Use of Remote Sensing Data to Improve Air Quality Decision Support Systems Used to Protect Public Health

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6. Texas Commission on Environmental Quality (TCEQ)
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PROJECT INFORMATION

TOPIC: **Use of Remote Sensing Data to Improve Air Quality Decision Support Systems Used to Protect Public Health**

POP: 8/24/2018 - 8/23/2021 (ROSES17-A.39) – **NCE till 8/23/2022 (Final Report)**

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Partners: California Air Resources Board (CARB), USEPA, Texas Commission on Environmental Quality (TCEQ), Georgia Environmental Protection Division (GA-EPD), The Lake Michigan Air Directors Consortium (LADCO - representing states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin).

Earth Obs./Models: NASA's GOES Product Generation System (skin T, surface insolation and albedo, cloud top T, cloud albedo); MODIS/VIIRS products (Skin Temperature, surface insolation and albedo); GOES GLM; WRF/SMOKE/CMAQ model.

Objective: To employ NASA assets and satellite products to improve the air quality management Decision Support Tools (DSTs) used in defining emission control strategies for attainment of air quality standards.

TCEQ · California Air Resources Board · Georgia · NASA · United States Environmental Protection Agency · LADCO · NSSTC · The University of Alabama in Huntsville

SPECIFIC OBJECTIVES

In This Project NASA Assets and Satellite Data Will Be Used to Improve the Quality and Accuracy of Retrospective Baseline Simulation in Which Proposed SIP Emission Reductions Are Tested

Upgrading Data Generation and Archiving System

- **Upgrading GOES Product Generation System (GPGS):** Collaborating with the NASA's the Short-term Prediction Research and Transition (SPoRT) Center, GPGS is being recoded to process GOES-16, 17, data.

Improving Representation of Physical Atmosphere

- **Improved Characterization of Surface Energy Budget:** Using satellite derived skin temperature to retrieve soil moisture and improve surface evapotranspiration performance in WRF.
- **Improving Boundary Layer Development in the Model:** By improving BL moisture and temperature structure.
- **Improving Model Cloud Field:** Assimilating satellite observed clouds in WRF.

Improving Emission Estimates in AQ Model

- **Utilization of Satellite Derived Lightning Generated NO (LNOx) Emissions:** This activity utilizes newly available lightning optical energy from the Geostationary Lightning Mapper (GLM) to produce lightning-generated NO emissions input for air quality models.

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MILESTONES

Milestone Statement	Date
Commenced work on the project	Sept. 2018
Updated insolation retrievals, Cloud Assimilation System (CAS) integrated in WRF-Chem and WRF-CMAQ, and GLM-LNOx estimates performed (**ARL 3**)	Sept. 2019
Insolation products evaluated and used in simulations using CAS, results assessed, initial integration and verification completed (**ARL4**)	Sept. 2020
CAS was tested in WRF/SMOKE/CMAQ AQM system, used in semi-operational setting and improvements demonstrated (**ARL 6**)	sept. 2021
ARL 7 achieved	Aug. 2022
Papers published and presented at international conferences	Dec. 2018, Aug. 2022

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RESULTS/ACHIEVEMENTS

- Revised GOES Product Generation System (GPGS) for GOES-R
- Developed/implemented/tested/evaluated GLM-LNOx Processing System
- Improved/tested/evaluated Cloud Assimilation System (CAS)
- Skin-T assimilation within P/X implemented and tested
- In collaboration with end-users multi-year air quality simulations performed and results published
- Software tools were documented and released to end-users (EPA/TCEQ/LADCO/GaEPD)
- Had end-users engagement/involvement throughout the project.

RISKS & ISSUES

- The major challenge in the project was the restricted working conditions under the pandemic.
- Having multiple regulatory agencies as partners looked good on paper, but did not allow getting to higher ARL level.
- Availability and quality of insolation retrievals is still a concern. SPoRT can produce better quality Skin-T and insolation, but it is not operational.

Publications

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