Tropospheric Emissions: Monitoring of Pollution



Development of TEMPO Data at NASA SPoRT for Air Quality and Public Health Applications

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HAQAST6 Meeting

Pasadena, CA









Hourly Measurement of Pollution

minutes

60



<u>Mission</u>: Transition unique NASA and NOAA observations and research capabilities to the operational weather community to improve short-term weather forecasts on a regional and local scale

SPoRT prepares the *community* of *end users and mission scientists* for next generation satellite missions and capabilities through an interactive R2O/O2R paradigm

Current/Future Activities:

- Successful partnerships to prepare NWS forecasters for GOES-R and JPSS through use of experimental proxy products
- Expanding partnerships to other government agencies and new NASA missions





Pre-launch R2O/O2R Activities



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Keys to successful day 1 readiness

- Data in the end users' display system
- Targeted training
- Assessments to gather feedback from users for the mission scientists

Pre-launch R2O/O2R activities can provide valuable input to data processers, mission scientists, algorithm developers, and guide baselining of products/capabilities



feedback loop for the TEMPO Science Team

Tropospheric Emissions: Monitoring of Pollution

Introduction

The TEMPO mission is currently on-schedule and on-budget for an expected launch date in 2020 or 2021, and will be hosted on a commercial geostationary communications satellite with a Field of Regard (FOR) over North America for allowing hourly daytime monitoring capabilities. For each geospatial scene in the FOR, the TEMPO grating spectrometer instrument will measure the solar backscattered radiance in the ultraviolet (290-490 nm) and visible (540-740 nm) with a spectral resolution and sampling of 0.6 and 0.2 nm, respective), for retrieving aerosol and cloud parameters, along with the major elements in tropospheric ozone (0₃) chemistry cycle consisting of nitrogen dioxide (NO₂), sulfur dioxide (SO₂), formaldehyde (H₂CO), glyoxal (C₂H₂O₂), water vapor (H₂O), and UVB radiation. The high spatial resolution 0.2 1.km x 4.7 km at the center of the FOR will allow for unprecedented air-quality monitoring at sub-urban scales.

TEMPO Early Adopters

Objectives

TEMPO Early Adopters are working towards identifying the myriad of capabilities and applications of TEMPO, recognizing the needs of the end-user community, and planning how these needs can be met prior to the TEMPO launch.

1 Identify key end users and end-user applications in the areas of air-quality modeling: planning and assessment; emissions; and health, agricultural, and better prepare the air quality agricultural, and the post of air-quality and better prepare the air quality agricultural, and better prepare the air quality agricultural, and the post-launch data, while also realizing the

Define processing and delivery needs from NASA for operational forecasting, episode analysis, and trend evaluation by air quality agencies.

NASA SPoRT Collaboration

regional and local applications of the data.

The SPoRT Center was established in 2002 for transitioning unique satellite observations and research capabilities to end users to improve short term forecasting and decision support. SPoRT team members work within a research to operations/operations to research paradigm to introduce experimental products to the operational environment via active involvement of end users. Involving the end users in the process ensures the products being developed by the researchers meet the end users' needs. This highly successful paradigm will be utilized for transitioning real-time TEMPO data products to end user communities in an effort to assess the impact on operations and develop end-user tailored products. Prior to TEMPO launch, SPoRT will apply the paradigm to (1) establish relationships with end users, and (2) deliver TEMPO proxy products in a format compatible with their decision support or display systems, and (3) gather feedback from the end users through targeted assessment of the products. These pre-launch activities will enqage





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- Synthetic TEMPO proxy data generated using simulated gaseous and aerosol composition from GEOS-NR
- Goal: Utilize TEMPO proxy data for applications to accelerate operational use of real TEMPO products after launch in early 2022

Document

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32°N 124°W

122°W

120°W

118°W

116°W





 NO₂ point source emission from Alabama Power Gaston Plant is apparent in morning TEMPO scan, no signal in later OMI scan

Document Title

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• TEMPO at county level, broader scale NO₂ field shows at county level, but NO₂ emission from Alabama Power Gaston Plant is no longer apparent

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Google Cloud Platform



Document Title

Preparing and storing L2 products and formatted text files of gas concentrations and meteorology at county level for public health stakeholders (e.g., Alabama Hospital Association, Alabama Quality Assurance Foundation)



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3) Can ingest GRIB, NetCDF (CF compliant), GeoTIFF



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ESRI Visualization for TEMPO





Corridor of mobile-source NO₂ from Chicago to Milwaukee



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Fully ingest TEMPO proxy dataset from July 2013-June 2014 into ESRI platform for allowing effective analysis of L2 products

Setup FTP server for distributing proxy data to community, LDM solution for future real-time data

Goal: Engage with end users/stakeholders on assessing TEMPO applications and preferred visualization frameworks prior to launch

Plans to use TEMPO data, low-cost sensor network over northern AL, and hospital claims data for public health study

Proposed study to start ingesting upcoming GEMS data into NASA modeling system over South Asia, which will help identify future capabilities of TEMPO

TEMPO public health conference at University of Alabama in Huntsville with conference date of 10/10/19





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Thanks!



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The public health conference aims to promote multidisciplinary understanding of TEMPO mission data products, scientific and technological components of the TEMPO mission, and applications of the TEMPO data products to health-related endeavors.



