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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_____

Date Submitted: ____August 15, 2006_____

Report for the **Monthly** period:

Starting Date __July 1, 2006___ Ending Date ____July 31, 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 July by the two research teams included the following:

- In previous months, the completion of new land cover data for the region beyond the HGBPA modeling domain was impeded by the long delay of a contract agreement between CSR, HARC and the Texas Forest Service (TFS) that would supply critical ground truth information required for the image classification procedure. Contract negotiations were concluded in June 2006. Work funded by a separate HARC contract, but related to Task 2.1, recommenced in late July. CSR and TFS staff met on July 24 in College Station to coordinate activities. Generation of leaf biomass for 43 East Texas counties and 4 counties in the DFW Metroplex is underway at TFS, as is the work that will support refinement of the East Texas land cover classification.

- As part of Task 2.2, CSR prepared land cover areal fraction datasets for ingestion into the CAMx model.

- As part of Task 2.2, the CSR land cover dataset was transformed through a category crosswalk to the 11 CAMx land use classes to estimate dry deposition for the HGBPA modeling domain. In a further investigation of the sensitivity of urban dry deposition rates and ozone mixing ratios, the CSR land cover dataset was compared to the MODIS and AVHRR datasets as a possible source for updated LULC. This comparison provides insight into the importance of ground-truth data collection in urban areas and evaluation of the performance of the MODIS data product in capturing accurate LULC. The CSR dataset was input into CAMx, and the model was run for the August – September 2000 episode to compare predicted mixing ratios in high population areas using both the CSR and MODIS datasets for dry deposition modeling. These results are included in the journal submission in preparation by CEER.

- Work continued on Task 2.3. Pending a formal decision with CEER regarding data input requirements for GloBEIS, CSR prepared both composite images for LAI/fPAR as well as the episodic data time series with bad data values coded to 255.

- Efforts to relate NDVI values to PDSI values continued by concentrating on the months of greatest interest indicated in Task 2.4.1: August and September of the year 2000. July was also included in the study to consider the possible time lag between the changing PDSI value and the NDVI response. In the first 5 years of data, from 1995 through 1999, the patterns between plots of the NDVI deviations and PDSI values suggest a positive correlation that might be useful. Low PDSI values are generally associated with low NDVI deviations and high PDSI values are generally associated with high NDVI deviations. Uncharacteristically, for 2000, the target year for this task, the data are inversely correlated. Increasing PDSI values are associated with decreasing NDVI values. The data for the July-August period in 2001 also appears inversely correlated, although to a slightly lesser degree. It is possible to establish a scale to relate the 2000 NDVI values to the PDSI values. PDSI values for each pixel in the region could be generated that, on average, would be directly related to the reported PDSI for the whole region, but as a general rule, the application of this method would be highly suspect.

- To meet the requirements of Task 2.6, CSR finalized the analysis of the soil moisture measurements performed at the Harris Ranch field site near Uvalde, Texas, operated by the Texas Cooperative Extension. The analysis used local precipitation measurements at Harris Ranch to identify 6 major precipitation events and compared the field soil moisture response to these events as measured by the field stations and by the AMSR-E sensor. Based on information from researchers at the Cooperative Extension, CSR compared only the field soil moisture measurements that were not modified by soil treatment methods. The initial conclusion is that the AMSR-E soil moisture measurements are not as sensitive as the field measurements. The soil moisture values derived from AMSR-E were significantly smaller than the field measurements following precipitation events. After prolonged periods of drought, the AMSR-E soil moisture values were similar to the field values.

- Also as part of Task 2.6, CSR discussed the AMSR-E soil moisture algorithm with Dr. Enin Njoku, the ASMR-E science team leader for soil moisture detection. He indicated that the soil moisture algorithm is currently being modified such that the effects of topography and surface roughness are modeled separately from the effects of vegetation water content. Once completed, the new algorithm will be used to re-process the archive of AMSR-E soil moisture data products. It is unlikely that reprocessed data will be available for use before completion of the current project.

- For Task 2.6, CSR began writing a draft for the final report of the soil moisture detection results using AMSR-E data.

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, and 2.6, with Task 2.2, subtask 2.4.1 and Task 2.6 receiving particular attention.

Section II: **Problems/Solutions**

One persistent problem impeding progress in Task 2.3 is the frequent occurrence of cloud cover during the target episode time and place (Houston, August – September 2000). A possible solution for the problem has been identified. A new time-series cloud interpolation software package for MODIS data was recently discussed at a remote sensing conference. The author of the software has been contacted. Once obtained, the new software will be run on the LAI/FPAR

products for the episode. Our expectation is that this software can interpolate over the data coded as clouds and/or poor quality and will create a more useful time-series product for the air modeling.

Striking differences in the relationships between NDVI deviations and PDSI values cast suspicion on the validity of the reconstructed cloud-free NDVI dataset, however initial efforts to verify the 2000 and 2001 data have failed to demonstrate any obvious errors in the generation of the data. As part of Task 2.4, a more thorough verification of the data is underway to ensure that the reconstructed NDVI values reflect the satellite observed measurements.

Unforeseen delays at the University of Houston have precluded them from performing the planned meteorological simulations of soil moisture for comparison with the remote sensing measurements from AMSR-E as part of Task 2.6. It is not clear whether these simulations will be completed in time to include them in the final report.

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)*

CSR will refine and extend land cover data for the project area in August and September. CSR will also provide biomass data compiled by the Texas Forest Service as it becomes available.

CEER continues preparation of a submission on the dry deposition research to the journal *Atmospheric Environment*.

CEER will work with NCAR to compare biogenic emission estimates produced by GloBEIS and the new MEGAN model created by NCAR. This work will compare predicted biogenic emissions using the current TCEQ LULC dataset and the new CSR LULC dataset. CEER may prepare a journal submission on the biogenic emissions inventory prepared from the CSR dataset and a 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. CSR will adapt scripting developed for Tasks 2.1 and 2.2 for this purpose.

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 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 data preparation for future air quality modeling.

Final report writing for Task 2.6 will be completed within the month.

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

_____ Date: *August 15, 2006*

Authorized Project Representative's Signature