

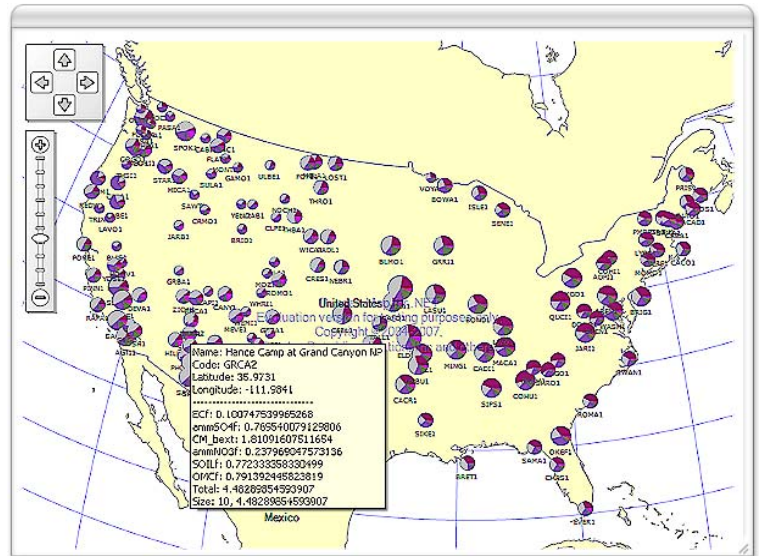
Improving Air Quality Analysis and Planning through the Integration of Satellite Data with Ground-based Observations, Modeling Results, and Emissions Estimates: Enhancements to the VIEWS/TSS System with Data from CALIPSO, Aura, Terra, and Aqua



Summary

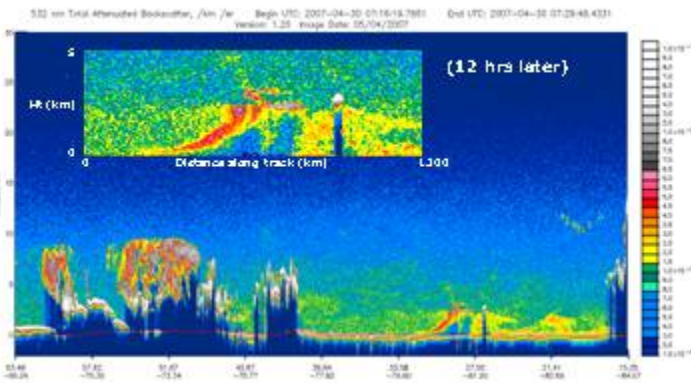
Regional planning organizations led the development of the VIEWS/TSS – a web-based, integrated, relational database system developed to support data analysis and air quality decision-making by state, tribal, local and federal air agencies, and federal land managers. This system currently uses multi-scale air quality analyses of a variety of ground-based data to support planning to meet the National Ambient Air Quality Standards and reduce regional haze in the Federal Class I areas. This project, funded by NASA, incorporates remotely sensed data from a variety of satellite instruments, along with advanced analysis tools into the VIEWS/TSS for integrated and improved decision support, through better characterization of pollutants and their sources at the ground and aloft. The remotely sensed data to be incorporated into VIEW/TSS will be drawn from among several instruments and platforms including MODIS and MISR (on board Terra and Aqua), OMI (on board Aura), and CALIOP (lidar on board CALIPSO), and products, e.g., the NOAA GOES Aerosol and Smoke Product (GASP).

VIEWS/TSS Chemical Species Footprint: IMPROVE Monitor Sites



2007 Satellite Image of Fires over U.S.

The MODIS sensors on the Terra and Aqua satellites reveal significant aerosol sources affecting air quality. Here, fires in Georgia are shown qualitatively to affect air quality in Florida.



Assessing air quality above the ground

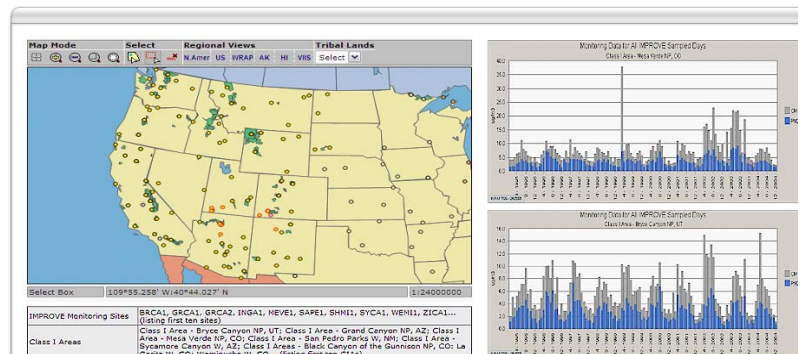
The LIDAR profiles from the CALIPSO satellite tell us where in the vertical the smoke rises. For the Georgia fires in early May 2007, the smoke plumes rose quickly (inset) above ground.

CALIPSO

The CALIPSO satellite provides vertical profiles of dust and aerosols in the atmosphere.

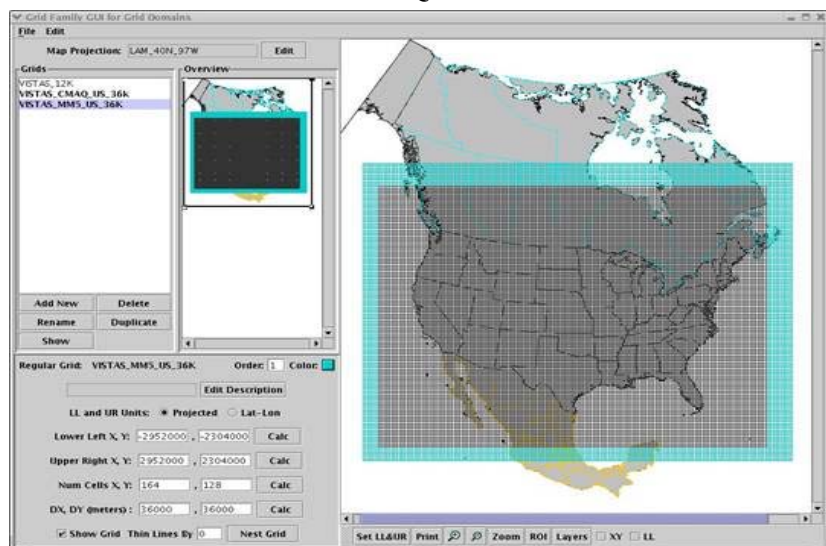


VIEWS/TSS Monitoring Results for multiple NAAQS indicators and time periods at multiple locations



The project also facilitates a more thorough and efficient evaluation of advanced 3-D gridded air quality models such as the EPA Community Multiscale Air Quality (CMAQ) model, used as an analysis tool in air quality decision support.

RPO North American 36-km CMAQ Domain within MM5 36-km domain



The project supports and engages several end user groups, including the Western Regional Air Partnership (WRAP), National Park Service (NPS), U.S. EPA, and the North Carolina and Utah Divisions of Air Quality. The University of North Carolina leads the project with co-investigators at the Cooperative Institute for Research in the Atmosphere (CIRA), and the University of Maryland, Baltimore County (UMBC).

Air Quality Analysis and Planning Support Deliverables

Local air quality is affected to varying degrees in space, time, and chemical composition by both local emissions and regional/long-range transport (R/LRT) of pollutants. Trans-Pacific transport of pollutants has affected regional ozone levels in the Western U.S., while dust and smoke plumes from China have been seen to reduce visibility in the rural Midwest. Pollutants emitted from remote sources (primary particulates such as soot and dust, and gas phase ammonia, sulfur, nitrogen and organic compounds) can be transported, chemically transformed from gas-phase precursors into aerosols, and deposited within North America. States must assess R/LRT vs. local source contributions of these pollutants to prepare effective State Implementation Plans (SIPs) demonstrating compliance with evolving EPA air quality standards and State-determined regional haze and public health goals. Combined analysis of modeled and observational data to help understand the temporal evolution and spatial distribution of air quality has the potential to significantly improve our quantitative knowledge of source-receptor relationships by leveraging existing NASA Applied Science and U.S. EPA projects, (3DAQS and the Remote Sensing Information Gateway [RSIG]) that are integrating satellite and ground-based datasets. The following deliverables are expected from this project:

- Routine capture, analysis, and processing algorithms with high temporal and spatial resolution to provide land use/land cover data as inputs to emissions and air quality modeling;
- More complete temporal and spatial resolution of activity data and emission rates from natural and anthropogenic emission sources in remote areas and from individual sources and source clusters;
- Three-to-four-dimensional (2-3 spatial and 1 temporal) vertical profiles and column measurements of pollutants (e.g., aerosol extinction profiles, column NO₂ and O₃) to improve boundary and other inputs, and provide evaluation data for gridded chemistry- transport models (CTMs) such as CMAQ;
- Advanced analysis tools to better understand the relevant atmospheric processes and their representation in the CTMs; and
- Visualization and quantitative analysis of satellite data in combination with existing monitoring and emissions data, and modeling results within a unified data analysis and decision support platform.

User Review and Interaction

A series of workshops during the 3-year period of this project will be sponsored by WRAP, NPS, and U.S. EPA to elicit review and comments on the progress and content of the deliverables.

PROJECT AT A GLANCE

- Integrates NASA satellite data and advanced analysis capabilities into the VIEWS/TSS air quality data and decision support system.
- Permits better characterization of pollutants according to local emission sources vs. regional and long-range transport, and their vertical mixing characteristics.
- Engages end-user participation in the optimal design of the system for the use and interpretation of satellite data products in air quality assessments.

Key Websites

Visibility Information Exchange Web System

<http://vista.cira.colostate.edu/views>

WRAP Technical Support System

<http://vista.cira.colostate.edu/views>

Infusing satellite Data into Environmental Applications (IDEA)

<http://idea.ssec.wisc.edu/>

EPA Air Quality System (AQS)

<http://www.epa.gov/ttn/airs/airsaqs/NASA>

NASA ROSES Project Communication Wiki

<http://vista.cira.colostate.edu/AirDataWiki/>
(UNC/CIRA NASA ROSES 2007 Project link)

Value & Benefits

- Increased understanding of source-receptor relationships, leading to improved accuracy in choosing and applying control strategies.
- Increased reliability in air pollution control decisions to reduce health impacts and visibility degradation due to poor air quality, and to promote healthier ecosystems.
- Valuable case studies and precedents for future air quality analysis and planning activities.

For more information about this project:

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