AQRP Monthly Technical Report

PROJECT TITLE	Use of Satellite Data to Improve Specifications of Land Surface Parameters	PROJECT #	17-039
PROJECT PARTICIPANTS	Richard McNider, Arastoo Pour –Biazar, Kevin Doty, Yuling Wu	DATE SUBMITTED	September 14, 2017
REPORTING PERIOD	**From:** August 1, 2017 **To:** August 31, 2017	REPORT #	10

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task

(1) Applicable to Tasks 2,3,4,6 and 7 – Reproducing Previous Project Statistics: Work has continued on trying to determine the cause of the discrepancies between the control case in last year's project and this year. After, many runs changing inputs in a methodical manner we cannot reduce the bias statistics in the current model to that found in last year's project. We have then come to a conclusion that the differences (degradation) are due to the upgrade in WRF from WRF 6.1-WRF 8.1. We have found code differences that may explain the discrepancies but we have concluded that reverting to 6.1 is difficult and since 8.1 is the newer version we see no reasons for going backwards. Thus, we decided that rather than trying to reproduce the older results we will go forward with a process to define a new control case using WRF 8.1.

(2) Applicable to Tasks 2,3,4,6 and 7 – Defining Control Case Inputs: Giving the issues encountered that showed that different physics choices and input data can drastically change model performance we stepped back and thought about what the control case should be. Should it be a case that has minimal error or the case that is likely to be used by the larger WRF community. Our previous model set-ups had been patterned after TCEQ inputs. However, in talking to TCEQ we found that these are fluid and have not been firmly tied down for the P-X scheme.

We thus decided that the appropriate control case would be one most likely to be used within the WRF/Air Quality Community. We thus contacted the EPA NERL group and obtained their model name list and set up. Since we are trying to show that satellite data can improve model performance in the P-X scheme it seems reasonable to use what the Pleim group at EPA would use for their control model set-up. If we picked a different control set-up and showed improvement there might be concern that we picked a control set-up that had a larger error making the use of satellite data appear better.

Control Case and Subsequent Runs: Using the EPA set-ups we have made the control runs for 2013. We have also decided on the sequence of satellite assimilation runs. These are:

    (1) Control Using EPA setups
    (2) Satellite Insolation (but with WRF albedo)
    (3) Veg Fraction – adding MODIS derived vegetation fraction
    (4) Soil Moisture Nudging
    (5) Heat Capacity Nudging
    (6) Use of Tendencies in Moisture Nudging

Of September 14, 2017 all model runs have been made for the above.

Task 7 - Additional Model Evaluation Period: As noted in the proposal for this project, the Discover AQ period was not a particularly representative period for air quality concerns. Many active fronts and pervasive cloudiness dominated the period. Thus, as part of this year's effort an additional modeling period was to be chosen in conjunction with TCEQ. After discussion with TCEQ it was decided that the period July 1, 2012 – August 31, 2012 would be the new period. The drier 2012 year is a contrast to the 2013 Discover AQ period. This period may coincide with potential SIP work in in Texas.

Preliminary Analysis

Control Case and Subsequent Runs: Using the EPA set-ups we have made the control runs for 2013. We have also decided on the sequence of satellite assimilation runs. These are:

    (1) Control Using EPA setups
    (2) Satellite Insolation (but with WRF albedo)
    (3) Veg Fraction – adding MODIS derived vegetation fraction
    (4) Soil Moisture Nudging
    (5) Heat Capacity Nudging
    (6) Use of Tendencies in Moisture Nudging

Of September 14, 2017 all model runs have been made for the above.

Data Collected

We contacted Jon Pleim and Rob Gilliam at EPA NERL to get their model set ups. They provided namelists for the WRF run. We had to process new land use data sets associated with their set-ups.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments
We have had delays in making some model runs in part because of some issues we have found with the statistics of the control case being larger than in previous year results. Since reproduce-ability is a hallmark of science we took this seriously. After many hours of trying to replicate the old results changing the inputs to be exactly like the old runs we concluded it was due to the new WRF version. After, this we decided to develop a new control set up. However, all of this has put us behind schedule. However, with a recent no cost extension provided by AQRP we believe we will finish all work in the proposed project.

Goals and Anticipated Issues for the Succeeding Reporting Period

We anticipate having all model runs completed and analyzed by the 3rd week of September and a draft final report to AQRP by October 15.

Detailed Analysis of the Progress of the Task Order to Date

(see above)

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

__Yes __X_No

Toward the use of Satellite Skin Temperature Data to Improve Land Surface Parameters in Air Quality Studies, to be submitted to Journal of Applied Meteorology.

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

___Yes   __X_No

Do you have any bibliographic publications related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

___Yes   __X_No

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).

___X Yes   ___No

We are developing a paper - Toward the use of Satellite Skin Temperature Data to Improve Land Surface Parameters in Air Quality Studies, to be submitted to Journal of Applied Meteorology.

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

___Yes   __X_No

Submitted to AQRP by

Principal Investigator

Richard T. McNider
University of Alabama in Huntsville