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Texas Commission on Environmental Quality
New Technology Research & Development (NTRD) Program
Monthly Project Status Report

Contract Number: 582-5-70807-0009

Grantee: The University of Texas at Austin

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Report for the **Monthly** period:

Starting Date June 1, 2006 Ending Date June 30, 2006

Section I. Accomplishments (*Please provide a bulleted list of project accomplishments as well as a description of their importance to the project.)*

The project involves the collaboration of two University of Texas at Austin research centers: the Center for Space Research (CSR) and the Center for Energy and Environmental Resources (CEER). The CSR team is led by Melba Crawford (Co-PI), Gordon Wells (Co-PI) and Teresa Howard. The CEER team is led by Elena McDonald-Buller and David Allen.

Accomplishments in June by the two research teams included the following:

- As part of Task 2.1, CEER continued its investigation to discover suitable sources of meteorological data for input into GloBEIS to improve biogenic emission estimates using the CSR LULC dataset to facilitate comparison of these estimates with historical and future air monitoring system data.

- As part of Task 2.2., CEER continued to examine the impacts of land cover data on predictions of dry deposition velocities and ozone mixing ratios. To do this, two new land cover data products derived from satellite remote sensing instruments (MODIS and AVHRR) are used to describe the area of interest as areal fractions of the 11 dry deposition modeling land use/land cover categories. The land cover products are then used as inputs to the photochemical grid model used by the Sate of Texas and predictions are compared to model runs initialized with the land use data set currently used by the state. CEER also presented their recent findings on the use of satellite data for estimating dry deposition at the AWMA annual conference in New Orleans.

- CSR continued to study the relationship between the NDVI and PDSI in support of task 2.4.1. In this effort, a new product, the Vegetation Condition Index (VCI), was calculated by subtracting the monthly minimum NDVI and dividing by the monthly NDVI range. The VCI values were then averaged over the east Texas focus region for comparison with the weekly PDSI values. In this comparison, some periods appeared to yield closer correlations between the PDSI and VCI calculations when compared to the differences from median NDVI examined last month. Periods in which PDSI and VCI changed in opposite directions still occurred. Thus, it is clear that the VCI will not provide a simple, reliable measurement relatable directly to PDSI. It may be possible to reduce the complexity of the problem by focusing on representative areas dominated by a single type of vegetation cover or by focusing on specific time intervals, perhaps using a separate equation for each month of the year.

- For Task 2.5, CSR delivered the final fire products to CEER to meet the task objectives.

- To meet requirements of Task 2.6, CSR focused on comparisons using field data measured at the Uvalde test site. Discussions with Texas Cooperative Extension field personnel at Uvalde indicated that the soil moisture measurement points were selected to investigate soil treatment methods (e.g., controlled burning, roller chopping) performed by the researchers at various times. Thus, the soil moisture measurements at some locations are not representative of the large area covered by the sensor footprint of AMSR-E and must be removed from analysis. The Uvalde researchers were asked to identify when and where the soil treatment was performed so that these measurements can be discarded. In addition, records of local precipitation data were obtained from the Uvalde test area.

- Also as part of Task 2.6, AMSR-E soil moisture data were sent to researchers at the University of Houston for comparison of the remotely sensed soil moisture measurements with values obtained by meteorological simulations.

Indicate which part of the Grant Activities as defined in the grant agreement, the above accomplishments are related to:

As noted, the accomplishments are primarily related to Tasks 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6, with Tasks 2.2, subtask 2.4.1 and 2.6 receiving particular attention.

Section II: **Problems/Solutions**

We have come to question whether the PDSI (see Task 2.4) represents the most useful parameter for estimating biogenic emissions. Christine Wiedinmyer of NCAR indicated that PDSI was likely selected by modelers for the lack of a better alternative. A review of literature related to vegetation monitoring leads to the conclusion that little research has been done to determine whether a meteorologically derived drought index, such as the PDSI, or a remotely sensed parameter, such as NDVI, provides a better correlation with biogenic emissions. However, there is some indication that a satellite derived NDVI may correlate better with crop yields than meteorologically derived drought indices. While agricultural crops differ from the tree cover that interests atmospheric modelers, this result suggests that remotely sensed data could provide better information about biogenic responses and thus more accurate biogenic emission estimates than the PDSI. Literature research concerning this issue will continue.

The development of completed land cover for the region outside of the HGBPA modeling domain has been impeded by the long delay of a contract agreement between CSR, HARC and the Texas Forest Service that would supply critical ground truth information required for the image classification procedure. Contract negotiations were concluded in June 2006. CSR anticipates that work on Task 2.1 will recommence in late July.

Section III. **Goals and Issues for Succeeding Period**: (*Please provide a brief description of the goal(s) you hope to realize in the coming period and identify any notable challenges that can be foreseen)*

CEER will explore the use of the CSR land cover dataset for dry deposition estimation by cross-walking the CSR land cover categories to the 11 CAMx land use categories to create a consistent LULC dataset for the HGBPA domain. In a further investigation of the sensitivity of urban dry deposition rates and ozone mixing ratios, the CSR land cover dataset will be used as a third land use input for the HGBPA domain. This will provide insight into the importance of ground-truth data collection in urban areas to provide a more accurate prediction of mixing ratios in high population areas.

CSR will prepare land cover areal fraction datasets for ingestion into the CAMx model, as described above.

CEER is also preparing a submission of the dry deposition work to the journal *Atmospheric Environment*. CEER may prepare a journal submission on the biogenic emissions inventory prepared from the CSR dataset and comparison with results from the MEGAN model being developed by NCAR.

A component required to complete Task 2.3 is the completion of scripting that converts raster binary data to the ASCII format required for ingestion into the GloBEIS model following the reprojection of the data from the Albers Equal Area projection into the Lambert Conformal Conic projection adopted by TCEQ for air quality modeling. Pending a formal decision with CEER regarding data requirements for GloBEIS, CSR will prepare both composite images for LAI/fPAR as well as the incomplete time-series with bad data values coded to 255.

An additional objective for Task 2.3 is to investigate whether the MODIS-derived LAI/fPAR values could be modified to match Texas land cover codes rather than the IGBP land cover classification codes that are used by NASA. One initial test to determine the feasibility of the process is to aggregate the CSR land cover and the MODIS-derived IGBP land cover at the 4 km cell size and examine where differences occur in vegetation structure. For example, if the Texas land cover product of cells identified as pine forest match with the IGBP temperate conifer class then those two cover types are comparable. This analysis may provide some guidance to future air quality modeling efforts.

Task 2.4 was based on a plan to determine an appropriate scaling parameter to relate the NDVI to the PDSI for the purpose of approximating biogenic emissions. Focusing on oak-dominated areas in East Texas during the August-September time frame may simplify the relationship so that a simple scaling equation would be appropriate for task 2.4.1. If successful, the NDVI-derived PDSI will be applied to the GLOBEIS model and the results compared with results obtained when using the standard PDSI.

The work on Task 2.6 will be completed within the month.

Final report writing for completed tasks and for tasks nearing completion will commence.

Date: *July 15, 2006*

Authorized Project Representative's Signature