 11/30/2013.

Project 12-013	**STATUS: Active – December 14, 2012**

Development of Transformation Rate of SO_2 to Sulfate for the Houston Ship Channel using the TexAQS 2006 Field Study Data

ENVIRON International – Ralph Morris

AQRP Project Manager – Elena McDonald - Buller
TCEQ Project Liaison – Jim Price

Funding Amount: $59,974

Executive Summary
On June 2, 2010, EPA promulgated a new 1-hour SO_2 primary NAAQS with a threshold of 75 ppb. The 1-hour SO_2 NAAQS is much more stringent and replaces the old 24-hour (140 ppb) and annual (30 ppb) SO_2 NAAQS. States are required to submit 1-hour SO_2 State Implementation Plans (SIPs) by February 2014 that demonstrates compliance with the NAAQS by August 2017. Preliminary modeling indicates that SO_2 emissions for numerous sources will result in near-by exceedances of the 1-hour SO_2 NAAQS. Fossil-fueled power plants (73%) and industrial facilities (20%) are the main sources of SO_2 emissions in the U.S. Photochemical oxidants will convert some SO_2 to sulfate thereby reducing SO_2 concentrations. However, the EPA-recommended model for near-source 1-hour SO_2 modeling is the AERMOD steady-state Gaussian plume model that does not treat photochemical oxidants and has a very simple treatment of chemistry (exponential decay). EPA recommends that AERMOD be run with no SO_2 conversion for addressing 1-hour SO_2 NAAQS issues. This assumption may be appropriate for fossil-fueled power plants where the high NO_X concentrations inhibit photochemistry and consequently SO_2 oxidation near the source, but it may not be appropriate for the Houston Ship Channel where the atmosphere can be very reactive (due to HRVOC emissions) resulting in faster SO_2 to sulfate conversion rates.

The goal of this project is to develop a representative SO_2 transformation rate for the Houston Ship Channel area using measurements from the NOAA P-3 aircraft collected during the 2006 Texas Air Quality Study (TexAQS) that can be used with the AERMOD model to simulate 1-hour SO_2 concentrations. The proposed approach uses a grid model to simulate first-order transformation of SO_2 to sulfate for sources in the Houston Ship Channel. The model results with varying transformation rate are evaluated against the 2006 TexAQS P-3 aircraft measurement data to find what transformation rate best fits the observations and to determine whether one hypothetical transformation rate results in statistically better model performance than the other rates used.

Project Update

Task 3: Determine Transformation Rate of SO_2 to sulfate

We conducted a preliminary CAMx simulation for the September 19 flight transects with multiple model output reporting frequencies. The model predicted slightly lower peak SO_2 and sulfate concentrations with 1-hour output frequency than with 15- and 6-minute frequencies at the transects closer to the Houston Ship Channel while showing slightly higher peaks with 1-hour frequency at further downwind. As the model results with 15- and 6-minute frequencies do not show any significant differences in the model results, we selected the 15-minute output frequency for the subsequent model evaluation runs.

The model results showed that observed and modeled plumes were not exactly aligned because the meteorological model inputs were not sufficiently accurate to describe the actual wind direction at the time/height of the P-3 flights. Simply shifting the model plume direction would not help because multiple peaks were misaligned by different distances. Also, the modeled background sulfate concentrations appeared too high compared to those estimated by the observations. While the goal of this study is not directly related to accurate modeling of meteorology or background contributions, these factors made a conventional model evaluation methodology (i.e., biases and errors calculated from individual data points) less useful. Therefore, we devised an alternate model evaluation methodology that employs an aggregated quantity to represent the whole plume segment crossing a transect. An “average excess above background” concentration is defined as follows:

$$\frac{\int (C - C_B)\,dt}{\int dt}$$

where C and C_B are the total and background concentrations, respectively. The integration is limited to a transect segment identified as the Ship Channel plume (i.e., a segment dominated by the Ship Channel plume). The excess concentration is normalized by plume width (represented by flight time) so that uncertainties in the plume dispersion do not affect the model evaluation. For the modeled SO_2 and sulfate, the “excess above background” is simply the Ship Channel contribution as the model separately tracks SO_2 and sulfate from the Ship Channel sources. For the observed data, the background concentration is defined as the minimum concentration within the transect segment attributed to the Ship Channel plume. Model evaluation was performed over the ratios of sulfate to SO_2 average excess concentrations because our goal is to find the transformation rate of SO_2 to sulfate that best fits the aircraft measurement data. Figure 1 presents the root mean square error (RMSE) of the modeled ratio for each flight as well as the overall RMSE for SO_2-to-sulfate conversion rates from 0.01 to 0.1 hr-1. The result suggests the conversion rate of 0.04 hr^{-1} would best describe the transformation of SO_2 to sulfate in the Houston Ship Channel plumes.

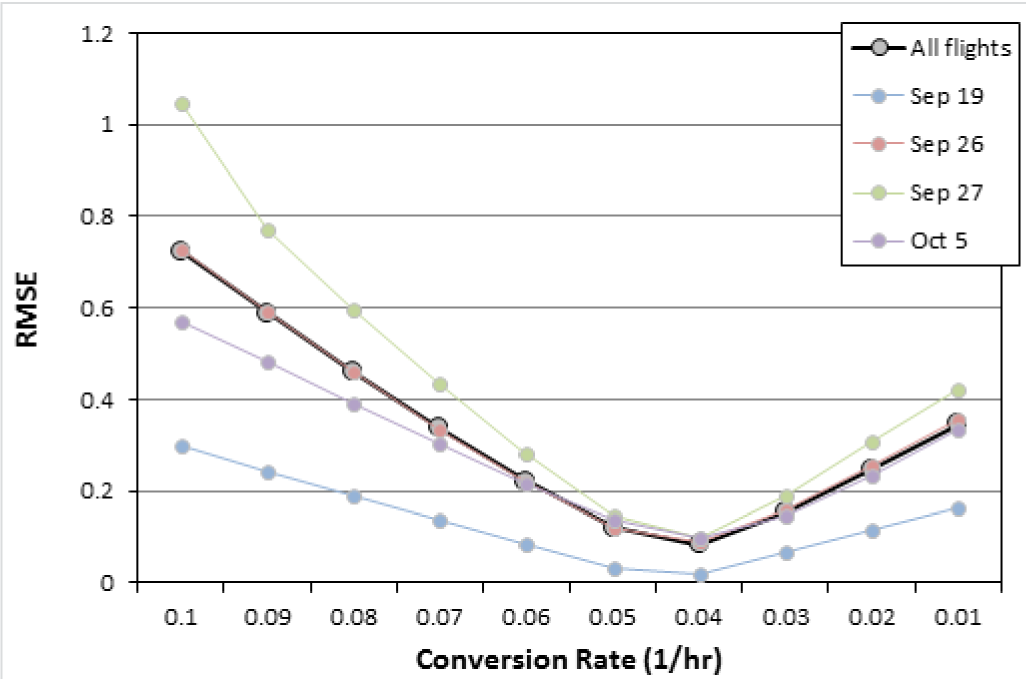


Figure 1. Root mean square errors of the modeled average excess SO_4 to SO_2 ratios.

An error was discovered in the emission input processing after the modeling analysis had been completed. The problem was fixed, and the grid model simulations and evaluation had to be re-done with the corrected emissions. It turned out that the error had only a small effect on the model results. However, it delayed the project schedule by about a month.

All funds allocated to the project will be used upon the project completion.

Project 13-016	STATUS: Active – November 20, 2012

Ozonesonde launches from the University of Houston and Smith Point, Texas in Support of DISCOVER AQ

Valparaiso University – Gary Morris
University of Houston – Barry Lefer

AQRP Project Manager – Gary McGaughey
TCEQ Project Liaison – Dave Westenbarger

Funding Amount: $86,667
($66,821 Valparaiso, $19,846 UH)

Executive Summary
An intensive series of ozonesonde launches during DISCOVER AQ (September 2013) provides insight into the recirculation of ozone over Galveston and Trinity Bays. With potential operational launch sites at LaPorte, the University of Houston Main Campus, and Smith Point, the coordinated set of ozone profiles will permit us further insights into the importance of re-circulated ozone on exceedence events during the late Summer high ozone season in Houston, Texas.

Project Update
This report summarizes our work on this project during the period 1 June through 31 August 2013. The investigators on this team prepared, revised, and submitted monthly reports for May, June, and July as well as a quarterly report for the period from the inception of the grant through 31 May 2013.

The investigators attended phone conferences led by Jim Crawford on DISCOVER-AQ planning.

The investigators worked with Anne Thompson (Penn State University, NASA Goddard Space Flight Center), Rich Clark (Millersville University), Henry Selkirk (USRA/GESTAR, NASA Goddard Space Flight Center), and Barry Lefer (University of Houston) to coordinate balloon activities in the Houston area during the DISCOVER-AQ period.

Dr. Morris also worked with the FAA to secure launch protocols for all of the various free release balloon sites that have been identified as possible launch locations for DISCOVER-AQ, including Galveston Island, the University of Houston Coastal Center, Ellington Field, the University of Houston Main Campus, the University of Houston Sugar Land Campus, Jones Forest, and Smith Point.

At present, the Penn State NATIVE trailer will be stationed at Smith Point, providing on ground, in situ observations that will be valuable for identifying diurnal variations in ozone and ozone precursors as well as validation of the pre-launch ozonesonde data from Smith Point. The Penn State team will be responsible for Smith Point launches during DISCOVER-AQ.

Our team will launch at locations around Houston most favorable to the science of understanding the ozone distribution across Houston and the partitioning of sources.

Dr. Morris has also spent time developing an automated data processing system that will take the raw flight data, perform an initial quality check, correct pressure offsets when detected, and create the standard suite of plots to be posted on the project website: www.valpo.edu/ozone. The system has been tested with data from Houston and another site and is working well. Launch teams simply post the data to a Dropbox folder, and with a single command, the data are processed, quality checked, and archived. We are still developing the script that will automatically update the website. At present, that work still needs to be performed manually.

Project 12-018 **STATUS: Active – January 8, 2013**

The Effects of Uncertainties in Fire Emissions Estimates on Predictions of Texas Air Quality

University of Texas at Austin – Elena McDonald-Buller
ENVIRON International – Chris Emery

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Clint Harper

Funding Amount: $106,970
($85,282 UT Austin, $21,688 Environ)

Executive Summary

Wildland fires and open burning can be substantial sources of nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane hydrocarbons (NMHCs), which are precursors to ozone formation, as well as particulate matter (PM), sulfur dioxide (SO_2), and ammonia (NH_3). Fire emissions are often transported over long distances and can contribute to exceedances of air quality standards at local and regional levels. Achieving attainment with the National Ambient Air Quality Standards (NAAQS) for ozone has been the primary focus of State Implementation Plans (SIPs) for Texas. Accurate characterization of fire events is necessary for understanding their influence on measured ambient concentrations, for providing a weight of evidence for exceptional event exclusions if necessary, and for conducting air quality modeling for planning and attainment demonstrations. In addition, if more stringent federal standards for ozone are considered in the future, emissions of its precursors from regional sources, such as fires in the Western U.S., Mexico, and Central America, that can contribute to background concentrations will become increasingly important for understanding the relative effectiveness of local and regional emissions control programs. This project examines the effects of uncertainties in fire emissions estimates on modeled ozone and particulate matter concentrations in Texas using the Fire INventory from NCAR (FINN) and the Comprehensive Air Quality Model with extensions (CAMx).

Project Update

A climatology of fires in Texas, Louisiana, five central states (Arkansas, Kansas, Missouri, Mississippi, Oklahoma), eleven western states (New Mexico, Colorado, Wyoming, Montana, Idaho Washington, Oregon, California, Arizona, and Utah), Mexico, Central America (Guatemala, Belize Nicaragua, Costa Rica), and Western Canada was developed utilizing default FINN estimates from 2002-2012. A literature review of the effects of fires on air quality, climate change and fires, fire emissions estimation methods, and the FINN default model configuration and input parameters was completed.

ENVIRON/Alpine Geophysics transferred a 2008 CAMx modeling database, which spanned the time period of April 1 – October 15, 2008, to the University of Texas at Austin (UT). UT installed the episode on the Lonestar 4 system at the Texas Advanced Computing Center

(TACC). Fire emissions estimates for CO, NO_x, VOCs, and $PM_{2.5}$ from BlueSky/SMARTFire 2, which was utilized in the original CAMx episode, have been compared to estimates from FINN for the episode period. Because both emissions models are used for regional air quality model simulations in the U.S., it is valuable to compare their emissions estimates and effects on simulated air quality.

ENVIRON developed an EPS3 processing algorithm for FINN emissions that was used to spatially allocate estimates to the specific modeling grid (horizontally and vertically), temporally allocate daily estimates to each hour, and speciate VOC and other chemical species as appropriate for the CB05 chemical mechanism employed in CAMx. The CAMx-ready fire emissions inventory for the FINN default configuration replaced the BlueSky/SMARTFIRE 2 estimates for the April 1- October 18, 2008 episode as developed by Alpine Geophysics. UT completed a CAMx simulation with fire emissions based on the FINN default configuration that forms the base case to which the sensitivity analyses are being compared. Dr. Wiedinmyer visited Dr. McDonald-Buller's team at the University of Texas at Austin for three days during June 24-26, 2013. A primary goal of this trip was to develop the sensitivity analyses with FINN.

In order to assess the variability in estimated emissions to various uncertainties in the FINN model, the sensitivity simulations shown in Table 1 were performed. These included sensitivities to emission factors, land cover and land use inputs, fuel loading estimates, and fire location and area burned. Emission factors were updated with those published by Akagi et al. (2013) and Yokelson et al. (2013), downloaded from http://bai.acd.ucar.edu/Data/fire/). Uncertainties in the emissions factors were also tested using the uncertainties assigned by Akagi et al., (2013) and Yokelson et al. (2013) as upper and lower limits. The sensitivity of the emission estimates to global land cover classification was tested using the 2009 GlobCover global land cover map (http://due.esrin.esa.int/globcover/). A simulation was performed to test the fuel loadings assigned to each fire. For this case, the Fuels Characteristic Classification System (FCCS; http://www.fs.fed.us/pnw/fera/fccs/) was used in place of the default fuel loadings for vegetation identified. A simulation was also conducted in which SMARTFire was used to identify fire locations and estimated area burned, rather than the MODIS Rapid Response and the assumed area burned used by FINN. Data from the SMARTFire product were provided by Sim Larkin (US Department of Agriculture/US Forest Service) and Sean Raffuse (Sonoma Technology, Inc.) for the continental U.S.

In addition to analyzing the FINN emissions estimates from the sensitivity studies in Table 1 on state and regional scales, these inventories are being utilized in CAMx simulations by replacing estimates from the FINN default configuration in order to evaluate the effects on predicted air quality.

T**able 1.** Sensitivity simulations performed.

RUN NAME	**Land Cover/Fuel**	**Fuel Loading**	**Emission Factor**	**Fire Detection/Area Burned**
FINN default	default	default	default	default
Globcover	**GLOBCOVER**	default	default	default
newEmis	default	default	**New**	default
LOWemis	default	default	**Low**	default
HIGHemis	default	default	**High**	default
Fccsfuel	default	**FCCS**	default	default
SMARTFire2	default	default	default	SMARTFire2

*Default refers to inputs/parameters described by Wiedinmyer et al. (2011) for FINN version 1.

At this time, we intend to use all funds allocated to the project by 11/30/2013.

Project 13-022	STATUS: Active – January 29, 2013

Surface Measurements of PM, VOCs, and Photochemically Relevant Gases in Support of DISCOVER-AQ

Rice University – Robert Griffin
University of Houston – Barry Lefer

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Jocelyn Mellberg

Funding Amount: $206,815
($89,912 Rice, $116,903 UH)

Executive Summary

In recent years, the National Aeronautics and Space Administration (NASA) has placed considerable emphasis on the use of satellite remote sensing in the measurement of species such as O_3 and PM that constitute air pollution. However, additional data are needed to aid in the development of methods to distinguish between low- and high-level pollution in these measurements. To that end, NASA has established a program titled Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ). DISCOVER-AQ began in summer 2011 with work in the Mid-Atlantic Coast that featured satellite, airborne, and ground-based sampling. The DISCOVER-AQ program will conduct operations in and near Houston in September 2013.

During the Houston operations of DISCOVER-AQ, there will be a need for ground-based measurement support. This project will fill that need by providing quantitative measurements of sub-micron particle size and composition and mixing ratios of volatile organic compounds (VOCs) and other photochemically relevant gases such as O_3 and oxides of nitrogen (NO_x = nitric oxide (NO) plus nitrogen dioxide (NO_2)). The instrumentation for these measurements will be deployed using the University of Houston (UH) mobile laboratory.

The measurements made on the mobile laboratory generally will operate in two modes. First, during periods when DISCOVER-AQ flight patterns spiral over a given location, the mobile laboratory will operate at the ground surface beneath these spirals in a stationary mode in which surface air quality parameters are monitored continuously. Additional stationary mode measurements will be made at other locations of interest. When not in stationary mode, the mobile laboratory will be deployed to perform Lagrangian studies of air quality within plumes from major sources of primary pollutants, as well as downwind of the major metropolitan area, to characterize secondary processes at surface level.

Project Update

The bulk of the activity focused on preparation for the September deployment. Based on expected load, the power system, air conditioning, shocks, and wheels for the mobile laboratory were upgraded to accommodate all of the planned instrumentation. This will ensure smooth operation during the campaign. In addition, the instrument configuration plan within the bed was finalized, as was the layout and design for the inlets. Mock frames of all instruments were constructed and placed into the mobile laboratory to ensure that the layout will work geometrically. Team members also participated in conference calls with NASA and TCEQ to discuss flight plans, which in turn determined locations for surface deployments. This also entailed coordination with other mobile laboratory facilities (most specifically NASA, Princeton University, and Aerodyne Research, Inc.). In mid-August, NASA and TCEQ made a request that the Rice-UH group sample in the northwest section of the greater Houston area on flight days in order to characterize Houston outflow and to be co-located at least part of the time with instrumentation being operated by University of Texas researchers at the Conroe site. A preliminary plan for overnight locations also was created at the request of TCEQ staff. Part of the preparation for the campaign included training of students and staff from both universities on the relevant equipment; this is especially true of the Rice group, who deployed the PILS and a high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) to a stationary ground site in early summer, in part so that the staff could be better prepared for the September deployment. Students and staff from both universities also continued to purchase supplies necessary to perform the campaign.

In mid-August, the uploading process began. Each piece of equipment was uploaded onto the mobile laboratory during the week of August 19, 2013. This was followed by checks for power, air conditioning, shocks, etc. Based on HR-ToF-AMS overheating errors, installation of an additional air conditioner within the mobile laboratory shell was deemed necessary, which has been completed. During a test drive in late August, despite significant shock prevention efforts, the filaments on the HR-ToF-AMS were found to trip whenever the mobile laboratory went over even the smallest of bumps. It was decided that the laboratory would perform semi-mobile sampling (sample for a period of time, move a short distance, sample for another period of time, move a short distance, etc.) until replacement parts arrived. These are expected in early September. This limitation is expected to have limited overall impact on the data generated besides the existence of small gaps in data continuity during the early part of DISCOVER-AQ. The PILS and all associated required materials were deployed to the Manvel Croix site on August 26, 2013. As of the end of August, the team was ready to sample.

In addition, plans were made for non-flight days. On non-flight days, sampling locations and patterns will be based on meteorological patterns, needs (calibrations, rest for the staff, etc.), and specific questions. Several scientific objectives were discussed, including measurements in the Houston Ship Channel and Texas City areas and along roadways to investigate primary emissions, co-location at Manvel Croix to compare HR-ToF-AMS and PILS data to determine HR-ToF-AMS collection efficiency, co-location with the Princeton mobile laboratory that is measuring ammonia to investigate ammonia-ammonium equilibrium, deployment to Galveston to measure inflow, and deployment near special types of emission sources such as landfills and wastewater treatment facilities.

Project 13-024	STATUS: Active – February 20, 2013

Surface Measurement of Trace Gases in Support of DISCOVER-AQ in Houston in Summer 2013

University of Maryland – Xinrong Ren

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Erik Gribbin

Funding Amount: $90,444

Executive Summary:
The link between ozone (O_3) and NO_X (= NO + NO_2) photochemistry has been extensively studied for decades, yet new discoveries have revealed the need to improve scientific understanding of ozone formation chemistry. In order to improve the interpretation of aircraft and satellite observations to diagnose near-surface conditions relating to air quality, high-quality surface observations of ozone and particulate matter (PM) precursors are needed, especially in urban environments like Houston. To support the NASA DISCOVER-AQ study in Houston in summer 2013, we will make surface measurements of trace gases, including O_3, NO/NO_2/NO_Y, and SO_2. Research-grade instrumentation to measure these traces gases will be deployed at two of the science sites identified by TCEQ/AQRP. These measurements will be compared to concurrent aircraft measurements for the periods when the NASA P-3B aircraft conducts spiral profiles over the sites. Vertical distributions of these gases will be observed and compared with surface observations with the aim of improving the capability of transport models for air quality simulations. Data collected in the field study will be analyzed with regard to the source regions and emission profiles, reactive nitrogen budget, and relationship between NO_Z and O_3.

Project Update:
During the period from June 1, 2013 to August 31, 2013, the teams at University of Maryland College Park and NOAA's Air Resources Laboratory have accomplished the following tasks:

(1) Preparation for the DISCOVER-AQ field study in Houston, including
   a. the rebuild of the vacuum pump to be used for the NO-NO_2-NO_Y system with high ozone level during its operation;
   b. tests and calibration of the NO-NO_2-NO_Y system,
   c. calibrations of the ozone and SO_2 analyzers;
   d. preparation of data acquisition software based on Lab View;
   e. calibration of the Cavity Ring Down NO_2 analyzer,
   f. preparation of sample lines for the both the Galveston and Manvel Croix sites;
   g. further communication with Vincent Torres and Jim Thomas at University of Texas regarding the space and modification requirements for the Mobile Mini trailers at the sites.

(2) Completion of the final testing and calibrations for all instruments in the laboratory that were deployed in the DISCOVER-AQ field study in late August.

(3) Transport of the instruments to the Galveston and Manvel Croix sites and installation at both sites at the end of August.

(4) Completion of further testing and calibrations of the instruments in the field.

(5) Starting in August 31, all instruments were fully operational at the both sites.

(6) Preliminary data files have been submitted to the DISCOVER-AQ data archive on a daily basis.

During the next quarter, the following tasks are anticipated to be accomplished:

(1) To complete the data collection during DISCOVER-AQ in September 2013.

(2) Post-campaign calibrations of the instruments in the laboratory in October 2013.

(3) To finalize the data and submit them to the DISCOVER-AQ data archive

(4) To present the preliminary results from this project at the AQRP/TCEQ meeting in November 2013.

Implementation and evaluation of new HONO mechanisms in a 3-D Chemical Transport Model for Spring 2009 in Houston

University of Houston – Barry Lefer
UCLA – Jochen Stutz
Environ – Greg Yarwood
UNC at Chapel Hill – Will Vizuette

AQRP Project Manager – Elena McDonald-Buller
TCEQ Project Liaison – Doug Boyer

Funding Amount: \$117,269
(\$19,599 UH, \$17,944 UCLA, \$44,496 Environ, \$35,230 UNC)

Executive Summary

Although portions of the chemistry that lead to the formation of ozone have been understood for decades, new discoveries have revealed the need to improve scientific understanding of ozone formation chemistry. Radical production in Houston and other urban areas appear to be underestimated by chemical mechanisms. The roles of some radical precursors such as HONO, HCHO, and reactive VOCs in ozone formation in Houston and other Texas cities have not been well understood. Research based on both modeling and field measurements by the University of Houston, ENVIRON, University of California – Los Angeles, and the University of North Carolina – Chapel Hill has shown that nitrous acid (HONO) significantly affects the HOx budget in urban environments like Houston. These chemical processes connect surface emissions, both anthropogenic and natural, to local and regional air quality.

From April 15th to May 30th, 2009, a team of more than 40 scientists representing more than 15 different institutions collected a relatively complete suite of atmospheric measurements, including NO, NO_2, NO_Y, HONO, HNO_3, O_3, CO, SO_2, HCHO, HOOH, OH, HO_2, OVOCs, VOCs, actinic flux, PBL height, O_3 production rates, and vertical profiles (nominally 40m, 150m, 300m) of NO_2, HONO, O_3, SO_2, and HCHO, during the Study of Houston Atmospheric Radical Precursor (SHARP). The SHARP dataset provides us a unique opportunity to examine and improve our understanding of atmospheric HONO formation processes and how they may be implemented into the Comprehensive Air quality Model with extensions (CAMx) 3-D chemical transport model commonly used for SIP evaluations. The objective of this study is to develop, implement, and evaluate missing pathways for HONO formation in a photochemical model, CAMx, that is used routinely for regulatory applications in Texas and other areas. This model update is expected to improve the model’s ability to simulate ozone concentrations, because HONO is a potential daytime source of the hydroxyl radical, OH, which plays an important role in the ozone formation cycle. Measurements during the SHARP study in Houston showed that radical production in the early morning was dominated by HONO photolysis.

The modeling strategy is to take advantage of the SHARP data analysis in a previous AQRP project (Project 10-032) to develop parameterizations, based on current understanding of the important processes governing HONO formation, and implement and refine these parameterizations in CAMx using existing modeling databases for the Houston area during the SHARP period. Model performance evaluation will make use of process analysis tools to evaluate how HONO formation pathways influence radical budgets and ozone formation within CAMx simulations.

Project Update

The project team (UH, UCLA, UNC, and ENVIRON) has developed new CAMx HONO production mechanisms. As part of this effort, the ENVIRON team has rewritten the CAMx surface model to enable us to implement the following HONO processes into CAMx:

A) Unimolecular conversion of NO_2 to HONO in the dark as a function of relative humidity.

B) Photo-induced conversion of NO_2 to HONO during the daytime.

C) Photolysis of surface HNO_3 to HONO.

The UNC group has successfully run the new CAMx HONO parameterizations for the Spring 2009 SHARP period using CAMx 6.0. The preliminary process analysis results showed that very little HONO was being generated by HNO_3 deposition to the land surface. Further investigation revealed that HNO_3 surface loadings were too low by several orders of magnitude. The project identified an error in the new CAMx land surface model where the e-folding lifetime of the deposited species was too low. This error was corrected and new model runs look significantly better.

In contrast the homogenous HONO production mechanism was generating significant levels of HONO, often times much greater than the daytime observations at the UH Moody Tower during SHARP. The cause of the high homogenous HONO production resulted from unrealistically high ambient NOx levels in the CAMx model in the UH Moody Tower grid cell only during periods of easterly winds. This was traced to several off-road NOx sources (cranes and construction equipment) several kilometers east of Moody Tower in the particular 2009 inventory used by this project. Simply looking at the results of an adjacent grid cell to the southwest of the Moody Tower showed much better agreement with both NOx and HONO.

The project team has completed the implementation of HONO production mechanisms via the new CAMx land surface model and run this new code for the Spring of 2009. We are currently finishing up the CAMx Process analysis and writing the draft final project report.

Project 10-032 **STATUS: Active – January 25, 2013**

Collect, Analyze, and Archive Filters at two DISCOVER-AQ Houston Focus Areas: Initial Characterization of PM Formation and Emission Environmental Chamber Experiments to Evaluate NOx Sinks and Recycling in Atmospheric Chemical Mechanisms

Baylor University – Rebecca Sheesley

AQRP Project Manager – Dave Sullivan
TCEQ Project Liaison – Fernando Mercado

Funding Amount: $45,972

Executive Summary

DISCOVER-AQ (Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality) is a multi-year air quality research study set to focus on Houston, TX in September 2013. NASA's P-3B and B200 aircraft will be deployed to sample vertical profiles over specific focus areas using a spiraling vertical profile flight plans for selected days during the one month sampling campaign. In this study, we will measure elemental carbon (EC), organic carbon (OC), and optical black carbon (BC) at two of these vertical spiral sites during the DISCOVER-AQ mission. Baylor University's research group will collect, analyze, and archive particulate filters collected concurrently with DISCOVER-AQ 2013 Houston-based sampling campaign. Specifically, we will continuously measure OC, EC and BC at two surface sites on each day of the month that the NASA aircraft will be deployed. Collection will occur at two field stations located directly below aircraft focus areas (i.e. vertical profile sites). Results from the carbon measurements taken during the campaign will be disseminated to DISCOVER-AQ investigators and other external research groups. We will also archive particulate filters for future research opportunity. Access to these archived filters will be provided to DISCOVER-AQ investigators and external research groups.

Specific goals of this project are to:

1) Characterize OC and EC concentrations using fine particulate matter ($PM_{2.5}$) and total suspended particulate (TSP) air filter samples collected at two of DISCOVER-AQ Houston's focus areas.
    a. Focus areas include ground stations near Katy and H-NET Jones Forest.
    b. Archive filters for two years at -10°C for future research opportunities.
    c. Provide access of filters to DISCOVER-AQ project leadership and external research groups and collaborators.
2) Measure optical BC using a seven channel aethalometer at the H-NET Jones Forest ground station.
3) Compare ground-based OC, EC, and optical BC with other aerosol measurements made directly over focus areas on NASA's P-3B and B200 aircraft (i.e. water soluble organic carbon and BC).

Project Update
Significant progress has been made in the planning and preparation for the September DISCOVER-AQ sampling campaign. The two sites have been completely outfitted and students are on-site to begin sampling the first week of September. PIs Sheesley and Usenko have participated in the field campaign conference calls led both by AQRP and by NASA. PIs Sheesley and Usenko have also been working directly with Vince Torres and Raj Nadkarni to finalize site details and coordination for Manvel Croix. A site visit was made to Moody Tower to define sampler locations and discuss site logistics with Dr. Barry Lefer at University of Houston. Preliminary collaboration discussions of plans to share filter media collected by Baylor during the September campaign were conducted with Dr. Sarah Brooks at TAMU during a visit to TAMU; this is responsive to the goal of the Baylor AQRP project to distribute filter media to research collaborators. The study team discussed collaboration and filter media sharing with Dr. Rachelle Duvall, Dr. Tad Kleindienst, Dr. John Offenberg and Dr. Michael Lewandowski of the US EPA, NERL; this is also responsive to the goals of the Baylor PIs. Additional collaboration with Lea Hildebrandt Ruiz of UT was planned and a filter sampler plus training was provided to her to enable filter collection by her group at the Conroe site during the September campaign; this was coordinated with Rachelle Duvall of the US EPA and will enable additional filter media sharing among the institutions.

Field instrumentation preparation including filter substrate prep and aethalometer maintenance, testing and site setup has been completed. A preliminary week-long sample was collected to provide mass for preliminary analysis and to test additional analytical techniques. This sample will also provide information on the site conditions at Moody Tower leading into the September campaign. Three graduate students have been trained to use all sampling equipment and in proper QAQC during field work. An undergraduate student has been trained in filter substrate preparation and OCEC analysis.

In addition, we are finalizing collaborations with other AQRP funded and NASA DISCOVER-AQ collaborators: specifically focusing on sampling logistics and aerosol research. By reaching out to various AQRP and NASA collaborators we have succeeded in expanding the number of samplers at Manvel Croix and Moody Towers. This will:

a. Improve sampling logistics.

b. Increase sampling resolution: Improve coverage of events (i.e. pollution or fights).

c. Increase mass of particulates sampled.

d. Expand opportunities for collaboration.

There were no delays in site preparation which affected the sample setup. Potential issues with electrical power and air conditioning at Manvel Croix was immediately fixed by Jim Thomas.

The rewiring of one circuit at Manvel Croix allowed for higher time resolution sampling to better match DISCOVER-AQ flight days; this was accommodated within 24 hours.

We are anticipating that all funds allocated to this project will be utilized by November 30th, 2013.

Project 12-TN1	STATUS: Active – February 21, 2013

Investigation of surface layer parameterization of the WRF model and its impact on the observed nocturnal wind speed bias

University of Maryland – Daniel Tong
Pius Lee

AQRP Project Manager – Gary McGaughey
TCEQ Project Liaison – Bright Dornblaser

Funding Amount: $64,994

Executive Summary

This study investigates surface layer parameterizations in the Weather Research and Forecasting (WRF) model. The parameterization of energy fluxes from the surface layer significantly impacts the modeled near-surface winds. The WRF model tends to over-predict the surface wind speeds in eastern Texas in the evening hours, especially in coastal regions. This project examines the various similarity theories that parameterize the momentum fluxes of the surface layer used in the WRF meteorological model.

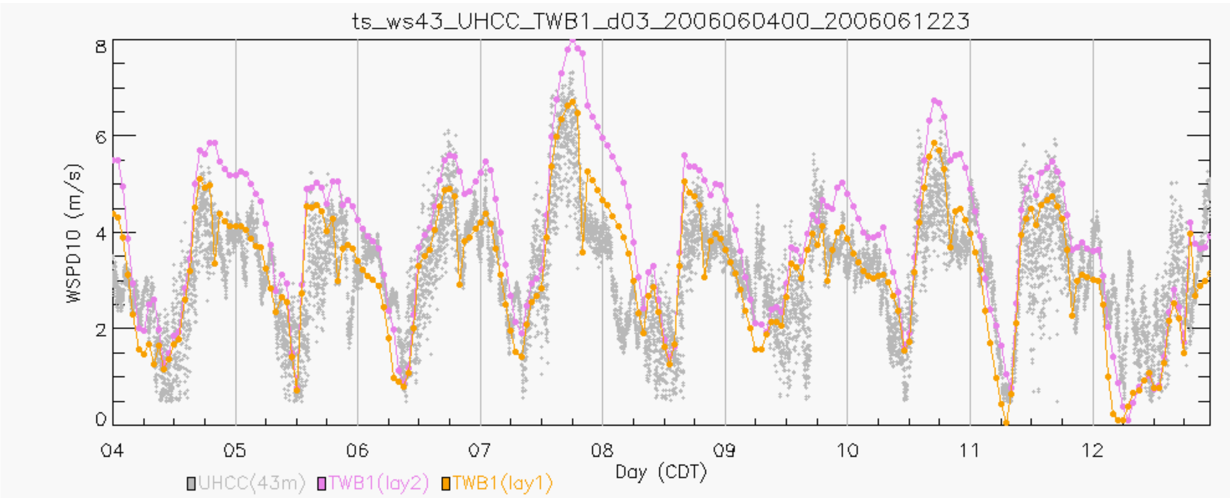
The investigation and possible remedy recommendation for rectifying the high wind-speed-bias is carried out in multiple steps: (A) Understand the sensitivities of the different surface layer schemes, (B) Examine the sensitivity of the flux-profile relationships with regards to synoptic and atmospheric stability conditions, and (C) Investigate the universal flux profile functions and the range of parameter values used by the functions to suggest potential modifications for improvement – especially for the stable regimes. These details of the surface layer schemes are important as they govern the correct timing of the decoupling of near-surface and surface phenomena which are critical in the redistribution of kinetic energy from the residual layer to the surface. The rate of transfer of energy affects the evolution of wind speeds in the lowest layers.

A series of sensitivity runs of the WRF model is devised and conducted with possible recommendation on adjusted values for several of the tunable constants in the surface layer similarity theory parameterizations. Although the runs will focus on an early summer period for the Houston-Galveston-Brazoria area, they should provide insight on the rate and strength of the coupling and decoupling between the surface layer and the lowest model level in a large range of land-use and meteorological conditions.

Project Update

We continued the effort to rerun the simulation with WRF Model version 3.4.1 for the innermost nest for Eastern Texas. This effort stemmed from a relevant decision that this upgraded version included two bug fixes with respect to WRF version 3.2.1 that we used in the previous TCEQ-funded project addressing the wind-bias problem described in the title of this project. Both fixes dealt with the Yonsei University (YSU) planetary boundary layer (PBL) parameterization scheme under stable atmospheric conditions and are directly binding on our model results for nocturnal wind speeds.

Figure 1 shows a comparison of measured and predicted wind speeds in the lowest levels over UHCC. The measurements were made at 43 meters. The predicted winds shown are at 16.9 m (first model level) and 59.4 m (second model level), respectively. The primary challenge of reducing the positive biases in low level wind at early evening hours at coastal sites was not addressed by the results of the newer WRF.



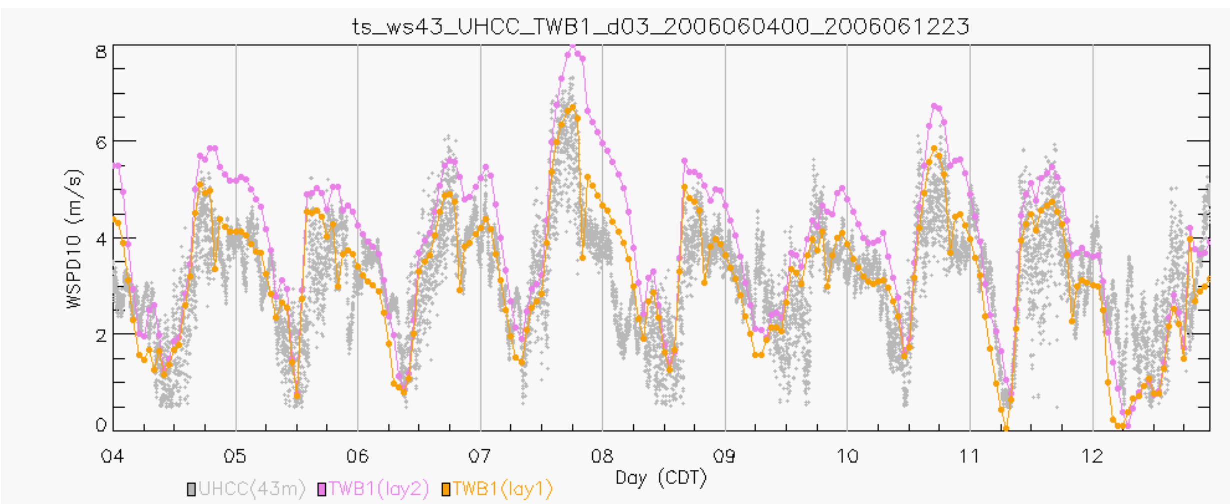


Fig. 1 Time series comparison of 43-m height observed wind (gray color) with 1st layer model wind (~16.9 m, pink line) and 2nd layer model wind (~59.4 m, red line) for large wind bias period at UHCC station for model results by (a) WRF3.2.1, and (b) WRF3.4.1.

We also explored the impact of changing the model physics option for land surface model (LSM) from the MM5's 5-layer slab model to a more sophisticated model – the National Centers for Environmental Prediction; Oregon State University; Air Force; Hydrological Research Laboratory (Noah) LSM. The model results showed some promise as bias was reduced for results by the newer WRF version 3.4.1 for some of these prognostic variables such as the reduced surface sensible heat flux biases over the large period between June 4 and June 13 2006 (See Fig. 2c). However the other variables such as 10 meter wind speed and wind direction did not necessarily see the same degree of improvement (See Fig 2 b and d).

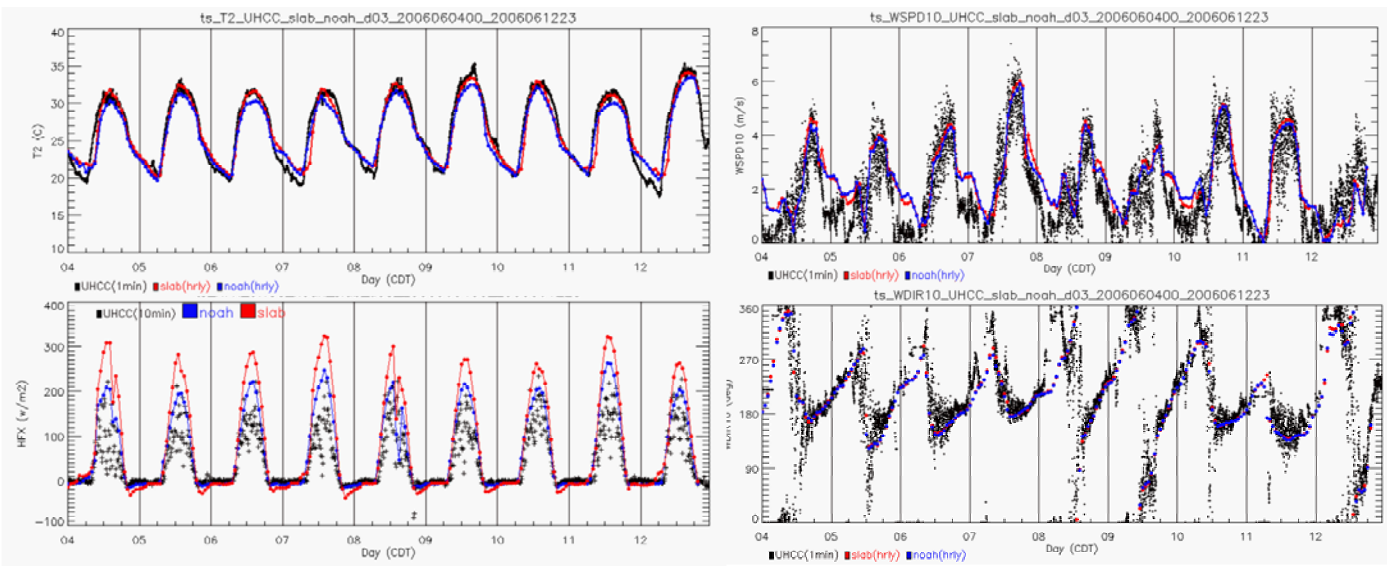


Fig. 2 Comparison of model results between Slab LSM (red) and NOAH LSM (blue) simulations between June 4 and June 13 2006 over UH Coastal Site for (a) 2 m temperature, (b) 10 m wind speed, (c) sensible heat flux and (d) 10 m wind direction.

Modification of WRF to generate extra intermediate output from the surface layer model

As the effort of model rerun did not completely rectify the nocturnal wind bias problem, we embarked to modify the surface layer module of the WRF model to generate extra intermediate output per time step to examine variables that may be an obvious cause of the biases. We started to analyze the stability regimes pertinent to the UHCC site. We had tried two approaches to generate extra intermediate output, such as the stability parameter z/L, where z is height and L is the Monin-Obukhov length scale. The first attempt was to modify the segment of the code where it was derived. We simply added a "print statement" to screen-dump the value at every time step in module "sfclay.F" that performs the surface similarity parameterization calculations. The calculation of z/L was based on Holtslag and De Bruin (1988) and Launiainen (1995). We noticed that there was a strong tendency of z/L to give the “zero” value as noted by Jimenez et al. (2012).

We will continue this time series analysis of the governing parameters of the surface layer model to identify possibilities to adjust one or several parameters to test for reductions in the modeled wind biases.

Project 12-TN2 **STATUS: Active – February 21, 2013**

Development of IDL-based geospatial data processing framework for meteorology and air quality modeling

University of Maryland – Daniel Tong
HyunCheol Kim

AQRP Project Manager – Gary McGaughey
TCEQ Project Liaison – Bright Dornblaser

Funding Amount: $69,985

Executive Summary

This project investigates basic computational algorithms to handle Geographic Information System (GIS) data and satellite data, which are essential in regional meteorological and chemical modeling. It develops a set of generalized libraries within a geospatial data processing framework aiming to process geospatial data more efficiently and accurately. The tool can process GIS data both in vector format (e.g., ESRI shapefiles) and raster format (e.g., GEOTIFF and IMG) for any given domain. Processing speeds will be improved through selective usages of polygon-clipping routines and other algorithms optimized for specific applications. The raster tool will be developed utilizing a histogram reverse-indexing method that enables easy access of grouped pixels. It generates statistics of pixel values within each grid cell with improved speed and enhanced control of memory usage. Spatial allocating tools that use polygon clipping algorithms require huge computational power to calculate fractional weighting between GIS polygons (and/or polylines) and gridded cells. To overcome the speed and computational accuracy deterioration issues, an efficient polygon/polyline clipping algorithm is crucial. A key for faster spatial allocation is to optimize computational iterations in both polygon clipping and map projection calculations.

The project has the following specific objectives: (A) To develop an optimized geospatial data processing tool that can handle raster data format and vector data format with enhanced processing time and accuracy, for any given target domain. (B) To collect and to process sample GIS and satellite data. Applications will include a spatial regridding method for emissions and satellite data, such as the Moderate Resolution Imaging Spectroradiometer (MODIS) Aerosol Optical Depth (AOD), the Ozone Monitoring Instrument (OMI), and the Global Ozone Monitoring Experiment (GOME)-2 NO_2 column data. (C) To perform an engineering test with processed fine resolution LULC data.

Project Update

We have focused on the development of a vector and raster data processing tool, by implementing polygon clipping and pixel statistics algorithms in IDL.

1. Development of GIS vector data processing tools

Handling vector data is essential to convert irregular-shaped GIS vector data into a designated model grid. We have developed two algorithms for spatial data regridding. Spatial regridding is a commonly performed procedure in satellite data processing. It converts a data set between different map projections and resolutions. Among numerous spatial regridding methods, interpolation and pixel aggregation are two of the most common methods. Interpolation is preferred when the target domain resolution is higher than the raw data pixels, while pixel aggregation is the preferred way to average all the pixels inside each domain cell when the grid cell size is bigger than the raw data pixel size. Despite their popularity, the need for more mathematically complete methods for spatial regridding has been raised, especially in dealing with fine resolution data and/or where conservation of a measured quantity is required. A case in point is processing emission data. It requires great caution on spatial data handling because mass conservation is strictly applied. EPA's spatial allocator used in their emission model Sparse Matrix Operator Kernel Emissions (SMOKE) is one of the examples to reproject emission data without a loss of emission quantity. It calculates fractional areas of overlapping polygons between raw data pixels and modeling grid cells. In order to build a lossless spatial regridding tool, we have utilized polygon clipping algorithms, and have developed a tool to perform accurate spatial regridding of satellite data. Two key algorithms for the regridding tool are developed and implemented: the "Conservative remapping" algorithm performs lossless spatial remapping, and the "Downscaling" algorithm is designed to generate fine structure out of coarse resolution input data (e.g. satellite pixels), with additional information from fine resolution data set (e.g. fine resolution model simulation)

2. Raster data processing tool

Algorithms for raster data processing are rather straightforward compared to vector processing algorithms that use complicated polygon clipping algorithms. However, optimizations of raw data accessing methods and pixel indexing are required to efficiently handle huge raster data. We have built partial data accessing routines for several GIS raster data formats such as Geo Tagged Image File (GeoTIFF) and ERDAS IMAGINE (.IMG) files, to avoid unnecessary access of whole data set that often causes memory problems. We also utilized histogram reverse-indexing methods from the IDL histogram routine, which enables easy access of grouped pixels for given indices (e.g. target domain cell index). In addition, it generates statistics of pixel values within each grid cell with improved efficiency and enhanced control of memory usage. Pixel statistics algorithm was further extended to be applied to any given polygons with arbitrary shapes, which enables the conversion of raster data information not only into domain cells but also to any GIS boundary (e.g. raster data statistics in any Federal Information Processing Standards (FIPS) boundary).

FINANCIAL STATUS REPORT

Initial funding for fiscal year 2010 was established at $2,732,071.00. In late May 2010 an amendment was issued increasing the budget by $40,000. Funding for fiscal year 2011 was established at $2,106,071, for a total award of $4,878,142 for the FY 2010/2011 biennium. FY 2010 funds were fully expended in early 2012 and the FY 2011 funds expired on June 30, 2013 with a remaining balance of $0.11.

In February 2012, funding of $1,000,000 was awarded for FY 2012. In June 2012, an additional $160,000 was awarded in FY 2012 funds and $1,000,000 was awarded in FY 2013 funds, for a total of $2,160,000 in funding for the FY 2012/2013 biennium.

In April 2013, the grant was amended to reduce the FY 2012 funds by $133,693.60 and increase the FY 2011 funds by the same amount.

In June 2013, the grant was amended to increase the FY 2013 funds by $2,500,000.

All of these funds were distributed across several different reporting categories as required under the contract with TCEQ. The reporting categories are:

Program Administration – limited to 10% of the overall funding (per Fiscal Year)
This category includes all staffing, materials and supplies, and equipment needed to administer the overall AQRP. It also includes the costs for the Council meetings.

ITAC
These funds are to cover the costs, largely travel expenses, for the ITAC meetings.

Project Management – limited to 8.5% of the funds allocated for Research Projects
Each research project will be assigned a Project Manager to ensure that project objectives are achieved in a timely manner and that effective communication is maintained among investigators in multi-institution projects. These funds are to support the staffing and performance of project management.

Research Projects / Contractual
These are the funds available to support the research projects that are selected for funding.

Program Administration

Program Administration includes salaries and fringe benefits for those overseeing the program as a whole, as well as, materials and supplies, travel, equipment, and other expenses. This category allows indirect costs in the amount of 10% of salaries and wages.

During the reporting period several staff members were involved, part time, in the administration of the AQRP. Dr. David Allen, Principal Investigator and AQRP Director, is responsible for the overall administration of the AQRP. James Thomas, AQRP Manager, is responsible for assisting Dr. Allen in the program administration. Maria Stanzione, AQRP Grant Manager, with assistance from Rachael Bushn, Melanie Allbritton, and Susan McCoy each provided assistance with program organization and financial management. This included assisting with the contracting process. Denzil Smith is responsible for the AQRP Web Page development and for data management.

Fringe benefits for the administration of the AQRP were initially budgeted to be 22% of salaries and wages across the term of the project. It should be noted that this was an estimate, and actual fringe benefit expenses have been reported for each month. The fringe benefit amount and percentage fluctuate each month depending on the individuals being paid from the account, their salary, their FTE percentage, the selected benefit package, and other variables. For example, the amount of fringe benefits is greater for a person with family medical insurance versus a person with individual medical insurance. At the end of the project, the overall total of fringe benefit expensed is expected to be at or below 22% of the total salaries and wages. Actual fringe benefit expenses to date are included in the spreadsheets above.

As discussed in previous Quarterly Reports, the AQRP Administration requested and received permission to utilize funds in future fiscal years. This is for all classes of funds including Administration, ITAC, Project Management, and Contractual. As of the writing of this report, the FY 10 and 11 funds have been fully expended. This same procedure will be followed for the FY 12 and 13 funds.

In June 2013, UT-Austin received a Contract Extension for the AQRP. This extension will continue the program through December 29, 2015.

Table 1: AQRP Administration Budget

Administration Budget (includes Council Expenses)
FY 2010/2011

Budget Category	FY10 Budget	FY11 Budget	Total	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary	$202,816.67	$172,702.06	$375,518.73	$375,518.73	$0	$0
Fringe Benefits	$38,665.65	$33,902.95	$72,568.60	$72,568.60	$0	$0
Travel	$346.85	$0	$346.85	$346.85		$0
Supplies	$15,096.14	$101.25	$15,197.39	$15,197.39	$96.73	$0
Equipment	$0	$0	$0			$0
Total Direct Costs	$256,925.31	$206,706.26	$463,631.57	$463,631.57	$0	$0
Authorized Indirect Costs	$20,281.69	$17,270.20	$37,551.89	$37,551.89		$0
10% of Salaries and Wages						
Total Costs	**$277,207**	**$223,976.46**	**$501,183.46**	**$501,183.46**	**$0**	**$0**
Fringe Rate	22%	22%		19%		

Administration Budget (includes Council Expenses)
FY 2012/2013

Budget Category	FY12 Budget	FY13 Budget	Total	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary	$68,340.00	$265,040.00	$333,380.00	$83,579.16	$0.00	$249,800.84
Fringe Benefits	$14,606.64	$47,706.00	$62,312.64	$19,299.29	$0.00	$43,013.35
Travel	$2,850.00	$750	$3,600.00	$339.13		$3,260.87
Supplies	$10,000.00	$10,000	$20,000.00	$1,815.13	$0.00	$18,184.87
Equipment	$0.00	$0	$0			$0
Total Direct Costs	$95,796.64	$323,496.00	$419,292.64	$105,032.71	$0.00	$314,259.93
Authorized Indirect Costs	$6,834.00	$26,504.00	$33,338.00	$8,357.91	$0.00	$24,980.09
10% of Salaries and Wages						
Total Costs	**$102,630.64**	**$350,000.00**	**$452,630.64**	**$113,390.62**	**$0.00**	**$339,240.02**
Fringe Rate	22%	22%		23%		

ITAC

All ITAC activities in this period were conducted via email and webinar, therefore no expenses related to ITAC meetings were incurred. The remaining FY 2011 ITAC funds were rebudgeted to the Project Management and Research Project categories, so that the funds could be fully expended for research activities by the AQRP.

Table 2: ITAC Budget

ITAC Budget
FY 2010/2011

Budget Category		FY10 Budget	FY11 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary							
Fringe Benefits							
Travel		$16,378.86	$6,292.97	$22,671.83	$22,671.83	$0.00	$0
Supplies		$1,039.95	$284.67	$1,324.62	$1,324.62	$0.00	0
Total Direct Costs		$17,418.81	$6,577.64	$23,996.45	$23,996.45	$0.00	$0
Authorized Indirect Costs							
10% of Salaries and Wages							
Total Costs		**$17,418.81**	**$6,577.64**	**$23,996.45**	**$23,996.45**	**$0.00**	**$0**

ITAC Budget
FY 2012/2013

Budget Category		FY12 Budget	FY13 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary							
Fringe Benefits							
Travel		$10,000	$8,000.00	$18,000	$0	$0	$18,000.00
Supplies		$500	$2,000.00	$2,500	$0		$2,500.00
Total Direct Costs		$10,500	$10,000.00	$20,500	$0	$0	$20,500.00
Authorized Indirect Costs							
10% of Salaries and Wages							
Total Costs		**$10,500**	**$10,000.00**	**$20,500**	**$0**	**$0**	**$20,500.00**

Project Management

In August 2012, Project Managers were assigned to the FY 2012-2013 Research Projects. Project Managers continued to work with Investigators to make sure they met reporting deadlines.

Table 3: Project Management Budget

Project Management Budget
FY 2010/2011

Budget Category		FY10 Budget	FY11 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary		$145,337.70	$121,326.64	$266,664.34	$266,664.34	$0	$0
Fringe Benefits		$28,967.49	$23,102.60	$52,070.09	$52,070.26	$0	($0.17)
Travel		$0	$0	$0	$0		$0
Supplies		$778.30	$207.98	$986.28	$986.22	$0	$0.06
Total Direct Costs		$175,083.49	$144,637.22	$319,720.71	$319,720.82	$0	($0.11)
Authorized Indirect Costs		$14,533.77	$12,132.66	$26,666.43	$26,666.32	$0	$0.11
10% of Salaries and Wages							
Total Costs		**$189,617.26**	**$156,769.88**	**$346,387.14**	**$346,387.14**	**$0**	**$0.00**

Project Management Budget
FY 2012/2013

Budget Category		FY12 Budget	FY13 Budget	Total Budget	Expenses	Pending Expenses	Remaining Balance
Personnel/Salary		$48,900.00	$152,000	$200,900.00	$40,921.65	$0.00	$159,978.35
Fringe Benefits		$9,106.00	$31,800	$40,906.00	$8,409.23	$0.00	$32,496.77
Travel		$500	$0	$500.00	$0.00		$500.00
Supplies		$7,279.76	$6,000	$13,279.76	$392.98		$12,886.78
Total Direct Costs		$65,785.76	$189,800	$255,585.76	$49,723.86	$0.00	$205,861.90
Authorized Indirect Costs		$4,890.00	$15,200	$20,090.00	$4,092.16	$0.00	$15,997.84
10% of Salaries and Wages							
Total Costs		**$70,675.76**	**$205,000**	**$275,675.76**	**$53,816.02**	**$0.00**	**$221,859.74**

Research Projects

FY 2010-2011

The FY 2010 Research/Contractual budget was originally funded at $2,286,000. After all transfers, it was increased by $1,827.93. The FY 2011 Research/Contractual budget was originally funded at $1,736,063. After all transfers, it was increased by $377.62, plus an additional $116,000 from FY 2012 funds that were changed to FY 2011 funds. This is an overall net increase of $13,205.55 to the Research/Contractual funds (and net reduction in Project Management/ITAC funds). ($105,000 in FY 2012 research funds were transferred to FY 2011, the remaining $11,000 were transfers from Project Management funds.)

All FY 2010 Research Project funding was fully expensed before the expiration of FY 2010 funds in June 2012. The FY 2011 Research Project funding that remained after all FY 2011 research projects were completed was allocated to FY 2012-2013 projects. This included the funds that were reallocated from FY 2012 to FY 2011. The funds were allocated to project 13-016 Valparaiso and project 13-004 Discover AQ Infrastructure. Both projects utilized their FY 2011 funds (project 13-004 $116,000 and project 13-016 $20,168.90) by June 30, 2013. A remaining balance of $0.11 was returned to TCEQ.

Table 4 on the following 2 pages illustrates the 2010-2011 Research Projects, including the funding awarded to each project and the total expenses reported on each project through the expiration of the FY 2011 funds on June 30, 2013.

FY 2012-2013

The FY 2012 Research/Contractual budget was originally funded at $815,000. Transfers to date have increased the budget by $27,500. The FY 2013 Research Contractual budget was originally funded at $835,000. In June 2013, Amendment 9 increased this budget by $2,100,000. (The remaining $400,000 was allocated to Admin and Project Management.) $1,402,744 of these funds were allocated to Project 13-004 to allow for the purchase of additional infrastructure equipment and expand the number of Discover-AQ sites. The funds that have not yet been allocated to research projects will be allocated from the next RFP.

Table 5 illustrates the 2012-2013 Research Projects, including the funding awarded to each project and the total expenses reported on each project as of August 31, 2013.

Table 4: 2010/2011 Contractual Expenses

Contractual Expenses				
FY 10 Contractual Funding		$2,286,000		
FY 10 Contractual Funding Transfers		$1,827.93		
FY 10 Total Contractual Funding		**$2,287,827.93**		
Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
10-008	Rice University	$128,851	$126,622.32	$2,228.68
10-008	Environ International	$49,945	$49,944.78	$0.22
10-009	UT-Austin	$591,332	$591,306.66	$25.34
10-021	UT-Austin	$248,786	$248,786.41	-$0.41
10-022	Lamar University	$150,000	$132,790.80	$17,209.20
10-032	University of Houston	$176,314	$176,314	$0
10-032	University of New Hampshire	$23,054	$18,850.65	$4,203.35
10-032	UCLA	$49,284	$47,171.32	$2,112.68
10-034	University of Houston	$195,054	$186,657.54	$8,396.46
10-042	Environ International	$237,481	$237,479.31	$1.69
10-045	UCLA	$149,773	$142,930.28	$6,842.72
10-045	UNC - Chapel Hill	$33,281	$33,281	$0
10-045	Aerodyne Research Inc.	$164,988	$164,988.10	-$0.10
10-045	Washington State University	$50,000	$50,000	$0
10-DFW	UT-Austin	$37,857	$37,689.42	$167.58
FY 10 Total Contractual Funding Awarded		$2,286,000		
FY 10 Contractual Funding Expended (Init. Projects)			$2,244,812.59	
FY 10 Contractual Funds Remaining Unspent after Project Completion				$41,187.41
FY 10 Additional Projects				
	Data Storage	$7,015.34	$7,015.34	$0
10-SOS	State of the Science	$36,000.00	$36,000.00	$0
FY 10 Contractual Funds Expended to Date*			$2,287,827.93	
FY 10 Contractual Funds Remaining to be Spent				$0

FY 11 Contractual Funding		$1,736,063.00		
FY 11 Contractual Funding Transfers		$116,377.62		
FY 11 Total Contractual Funding		**$1,852,440.62**		
Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
10-006	Chalmers University of Tech	$262,179	$262,179	$0
10-006	University of Houston	$222,483	$217,949.11	$4,533.89
10-015	Environ International	$201,280	$201,278.63	$1.37
10-020	Environ International	$202,498	$202,493.48	$4.52
10-024	Rice University	$225,662	$223,769.99	$1,892.01
10-024	University of New Hampshire	$70,747	$70,719.78	$27.22
10-024	University of Michigan	$64,414	$60,597.51	$3,816.49
10-024	University of Houston	$98,134	$88,914.46	$9,219.54
10-029	Texas A&M University	$80,108	$78,276.97	$1,831.03
10-044	University of Houston	$279,642	$277,846.38	$1,795.62
11-DFW	UT-Austin	$50,952	$29,261.75	$21,690.25
FY 11 Total Contractual Funding Awarded		$1,758,099		
FY 11 Contractual Funds Expended (Init. Projects)			$1,713,287.06	
FY 11 Contractual Funds Remaining Unspent after Project Completion				$44,811.94
FY 11 Additional Projects				
	Data Storage	$2,984.66	$2,984.66	$0.00
	12-016 Valparaiso	$20,168.90	$0.00	$21,168.90
	12-004 Discover AQ Infrastructure	$116,000.00	$115,999.89	$0.11
FY 11 Contractual Funds Expended to Date*			$1,852,440.51	
FY 11 Contractual Funds Remaining to be Spent				$0.11
Total Contractual Funding		$4,022,063.00		
Total Contractual Funding Transfers		$118,205.55		
Total Contractual Funding Available		$4,140,268.55		
Total Contractual Funds Expended to Date			$4,140,268.44	
Total Contractual Funds Remaining				$0.11

Table 5. 2012/2013 Contractual Expenses

Contractual Expenses

FY 12 Contractual Funding		$815,000		
FY 12 Contractual Funding Transfers		$27,500		
FY 12 Total Contractual Funding		**$842,500**		
Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
12-004	UT-Austin (Torres)	$4,820		$4,820.00
12-006	UC-Riverside	$101,765	$51,991.58	$49,773.42
12-006	TAMU/TEES	$44,494	$6,553.52	$37,940.48
12-011	Environ International	$77,420	$51,302.43	$26,117.57
12-012	UT-Austin (Hildebrandt)	$79,463	$40,805.64	$38,657.36
12-012	Environ International	$69,374	$20,951.90	$48,422.10
12-013	Environ International	$59,974	$43,353.42	$16,620.58
12-018	UT-Austin (McDonald-Buller)	$85,282	$33,615.73	$51,666.27
12-018	Environ International	$21,688	$4,053.96	$17,634.04
12-028	University of Houston	$19,599	$15,724.01	$3,874.99
12-028	UCLA	$17,944	$15,232.40	$2,711.60
12-028	Environ International	$44,496	$26,903.01	$17,592.99
12-028	UNC - Chapel Hill	$35,230	$30,465.25	$4,764.75
12-032	Baylor	$45,972	$23,478.80	$22,493.20
12-TN1	Maryland	$64,994		$64,994.00
12-TN2	Maryland	$69,985		$69,985.00
FY 12 Total Contractual Funding Awarded		$842,500		
FY 12 Contractual Funds Remaining to be Awarded		$0		
FY 12 Contractual Funds Expended to Date			$364,431.65	
FY 12 Contractual Funds Remaining to be Spent				$450,568

FY 13 Contractual Funding		$835,000		
FY 13 Contractual Funding Transfers		$2,100,000		
FY 13 Total Contractual Funding		**$2,935,000**		
Project Number		Amount Awarded (Budget)	Cumulative Expenditures	Remaining Balance
13-004	UT-Austin (Torres)	$1,571,124	$412,081.85	$1,159,042.15
13-005	Chalmers University of Tech	$129,047	$19,150.31	$109,896.69
13-005	University of Houston	$48,506	$23,027.69	$25,478.31
13-016	Valparaiso	$46,652	$18,289.37	$28,362.73
13-016	University of Houston	$19,846	$6,572.16	$13,273.84
13-022	Rice University	$89,912	$28,181.62	$51,730.38
13-022	University of Houston	$116,903	$68,302.16	$48,600.84
13-024	Maryland	$90,444	$33,911.99	$56,532.01
FY 13 Total Contractual Funding Awarded		$2,112,434		
FY 13 Contractual Funding Remaining to be Awarded		$822,566		
FY 13 Contractual Funds Expended to Date			$619,517.15	
FY 13 Contractual Funds Remaining to be Spent				$215,483
Total Contractual Funding		$3,777,500		
Total Contractual Funding Awarded		$2,954,934		
Total Contractual Funding Remaining to be Awarded		$822,566		
Total Contractual Funds Expended to Date			$983,948.80	
Total Contractual Funds Remaining to be Spent				$2,793,551

Summary

The expenditure of FY 2012 funds is proceeding as anticipated. It is expected that all FY 2012 funds, including Research/Contractual funds, will be fully expended by March 31, 2014. In December 2013, the AQRP Administration will request an extension of the end date of the FY 2012 funds from 12/29/13 to 3/31/14 to facilitate the final expenditures. This will also require budget transfers from the ITAC to the Project Management budget.

Once all FY 2012/2013 projects have been fully invoiced, a total of approximately $1,000,000 is expected to remain in FY 2013 project funds. Most of these funds will remain from Project 13-004, which was reduced in scope due to timing issues related to the purchase of infrastructure equipment. An off-shoot project from the AQRP Infrastructure project is expected to be approved that will utilize approximately $100,000 of this amount.

This will leave approximately $900,000 in FY 2013 funds and $825,000 in FY 2014 and FY 2015 funds, respectively, for a total of approximately $2,550,000 in the Research/Contractual budget.

Appendix A

Financial Reports by Fiscal Year

FY 10 and 11

(Expenditures reported as of May 31, 2013.)

Administration Budget (includes Council Expenses)

FY 2010

Budget Category		FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$202,816.67	$202,816.67		$0
Fringe Benefits		$38,665.65	$38,665.65		$0
Travel		$346.85	$346.85		$0
Supplies		$15,096.14	$15,096.14		$0
Equipment		$0.00			$0
Other					
Contractual					
Total Direct Costs		$256,925.31	$256,925.31		$0
Authorized Indirect Costs		$20,281.69	$20,281.69		$0
10% of Salaries and Wages					
Total Costs		**$277,207.00**	**$277,207.00**	**$0**	**$0**

Administration Budget (includes Council Expenses)

FY 2011

Budget Category		FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$172,702.06	$172,702.06	$0.00	$0.00
Fringe Benefits		$33,902.95	$33,902.95	$0.00	$0.00
Travel		$0.00		$0.00	$0.00
Supplies		$101.25	$101.25	$0.00	$0.00
Equipment					
Other		$0.00			$0.00
Contractual					
Total Direct Costs		$206,706.26	$206,706.26	$0.00	$0.00
Authorized Indirect Costs		$17,270.20	$17,270.20	$0.00	$0.00
10% of Salaries and Wages					
Total Costs		**$223,976.46**	**$223,976.46**	**0.00**	**$0.00**

ITAC Budget

FY 2010

Budget Category		FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary					
Fringe Benefits					
Travel		$16,378.86	$16,378.86	$0	$0
Supplies		$1039.95	$1,039.95		$0
Equipment					
Other					
Total Direct Costs		$17,418.81	$17,418.81	$0	$0
Authorized Indirect Costs					
10% of Salaries and Wages					
Total Costs		**$17,418.81**	**$17,418.81**	**$0**	**$0**

ITAC Budget

FY 2011

Budget Category		FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary					
Fringe Benefits					
Travel		$6,292.97	$6,292.97	$0.00	$0
Supplies		$284.67	$284.67	$0.00	$0
Equipment					
Other					
Total Direct Costs		$6,577.64	$6,577.64	$0.00	$0
Authorized Indirect Costs					
10% of Salaries and Wages					
Total Costs		**$6,577.64**	**$6,577.64**	**$0.00**	**$0**

Project Management Budget
FY 2010

Budget Category		FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$145,337.70	$145,337.70		$0
Fringe Benefits		$28,967.49	$28,967.49		$0
Travel		$0	$0		$0
Supplies		$778.30	$778.30		$0
Equipment					
Other					
Total Direct Costs		$175,083.49	$175,083.49	$0	$0
Authorized Indirect Costs		$14,533.77	$14,533.77		$0
10% of Salaries and Wages					
Total Costs		**$189,617.26**	**$189,617.26**	**$0**	**$0**

Project Management Budget
FY 2011

Budget Category		FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$121,326.64	$121,326.64	$0	$0
Fringe Benefits		$23,102.60	$23,102.77	$0	($0.17)
Travel		$0			$0
Supplies		$207.98	$207.92	$0	$0.06
Equipment					
Other					
Total Direct Costs		$144,637.22	$144,637.33	$0	($0.11)
Authorized Indirect Costs		$12,132.66	$12,132.55	$0	$0.11
10% of Salaries and Wages					
Total Costs		**$156,769.88**	**$156,769.88**	**$0**	**$0.00**

FY 2010

Budget Category		FY10 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$202,816.67	$202,816.67	$0.00	$0.00
Fringe Benefits		$38,665.65	$38,665.65	$0.00	$0.00
Travel		$346.85	$346.85	$0.00	$0.00
Supplies		$15,096.14	$15,096.14	$0.00	$0.00
Equipment		$0	$0.00	$0.00	$0.00
Other		$0	$0.00	$0.00	$0.00
Contractual		$2,287,827.93	$2,287,827.93	$0.00	$0.00
ITAC		$17,418.81	$17,418.81	$0.00	$0.00
Project Management		$189,617.26	$189,617.26	$0.00	$0.00
Total Direct Costs		$2,751,789.31	$2,751,789.31	$0.00	$0.00
Authorized Indirect Costs		$20,281.69	$20,281.69	$0.00	$0.00
10% of Salaries and Wages					
Total Costs		**$2,772,071.00**	**$2,772,071.00**	**$0.00**	**$0.00**

AQRP Budget

FY 2011

Budget Category		FY11 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$172,702.06	$172,702.06	$0.00	$0.00
Fringe Benefits		$33,902.95	$33,902.95	$0.00	$0.00
Travel		$0.00	$0.00	$0.00	$0.00
Supplies		$101.25	$101.25	$0.00	$0.00
Equipment		$0.00	$0.00	$0.00	$0.00
Other		$0.00	$0.00	$0.00	$0.00
Contractual		$1,852,440.62	$1,852,440.51	$0.00	$0.11
ITAC		$6,577.64	$6,577.64	$0.00	($0.00)
Project Management		$156,769.88	$156,769.88	$0.00	$0.00
Total Direct Costs		$2,222,494.40	$2,222,494.29	$0.00	$0.11
Authorized Indirect Costs		$17,270.20	$17,270.20	$0.00	$0.00
10% of Salaries and Wages					
Total Costs		**$2,239,764.60**	**$2,239,764.49**	**$0.00**	**$0.11**

Appendix B

Financial Reports by Fiscal Year

FY 12 and 13

(Expenditures reported as of May 31, 2013.)

Administration Budget (includes Council Expenses)

FY 2012

Budget Category		FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$68,340.00	$67,920.86	$0.00	$419.14
Fringe Benefits		$14,606.64	$15,700.48	$0.00	($1,093.84)
Travel		$2,850.00	$339.13		$2,510.87
Supplies		$10,000.00	$1,738.80	$0.00	$8,261.20
Equipment		$0.00			$0.00
Other					
Contractual					
Total Direct Costs		$95,796.64	$85,699.27	$0.00	$10,097.37
Authorized Indirect Costs		$6,834.00	$6,792.08	$0.00	$41.92
10% of Salaries and Wages					
Total Costs		**$102,630.64**	**$92,491.35**	**$0.00**	**$10,139.29**

Administration Budget (includes Council Expenses)

FY 2013

Budget Category		FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$265,040.00	$15,658.30		$249,381.70
Fringe Benefits		$47,706.00	$3,598.81		$44,107.19
Travel		$750.00	$0.00		$750.00
Supplies		$10,000.00	$76.33		$9,923.67
Equipment					
Other		$0.00	$0.00		$0.00
Contractual					
Total Direct Costs		$323,496.00	$19,333.44	$0.00	$304,162.56
Authorized Indirect Costs		$26,504.00	$1,565.83		$24,938.17
10% of Salaries and Wages					
Total Costs		**$350,000.00**	**$20,899.27**	**$0.00**	**$329,100.73**

ITAC Budget
FY 2012

Budget Category		FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary					
Fringe Benefits					
Travel		$10,000.00	$0.00	0.00	$10,000.00
Supplies		$500.00			$500.00
Equipment					
Other					
Contractual					
Total Direct Costs		$10,500.00	$0.00	$0.00	$10,500.00
Authorized Indirect Costs					
10% of Salaries and Wages					
Total Costs		**$10,500.00**	**0.00**	**$0.00**	**$10,500.00**

ITAC Budget
FY 2013

Budget Category		FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary					
Fringe Benefits					
Travel		$8,000.00	$0.00		$8,000.00
Supplies		$2,000.00	$0.00		$2,000.00
Equipment					
Other					
Contractual					
Total Direct Costs		$10,000.00	$0.00	$0.00	$10,000.00
Authorized Indirect Costs					
10% of Salaries and Wages					
Total Costs		**$10,000.00**	**$0.00**	**$0.00**	**$10,000.00**

Project Management Budget
FY 2012

Budget Category		FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$48,900.00	$40,921.65	$0.00	$7,978.35
Fringe Benefits		$9,106.00	$8,409.23	$0.00	$696.77
Travel		$500.00			$500.00
Supplies		$7,279.76	$392.98		$6,886.78
Equipment					
Other					
Contractual					
Total Direct Costs		$65,785.76	$49,723.86	$0.00	$16,061.90
Authorized Indirect Costs		$4,890.00	$4,092.16	$0.00	$797.84
10% of Salaries and Wages					
Total Costs		**$70,675.76**	**53,816.02**	**$0.00**	**$16,859.74**

Project Management Budget
FY 2013

Budget Category		FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$152,000.00			$152,000.00
Fringe Benefits		$31,800.00			$31,800.00
Travel		$0.00			$0.00
Supplies		$6,000.00			$6,000.00
Equipment					
Other					
Contractual					
Total Direct Costs		$189,800.00	$0.00	$0	$189,800.00
Authorized Indirect Costs		$15,200.00			$15,200.00
10% of Salaries and Wages					
Total Costs		**$205,000.00**	**0.00**	**$0.00**	**$205,000.00**

AQRP Budget
FY 2012

Budget Category		FY12 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$68,340.00	$67,920.86	$0.00	$419.14
Fringe Benefits		$14,606.64	$15,700.48	$0.00	($1,093.84)
Travel		$2,850.00	$339.13	$0.00	$2,510.87
Supplies		$10,000.00	$1,738.80	$0.00	$8,261.20
Equipment		$0.00	$0.00	$0.00	$0.00
Other		$0.00	$0.00	$0.00	$0.00
Contractual		$842,500.00	$364,431.65	$0.00	$478,068.35
ITAC		$10,500.00	$0.00	$0.00	$10,500.00
Project Management		$70,675.76	$53,816.02	$0.00	$16,859.74
Total Direct Costs		$1,019,472.40	$503,946.94	$0.00	$515,525.46
Authorized Indirect Costs		$6,834.00	$6,792.08	$0.00	$41.92
10% of Salaries and Wages					
Total Costs		**$1,026,306.40**	**$510,739.02**	**$0.00**	**$515,567.38**

AQRP Budget

FY 2013

Budget Category		FY13 Budget	Cumulative Expenditures	Pending Expenditures	Remaining Balance
Personnel/Salary		$265,040.00	$15,658.30	$0.00	$249,381.70
Fringe Benefits		$47,706.00	$3,598.81	$0.00	$44,107.19
Travel		$750.00	$0.00	$0.00	$750.00
Supplies		$10,000.00	$76.33	$0.00	$9,923.67
Equipment		$0.00	$0.00	$0.00	$0.00
Other		$0.00	$0.00	$0.00	$0.00
Contractual		$2,935,000.00	$619,517.15	$0.00	$2,315,482.85
ITAC		$10,000.00	$0.00	$0.00	$10,000.00
Project Management		$205,000.00	$0.00	$0.00	$205,000.00
Total Direct Costs		$3,473,496.00	$638,850.59	$0.00	$2,834,645.41
Authorized Indirect Costs		$26,504.00	$1,565.83	$0.00	$24,938.17
10% of Salaries and Wages					
Total Costs		**$3,500,000.00**	**$640,416.42**	**$0.00**	**$2,859,583.58**