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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: ____June 16, 2006__ _____

Report for the **Monthly** period:

Starting Date __May 1, 2006___ Ending Date ____May 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 May by the two research teams include the following:

- As part of Task 2.1, CEER estimated biogenic emissions with the GloBEIS 3.1 model using land cover and leaf biomass parameters generated using the new CSR land cover dataset (including leaf biomass parameters calculated from measurements obtained for the Houston Green project) and the Wiedinmyer -based LULC dataset. Due to large dependence on temperature and PAR (photosynthetically-active radiation) inputs, project work is currently limited to an intercomparison of the two datasets. More reliable meteorological inputs are needed to compare results with TCEQ modeling results and past/future observations. Discussions with TCEQ about possible sources of improved meteorological data (MODIS, MM5, University of Maryland, ground-based measurements, etc.) continue to be pursued.

- At the end of April, TCEQ requested that CSR generate GloBEIS land cover input for the HGBPA subdomain using a 2-km grid cell resolution. The request was met by making minor refinements to Geoprocessing and data parsing scripts previously constructed. CSR delivered two zipped archive datasets to TCEQ. The first contained ArcInfo grid files with calculated fractions per 2-km grid cell per land cover class and grids converted to ASCII format. The second included ArcInfo grid files with counts of 10 m pixels per 2-km grid cell per land cover class (the precursor to fractional output).

- As part of subtask 2.1.4.3, emission inventories were created for input into CAMx using the newly formed biogenic emission inventories and the 2000 anthropogenic emissions. For the new CSR land cover dataset emission inventory, NO emissions from the Wiedinmyer dataset were included because NO emissions were not specified for the CSR dataset.

- As part of subtask 2.2.2, CAMx runs were performed to evaluate the two newly created biogenic emission inventories on predicted ozone concentrations in the HGBPA region.

- As discussed in the April progress report, cloud cover in the HGBPA modeling subdomain during the 2000 episode prohibits the construction of a continuous LAI data time-series derived from satellite observations. Instead, the 8-day LAI products were composited to create a regional LAI map. During May, CSR and CEER explored the implications of using a single composite dataset instead of an incomplete time-series dataset for the modeling. CSR understands that the LAI data are used in the GloBEIS model as a surrogate to estimate fPAR (fractional photosynthetically active radiation). In anticipation, CSR extracted the fPAR products for each date and mosaicked the tiles into the regional grid. These products have the same QA/QC cloud flags as the LAI images (as the LAI data are actually derived from the fPAR). A regional composite fPAR image map was constructed.

- For task 2.4.1, NDVI values from NOAA-14 as well as weekly Palmer Drought Severity Index (PDSI) values have been compiled for the 7 year period from March 1995 though October of 2001 excluding the PDSI values for 2000. The 2000 PDSI values were unavailable. A comparison of the plot of the ratios to the PDSI values suggests that the NDVI generally yields a delayed, dampened response to the PDSI value that is also somewhat affected by the conditions of the previous year. There are many instances in which the same NDVI, NDVI-difference or NDVI-ratio values are associated with very different PDSI values. Such cases indicate that the NDVI, difference or ratio cannot be scaled or simply combined in order to estimate a useful PDSI value.

- As part of subtask 2.4.1.1, CSR developed a script to parse historical PDSI data that are stored in annual ASCII text files into individual text files arranged by year and week. CSR applied the conversion process developed in previous months to the newly parsed data, including the year 2000 PDSI values.

- In support of task 2.5.2, the MODIS aerosol products have been generated for 2004 using the new, collection 5 algorithms. These data are being analyzed and compared with particulate matter measurements to characterize the relationship between new AOD estimates and aerosol content.

- To meet requirements of Task 2.6, CSR performed quantitative comparisons between AMSR-E soil moisture measurements and field measurements of soil moisture at a field site in Uvalde. These quantitative comparisons showed favorable agreement after long periods of sustained drought, but the AMSR-E soil moisture values did not accurately track increases after rainfall events. The second field site previously identified for comparison was not used as a result of incompatible descriptions of the soil moisture and the limited time frame of the field measurements (once per year). Three additional field sites were identified in east Texas to be used for comparison between AMSR-E soil moisture and measured precipitation.

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 specific Subtasks 2.1.4.3, 2.2.2, 2.4.1.1, 2.5.2, and 2.6 receiving particular attention.

Section II: **Problems/Solutions**

Efforts to relate the NOAA-14 NDVI values to PDSI for task 2.4.1 have continued with the development of tools and methods to reformat and reproject the PDSI data to match the NDVI

data more closely. One challenge in relating the 1-km NDVI product to the PDSI data is that the PDSI values are reported for an entire region. Thousands of highly variable 1-km NDVI values are often associated with a single PDSI value. Thus tools are being developed to relate the statistics of the NDVI values within each PDSI region. It is expected that regional parameters will be developed to relate the NDVI, or the deviation from the mean NDVI, to the PDSI scale.

The relationship between NDVI and PDSI is more complicated than originally conceived. It is likely that an NDVI to PDSI conversion algorithm may incorporate 1st- and 2nd-order derivatives.

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 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.

CEER will use current agricultural census statistics along with CSR land cover data to reallocate NO emissions for the biogenic emissions inventory in the HGBPA domain.

A component required to complete Task 2.3 is to complete the 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 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 for future modeling efforts for air quality issues.

In continuing work for Task 2.4, it is likely that an NDVI to PDSI conversion algorithm may incorporate 1st- and 2nd-order derivatives as well as medium term historical statistics to estimate past PDSI values. It may be helpful to segment the data by vegetation type to reduce the complexity of the NDVI to PDSI relationship.

As part of Tasks 2.3 and 2.4, CEER will explore the use of LAI and drought index inputs derived from MODIS data on biogenic emissions estimated by GloBEIS.

In support of Task 2.6, CSR has begun to collaborate with Daewon Byun of the University of Houston to perform a comparison of AMSR-E soil moisture with values simulated by MM5/LSM. A comparison will be made for August 2005 over East Texas. CSR will finish qualitative comparisons between AMSR-E soil moisture and measured precipitation and begin development of a quantitative comparison between AMSR-E soil moisture and simulated values.

CEER will present findings on the use of remote sensing satellite data for estimating dry deposition at the AWMA annual conference in New Orleans. CEER is also preparing a submission of the dry deposition work to the journal *Atmospheric Environment* and may prepare a journal submission on the biogenic emissions inventory prepared from the CSR dataset.

_____ Date: *June 16, 2006*

Authorized Project Representative's Signature