

Tropospheric Emissions:  
Monitoring of Pollution



Hourly Measurement of Pollution

60 minutes

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

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July 10-12, 2019

HAQAST6 Meeting

Pasadena, CA

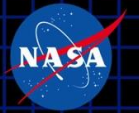


Smithsonian





# Short-term Prediction Research and Transition (SPoRT) Center



**Mission:** 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

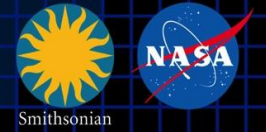








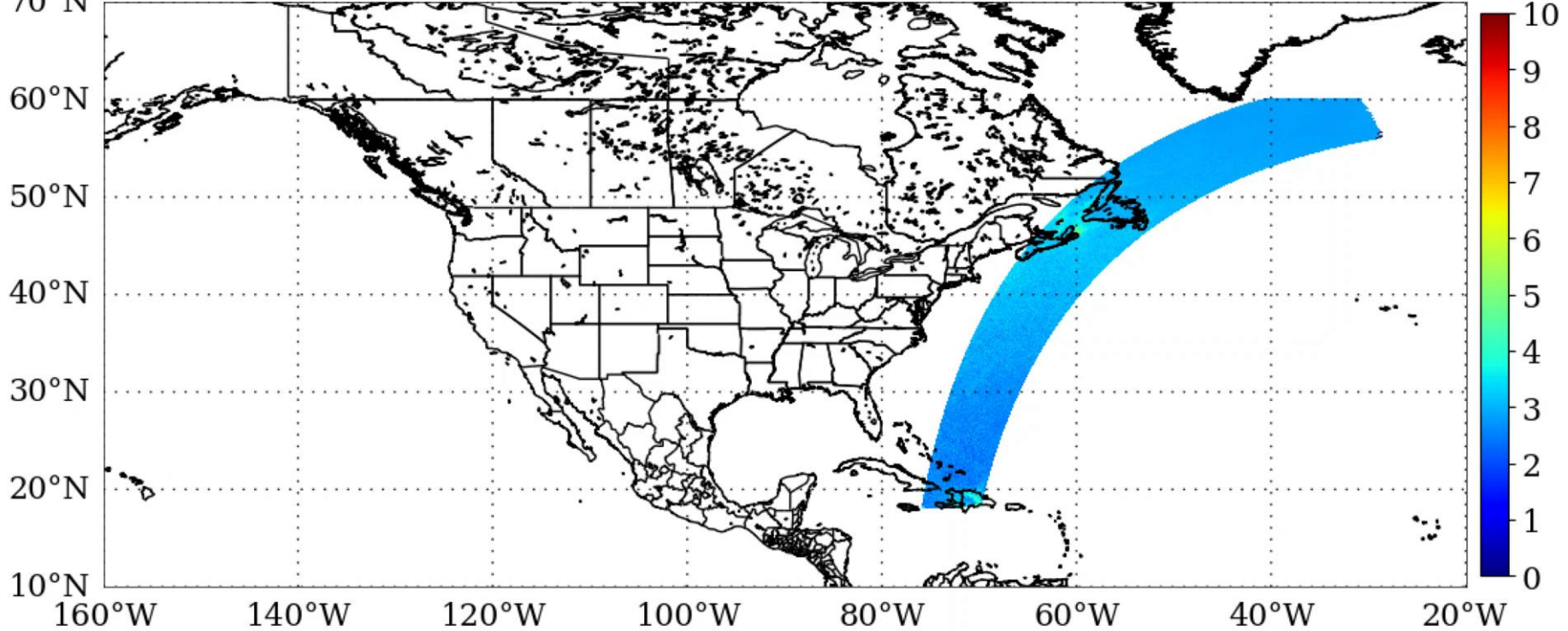
# Synthetic TEMPO data



## TEMPO NO<sub>2</sub>

20130908 1500UTC

TEMPO



NO<sub>2</sub> tropospheric column density (10<sup>15</sup> molec./cm<sup>2</sup>)

- 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



<https://weather.msfc.nasa.gov/sport/>

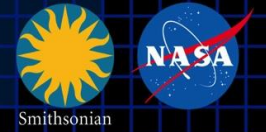
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**SPORT**

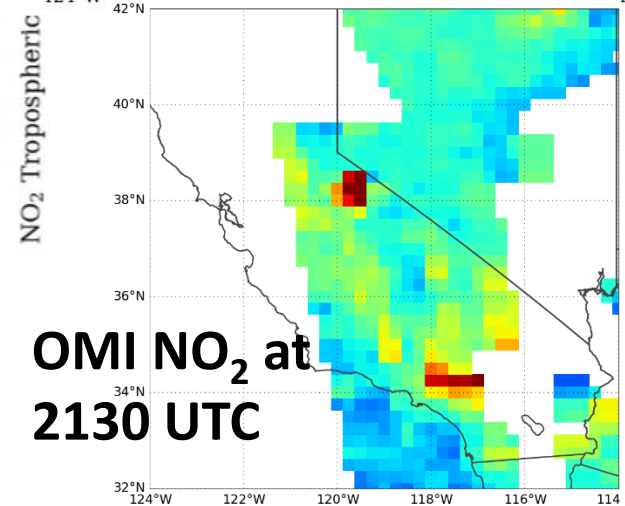
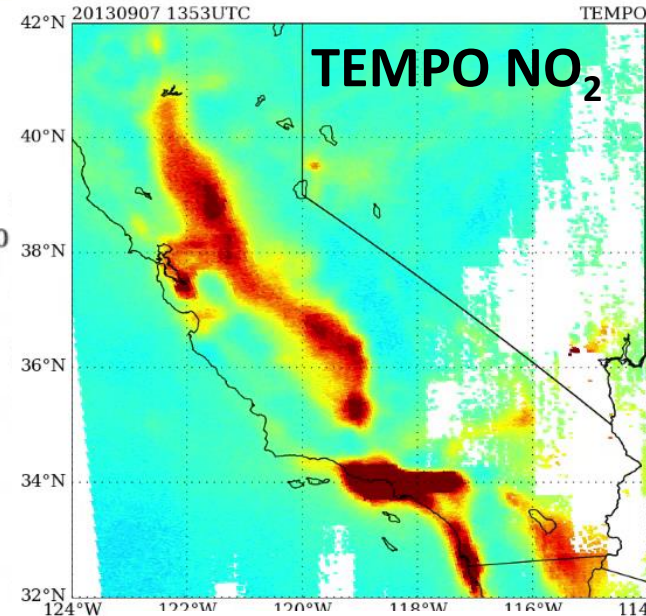
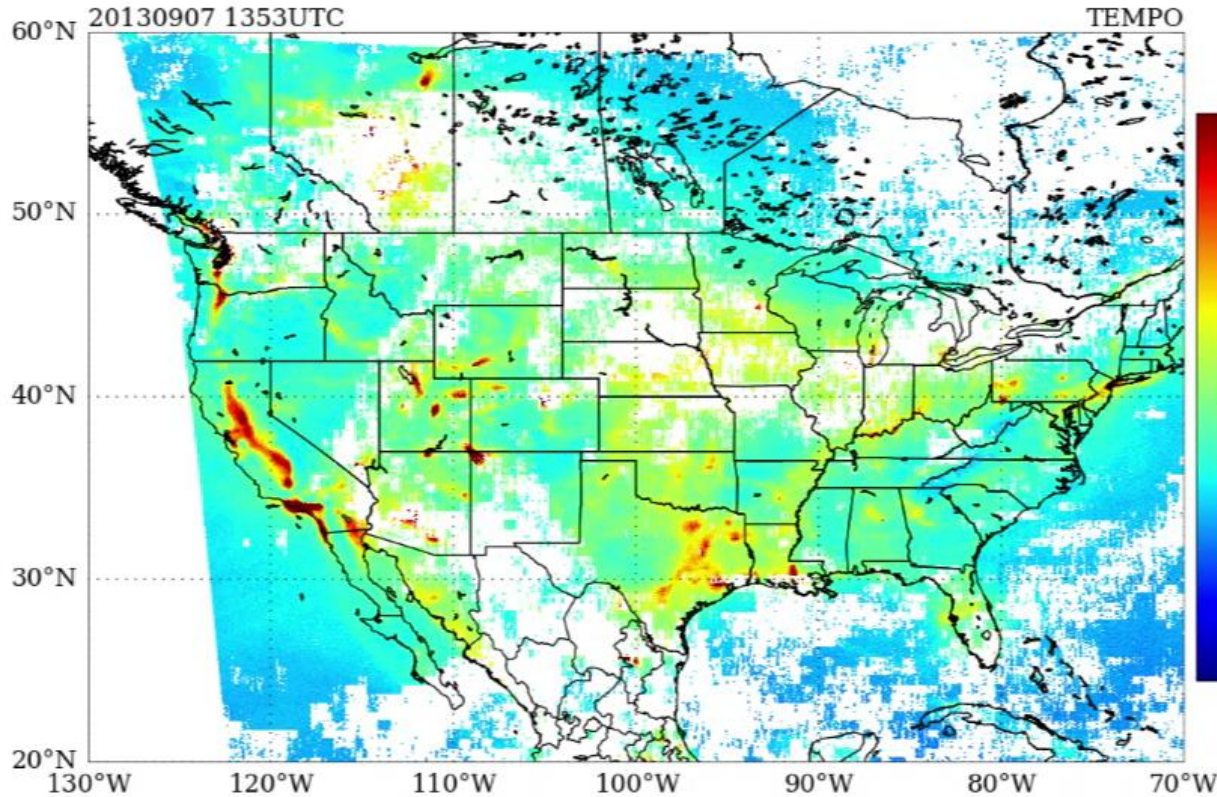




# Synthetic TEMPO data



## TEMPO NO<sub>2</sub>



- Diurnally varying mobile source emissions and smoke plumes shown in TEMPO proxy data



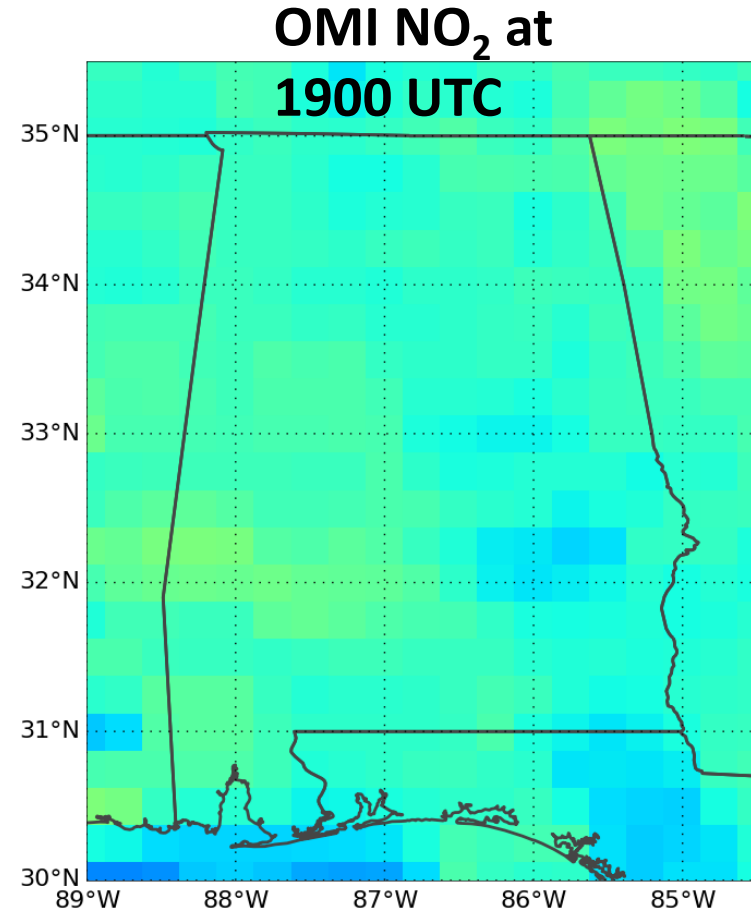
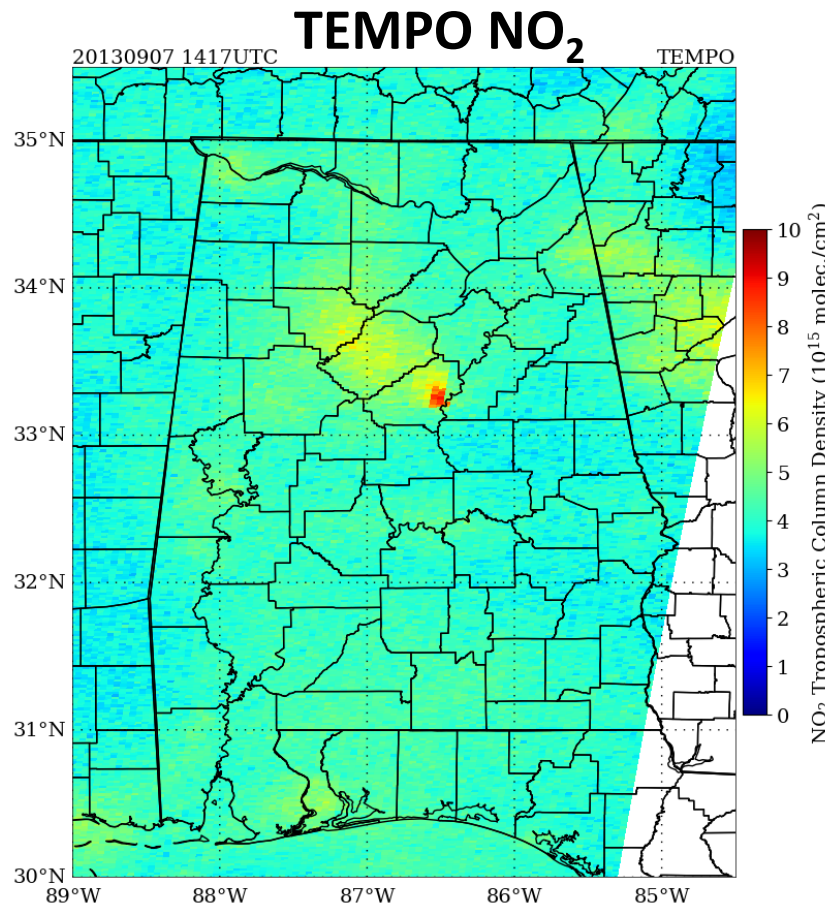
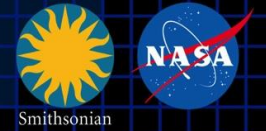
<https://weather.msfc.nasa.gov/sport/>

Document Title





# Synthetic TEMPO data



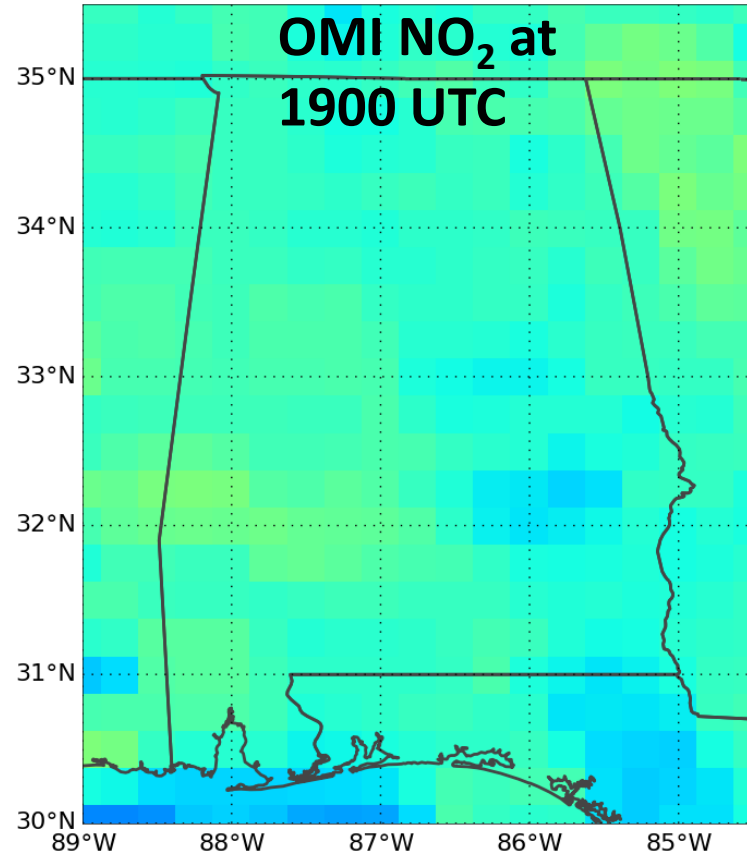
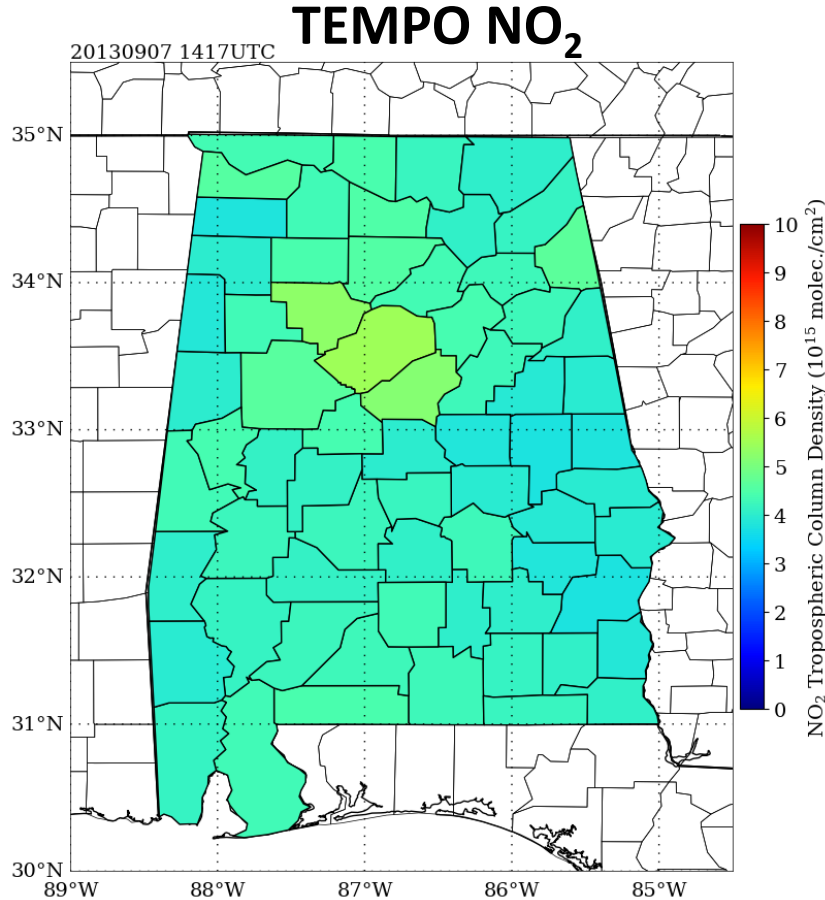
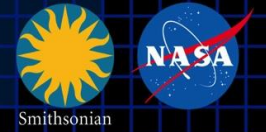
- NO<sub>2</sub> point source emission from Alabama Power Gaston Plant is apparent in morning TEMPO scan, no signal in later OMI scan







# Synthetic TEMPO data

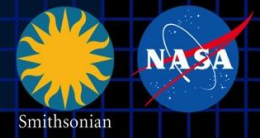


- TEMPO at county level, broader scale NO<sub>2</sub> field shows at county level, but NO<sub>2</sub> emission from Alabama Power Gaston Plant is no longer apparent





# Google Cloud Platform



← → ↻ https://console.cloud.google.com/storage/browser?folder=&organizationId=8

Google Cloud Platform TEMPO-HAQ

Browser CREATE BUCKET REFRESH DELETE

Filter by prefix...

Buckets

<input type="checkbox"/> Name	Default storage class <sup>?</sup>	Loc
<input type="checkbox"/> tempo_al_county	Multi-Regional	Unit
<input type="checkbox"/> tempo_I2	Multi-Regional	Unit

← → ↻ https://console.cloud.google.com/storage/browser/tempo\_I2?project=tempo-haq&folder=&organizationId

Google Cloud Platform TEMPO-HAQ

Bucket details EDIT BUCKET REFRESH BUCKET

tempo\_I2

Objects Overview Permissions Bucket Lock

Upload files Upload folder Create folder Manage holds Delete

Filter by prefix...

Buckets / tempo\_I2

<input type="checkbox"/> Name	Size	Type
<input type="checkbox"/> TEMPO_L2_V01_20130908T130001Z_S001G01.nc	55.49 MB	application/x-netcdf
<input type="checkbox"/> TEMPO_L2_V01_20130908T130557Z_S001G02.nc	55.49 MB	application/x-netcdf
<input type="checkbox"/> TEMPO_L2_V01_20130908T131153Z_S001G03.nc	55.49 MB	application/x-netcdf

← → ↻ https://console.cloud.google.com/storage/browser/tempo\_al\_county?project=tempo-haq&folder=&organizationId

Google Cloud Platform TEMPO-HAQ

Bucket details EDIT BUCKET REFRESH BUCKET

tempo\_al\_county

Objects Overview Permissions Bucket Lock

Upload files Upload folder Create folder Manage holds Delete

Filter by prefix...

Buckets / tempo\_al\_county

<input type="checkbox"/> Name	Size	Type
<input type="checkbox"/> TEMPO_HAQ_AL_20130908_1300.txt	3.67 KB	text/plain
<input type="checkbox"/> TEMPO_HAQ_AL_20130908_1400.txt	3.66 KB	text/plain
<input type="checkbox"/> TEMPO_HAQ_AL_20130908_1500.txt	3.64 KB	text/plain

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)



<https://weather.msfc.nasa.gov/sport/>

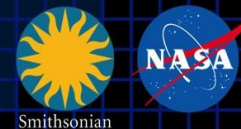
Document Title







# ESRI Visualization for TEMPO



https://msnseswms.ndc.nasa.gov/portal/home/webmap/viewer.html?layers=230b26ea6f7048eabce956f83eb00ce6

Home ▾ sporttempo

Modify Map Sign In

Details Basemap

Print

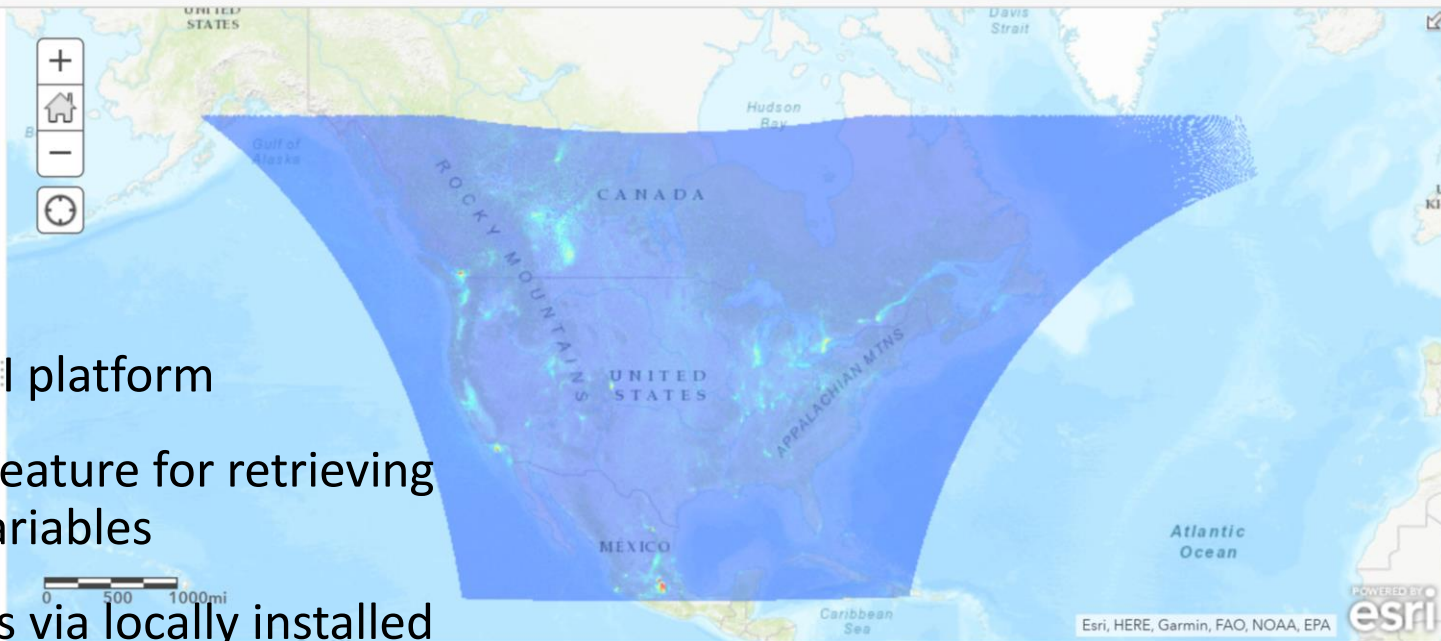
Measure

Find address or place



Contents

- ☑ sporttempo
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- ▶ Topographic



October 10, 2013, 10:30 AM - 11:30 AM

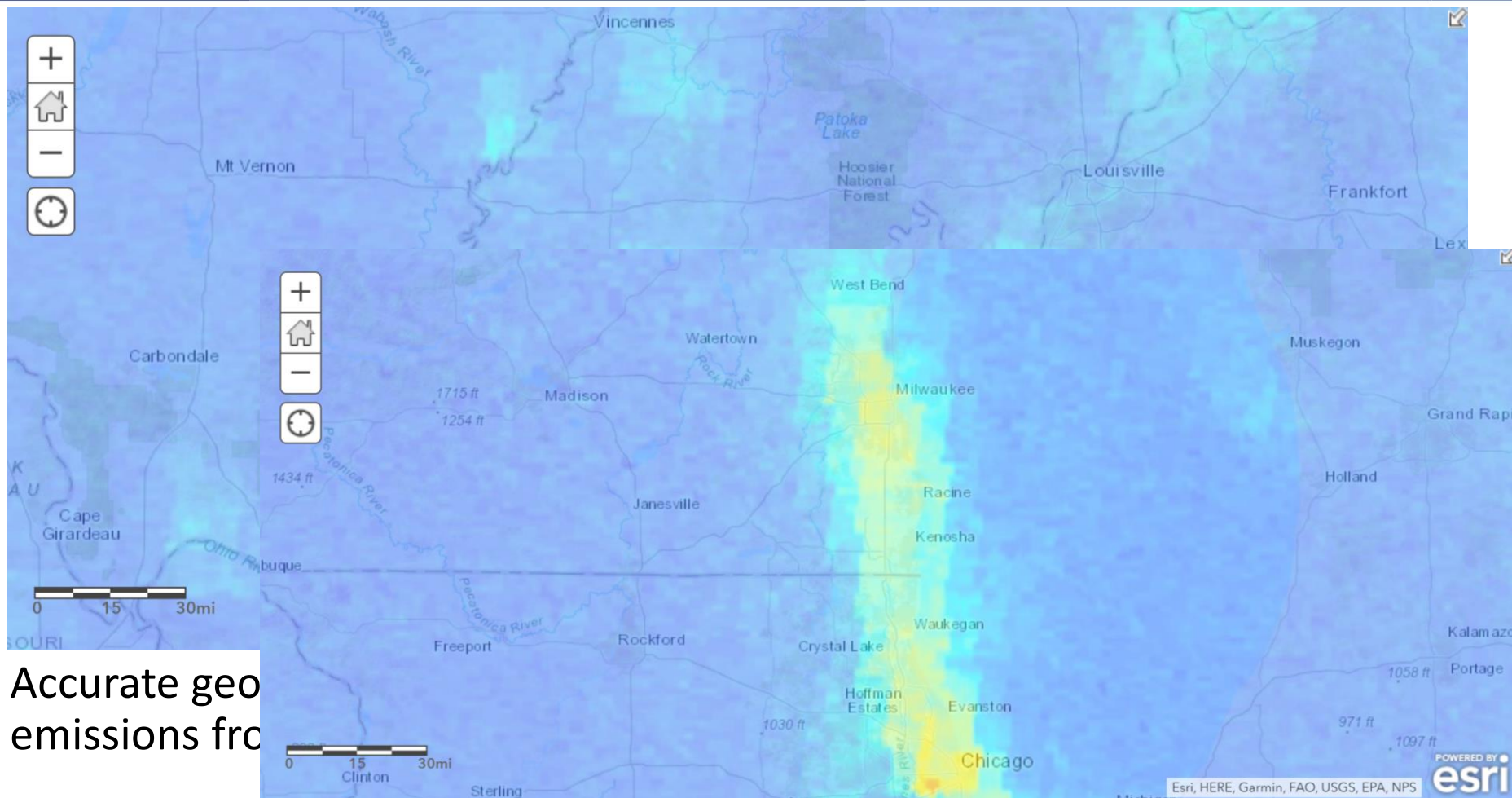
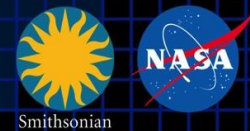
## Advantages of ESRI platform

- 1) Point and click feature for retrieving raw geophysical variables
- 2) Perform analysis via locally installed ArcGIS
- 3) Can ingest GRIB, NetCDF (CF compliant), GeoTIFF





# ESRI Visualization for TEMPO



Accurate geo  
emissions from

Corridor of mobile-source NO<sub>2</sub> from Chicago to Milwaukee



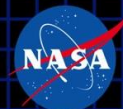
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# TEMPO Activities at SPoRT



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

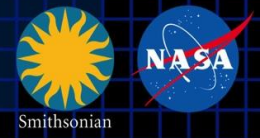
**TEMPO public health conference at University of Alabama in Huntsville with conference date of 10/10/19**







# Thanks!



[aaron.naeger@nasa.gov](mailto:aaron.naeger@nasa.gov)

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.

