



National Aeronautics and  
Space Administration

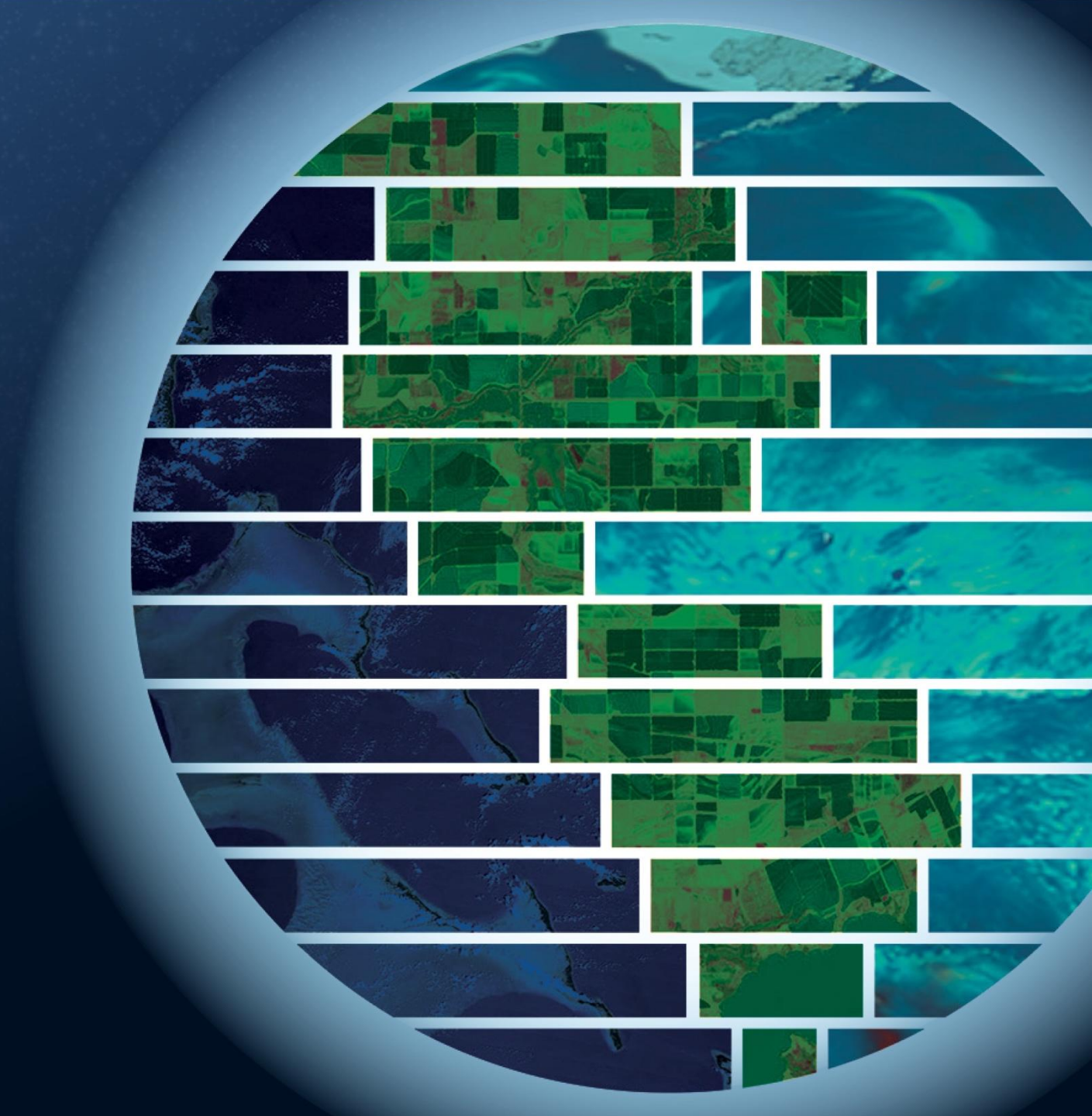
EARTHDATA

# Atmospheric Science Data Center (ASDC) & TEMPO Data Services

Atmospheric Science Data Center

Matthew Tisdale

Georgina Hayes-Crepps



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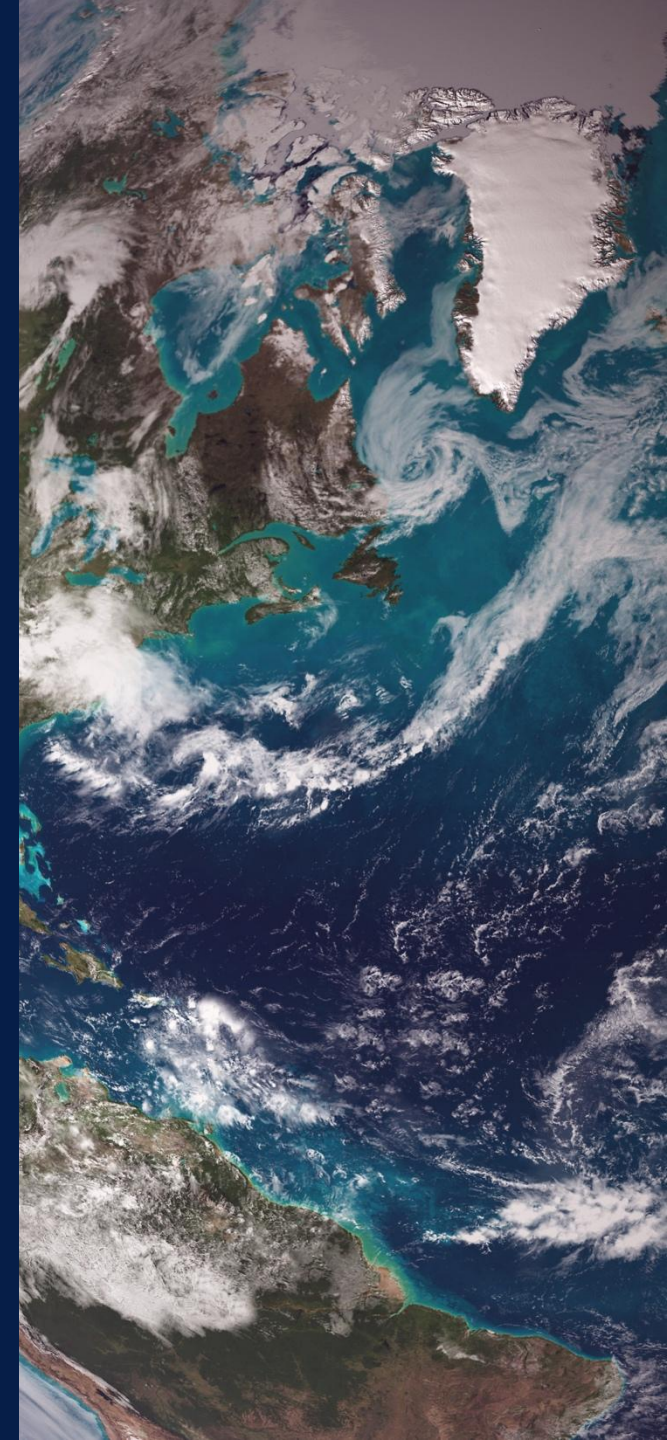
# Agenda

ASDC

TEMPO

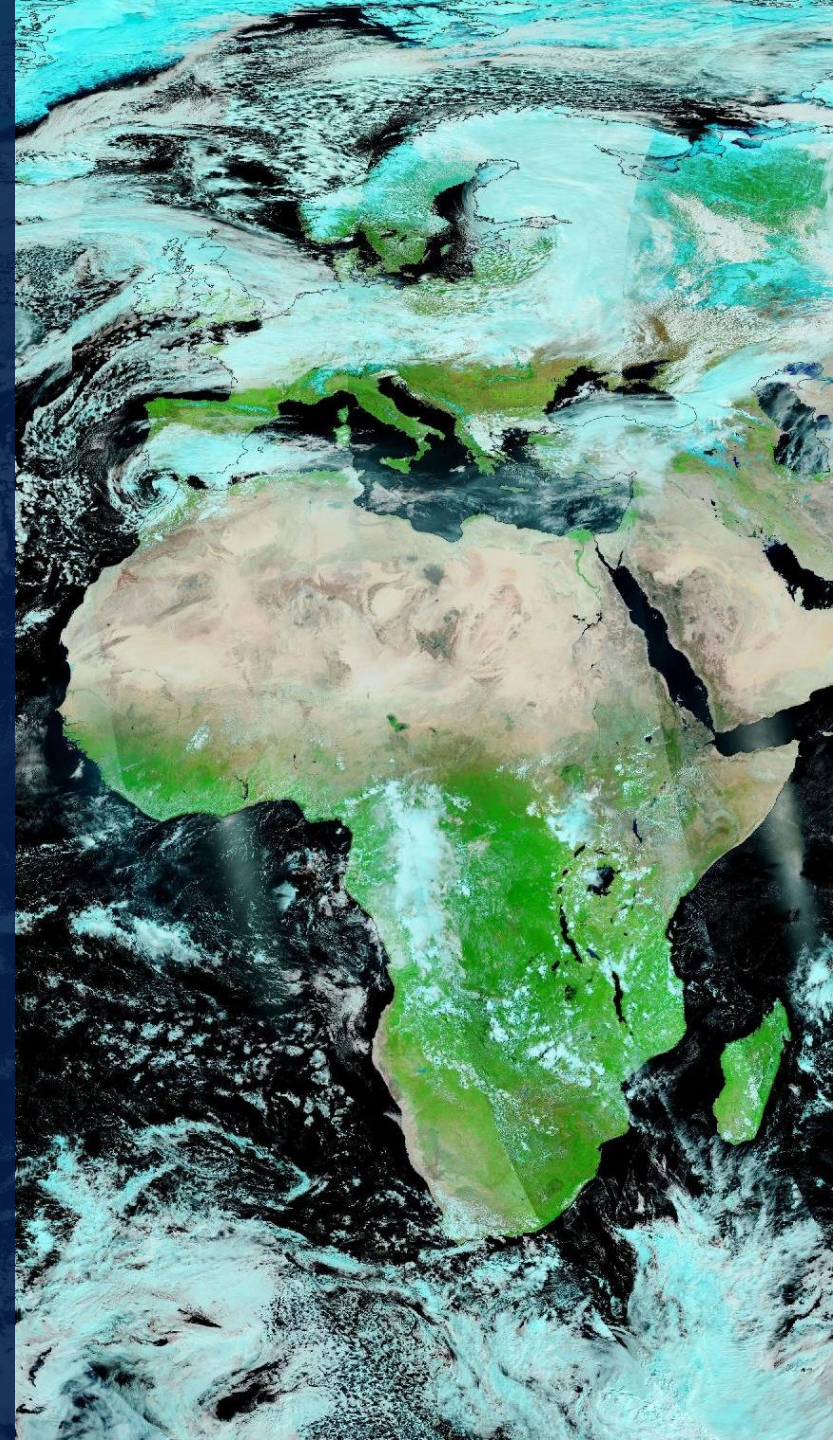
TEMPO Data Services

Additional Resources

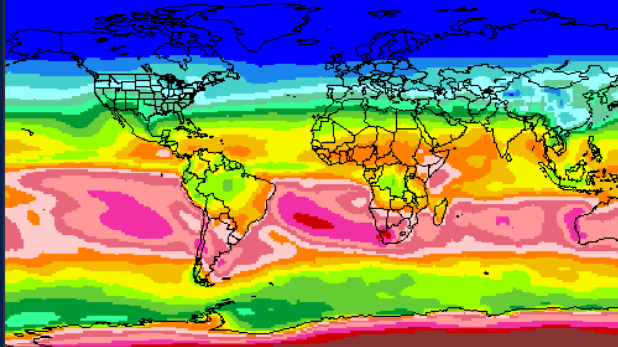


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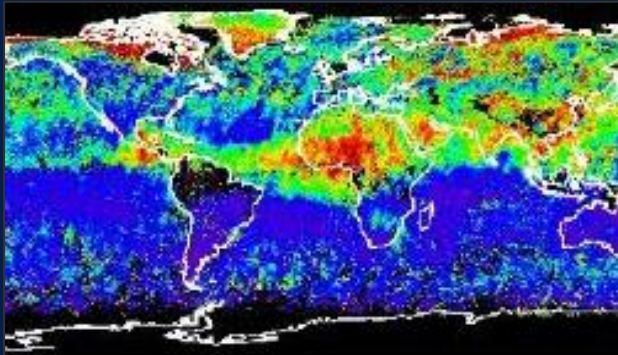
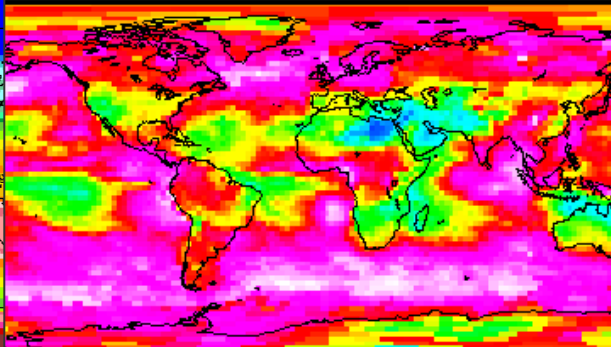
# Atmospheric Science Data Center (ASDC)



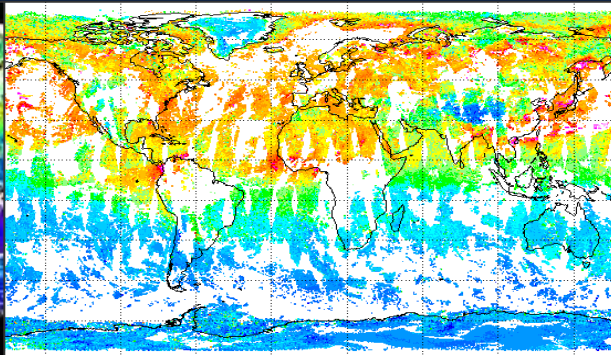
## RADIATION BUDGET



## CLOUDS



## AEROSOLS



## TROPOSPHERIC COMPOSITION

## ASDC at a glance

- ✓ **44+ Science projects**
  - TES ◦ MISR ◦ MOPITT ◦ CERES ◦ CALIPSO ◦ DSCOVR
  - SAGE III ISS
  - TEMPO ◦ PREFIRE ◦ MAIA
  - Airborne field campaigns (KORUS AQ, DISCOVER AQ, FIREX AQ, ACTIVATE, STAQS)
- ✓ **1100+ unique science products**
- ✓ **Data usage**
  - 3.5 PB ◦ 160,000 users
  - 158 countries
- ✓ **Data archive**
  - 6.5 Petabytes ◦ 168 million files (5,500 TB) on high-speed disks
- ✓ **Data in cloud (ongoing)**
  - Data and services in the cloud
  - Scalable infrastructure

## Primary Functions of ASDC

**Ingest** receive data from data provider

**Archive** preservation & provenance

**Distribute** tools and services

**Process** create higher level products

**Outreach & Support** research community



**EARTHDATA**

# ASDC Data Distribution: Tools and Services

## ✓ NASA Earthdata Search

- metadata ◦ browse ◦ download
- customize ◦ HTTPS and AWS S3 direct data access



## ✓ NASA Earthdata WorldView

- visualize ◦ GIBS API



## ✓ NASA Earthdata Harmony

- transform ◦ subset ◦ reformat
- aggregate



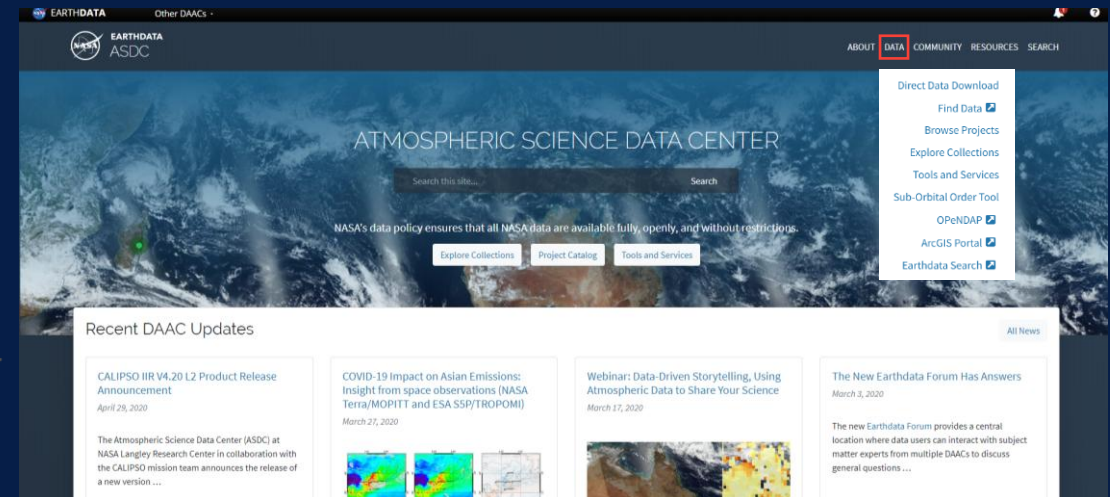
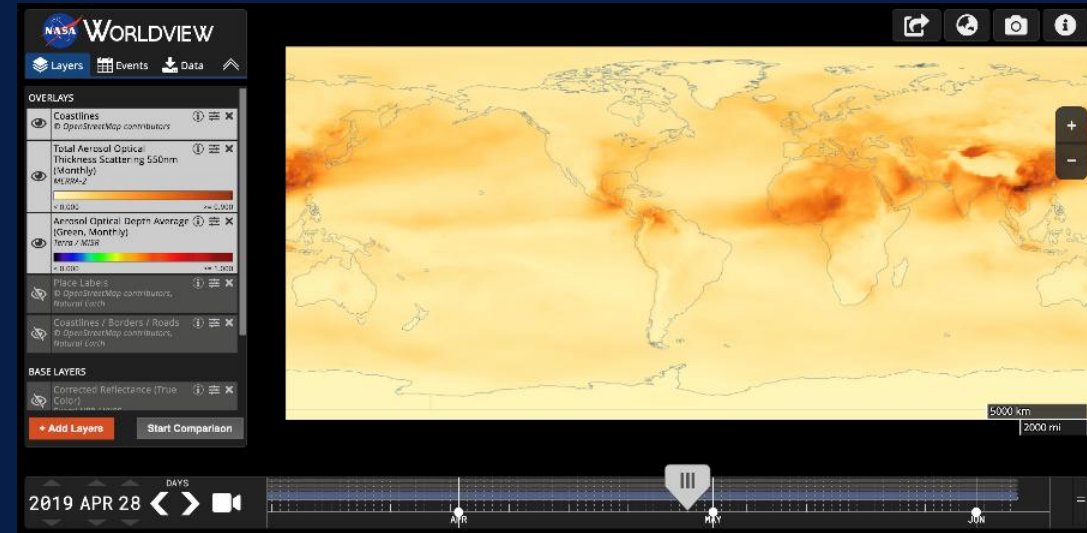
## ✓ NASA Earthdata GIS

- ArcGIS Image & Feature Service
- OGC WMS, WFS & WCS



## ✓ OPeNDAP

- transform ◦ subset ◦ reformat



## User Support and Other Resources

### Example scripts (ASDC GitHub)

- Python/Jupyter Notebook ◦ R scripts
- Contributed tutorials/scripts



**Earthdata Forum** <https://forum.earthdata.nasa.gov/>

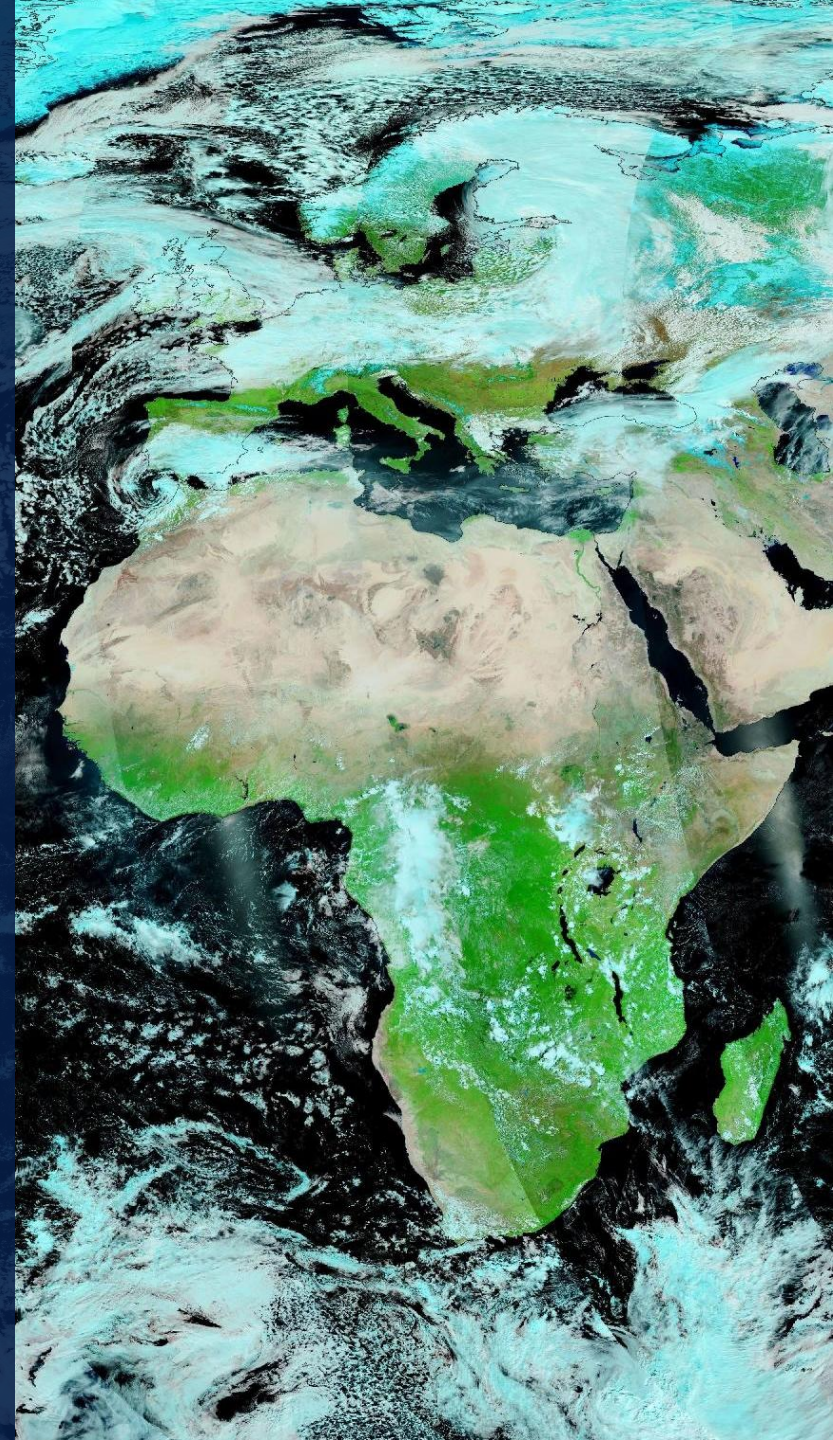
**ASDC User Support** [support-asdc@earthdata.nasa.gov](mailto:support-asdc@earthdata.nasa.gov)

<https://asdc.larc.nasa.gov/>



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TEMPO



# Tropospheric Emissions: Monitoring of Pollution

- Hourly daytime air pollution measurements over North America
- **Geostationary orbit** means TEMPO can scan the continent continuously
  - High temporal resolution
  - High spatial resolution
- Baseline data products:
  - Ozone
  - Nitrogen dioxide
  - Formaldehyde



# TEMPO Operations

## Nominal scans

- 2048 North/South pixels
- 1181 East/West steps per hour
- 2 x 4.75 km<sup>2</sup> at center of field of regard

## Optimized scans

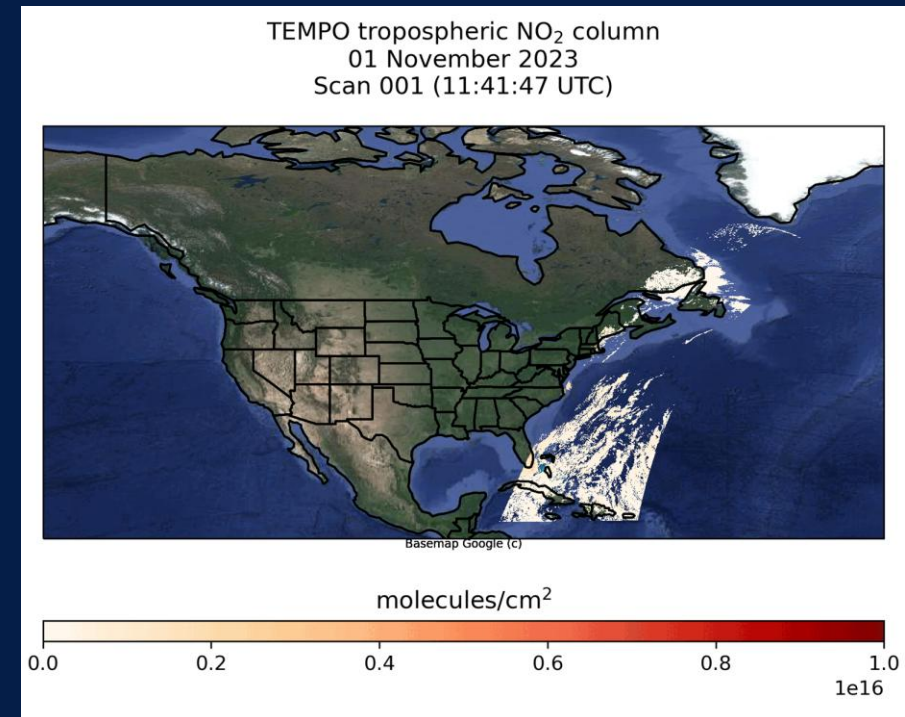
- Higher temporal resolution AM and PM scans over coasts (40 minutes)

## Twilight scans (city lights)

- Performed during darkness, before morning scans

## High-time scans

- Frequent scans (5 to 10 minutes) over selected longitudes
- Rare → can be requested but require science team approval



GOME-2

OMI

TROPOMI

TEMPO

Google Earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image © 2023 TerraMetrics

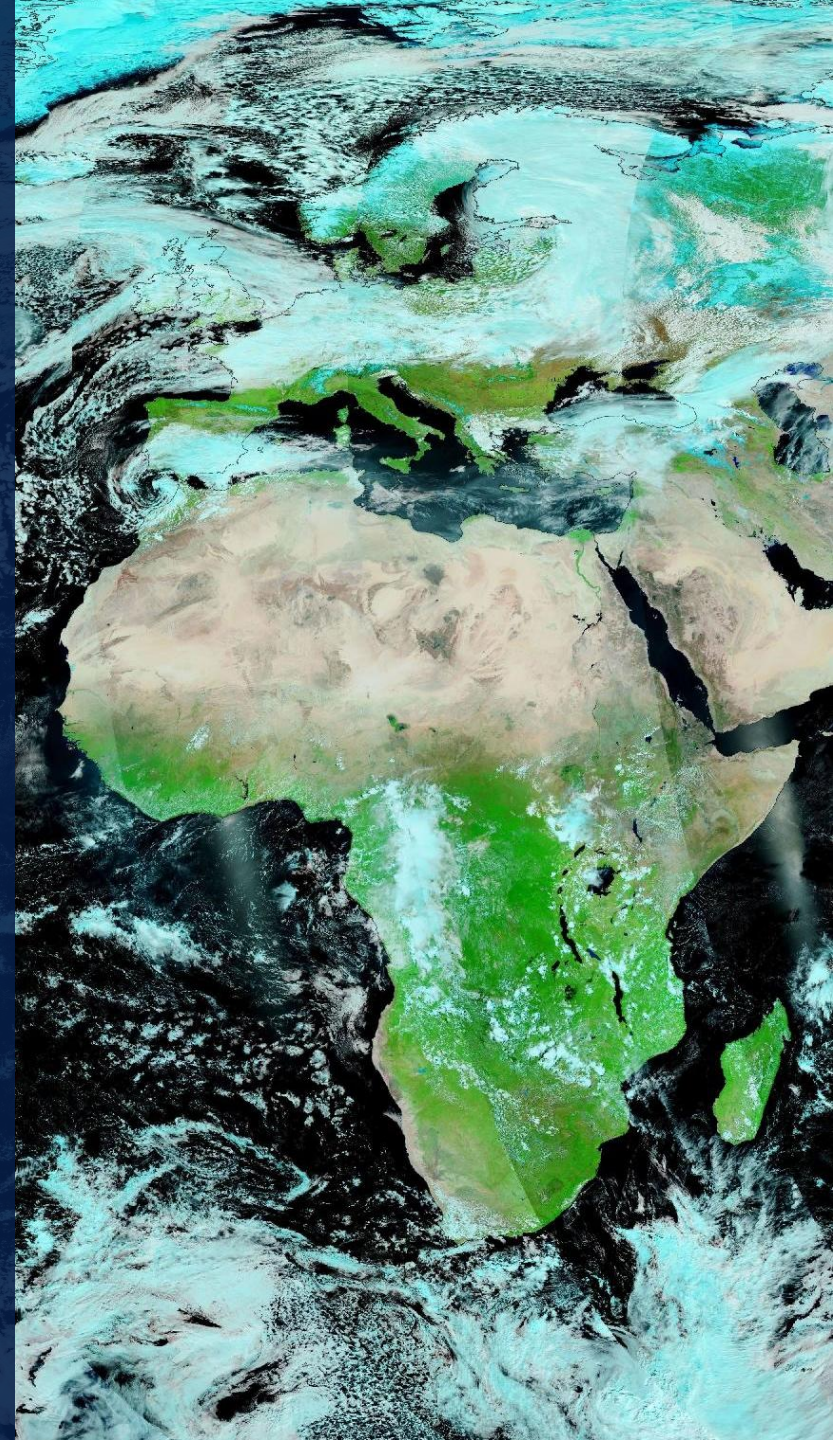
20 km



9

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# TEMPO Data Services

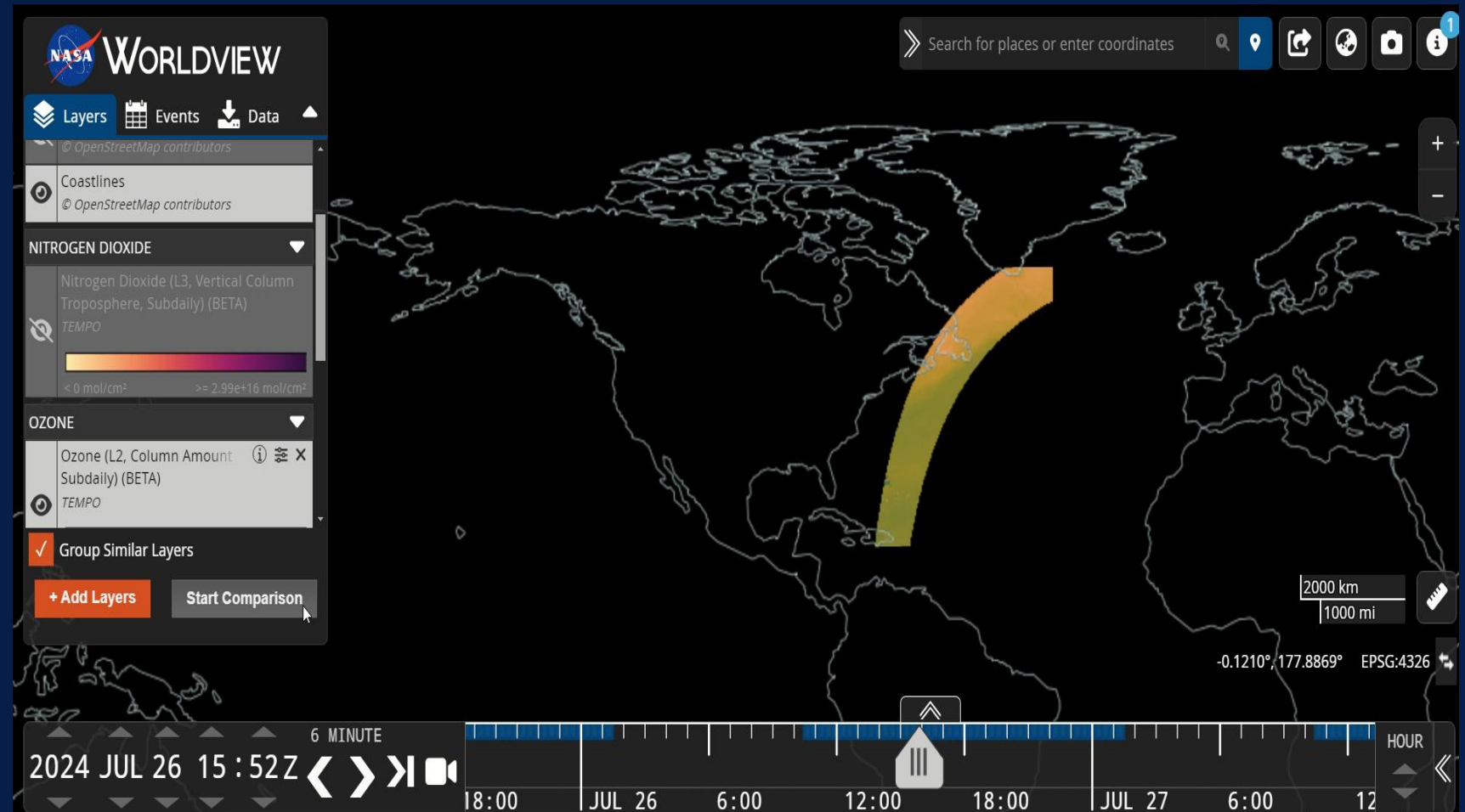


# Current TEMPO V04 Data Services

Tool and Service Availability	L1	L2	L3
Available in Earthdata Search (EDS)	Yes	Yes	Yes
Subsetting (temporal, spatial, variable)	No	Yes	Yes
OPeNDAP	No	Yes	Yes
Concatenation/Aggregation	No	Yes	No
Worldview/GIBS Imagery	No	Yes (selected variables)	Yes (selected variables)
ArcGIS Image Service	No	No	Yes (selected variables)
Remote Sensing Information Gateway (RSIG)	No	Yes	Yes
Thumbnails in EDS	Yes	Yes	Yes

# Worldview / Global Imagery Browse Service (GIBS)

- Browse Imagery
- Set Thresholds
- Animations
- Event Information
- Global Imagery Browse Service (GIBS) API



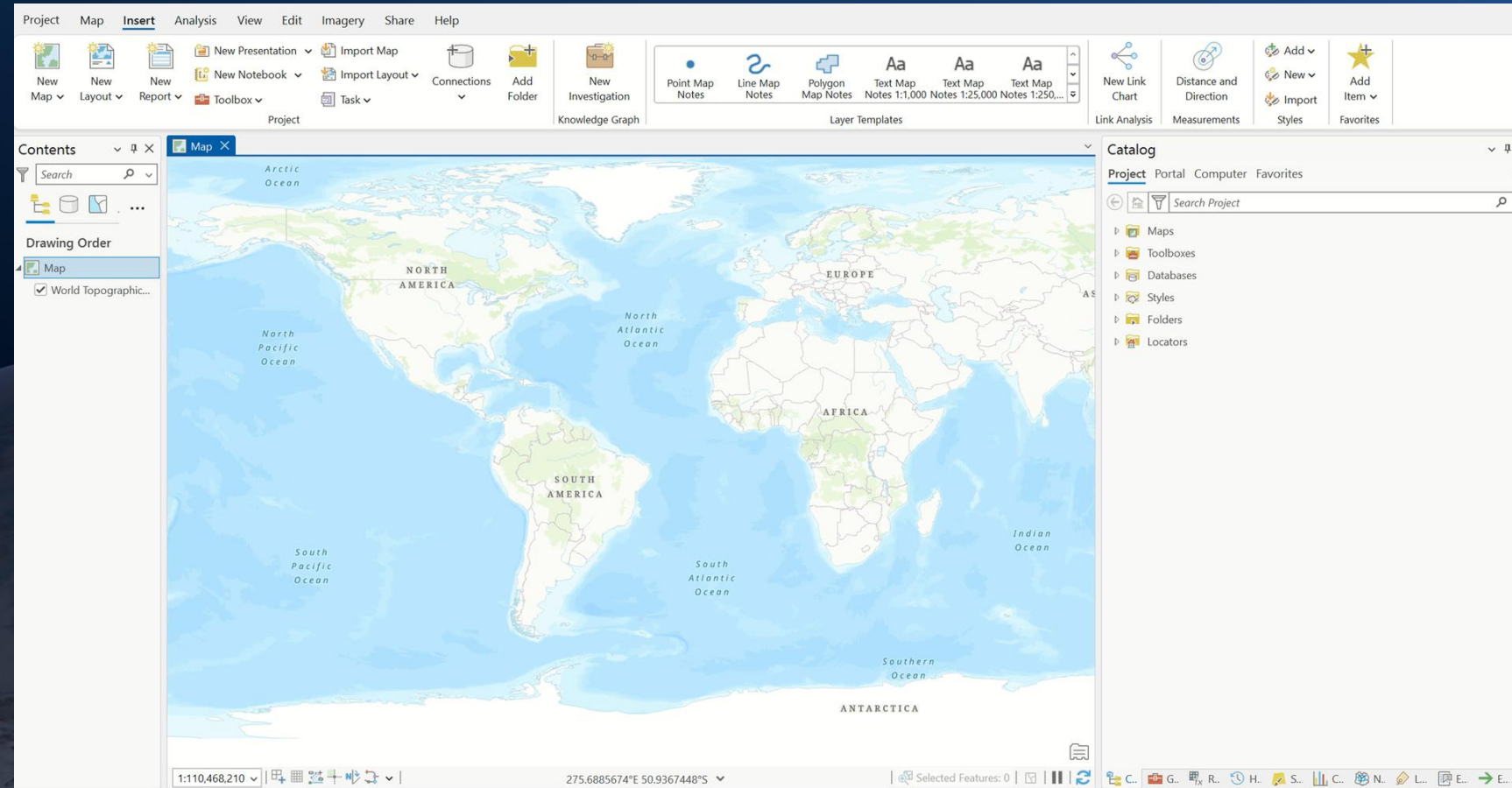
# Worldview / Global Imagery Browse Service (GIBS)

- Global Imagery Browse Service (GIBS) API

- Web Map Tile Service (WMTS)
- Tiled Web Map Service (TWMS)
- Web Map Service (WMS)

- Supported software

- QGIS
- Esri ArcGIS Pro
- Esri ArcGIS online
- Google Earth (Web/Pro)



# Earthdata GIS

- ArcGIS Image Services
- ArcGIS Feature Services
- Open Geospatial Consortium (OGC)
  - Web Map Service (WMS)
  - Web Coverage Service (WCS)
  - Web Feature Service (WFS)
- Web Maps
- Web Applications



BETA - Users may notice some functionality is not fully enabled. Please engage and provide feedback! [support@earthdata.nasa.gov](mailto:support@earthdata.nasa.gov)

Home Gallery Map Scene Groups Help  Sign In

## NASA Earthdata GIS

NASA's Earthdata Geographic Information System (EGIS) is currently in BETA and under active development. Therefore, users may notice some functionality is not fully enabled. At this time, 'sign in' options are restricted. Additionally, users are currently unable to save or print web maps from the viewer.





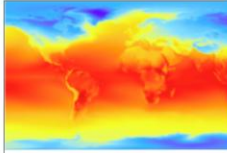

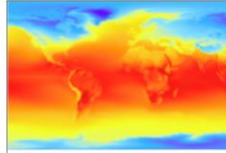
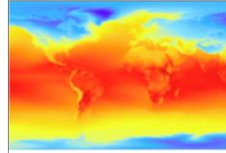
EGIS is a resource for distributing cloud-native, GIS-ready NASA Earth observation data, services, and resources. This includes ArcGIS and Open Geospatial Consortium (OGC)-compliant raster and feature geospatial services and raster analytic functions. EGIS will provide a consistent user experience and enhance resource discovery through primary platforms commonly used by the GIS community.

[Get information and guides](#) to help you find and use NASA Earth science data, services, and tools.

We'd love to hear from you! Please contact us at [support@earthdata.nasa.gov](mailto:support@earthdata.nasa.gov) with any questions or feedback you have.

### Featured Layers

NASA authoritative data sets enabled as web services to be used in GIS. Layers are visual representations of a geographic dataset in a digital map environment. These layers, often referred to as services, reference a data source that defines how the data should be visualized and contain the underlying data properties and values.

 <p>Imagery Layer GPM IMERG Early Precipitation ... Image service of IMERG Early product displaying precipitation rate in mm/hr at 30 minute intervals.</p>	 <p>Imagery Layer GPW Version 4 Population Coun... The GPWv4 UN WPP-Adjusted Population Count, v4.11 image service is part of the Gridded</p>	 <p>Imagery Layer GPW Version 4 Basic Demograp... The GPWv4 BDC, v4.11_2010 image service is part of the Gridded Population of the World, Version</p>	 <p>Imagery Layer GPW Version 4 Population Dens... The GPWv4 UN WPP-Adjusted Population Density, v4.11 image service is part of the Gridded</p>
 <p>Imagery Layer POWER Annual Solar This service provides global annual radiation data from 1984 to Near Real Time (NRT) from the Global</p>	 <p>Imagery Layer POWER Monthly Solar This service provides global monthly radiation data from 1984 to Near Real Time (NRT) from the Global</p>	 <p>Imagery Layer POWER Annual Meteorology This service provides global annual meteorology data from 1981 to Near Real Time (NRT) from the Global</p>	 <p>Imagery Layer POWER Monthly Meteorology This service provides global monthly meteorology data from 1981 to Near Real Time (NRT) from the Global</p>

# TEMPO ArcGIS Image Services

- Pre-filtered, analysis ready data
- Rest URL with build-in API functionality
- Available in NASA's Earthdata GIS Portal and Esri's Living Atlas of the World
- V03 being reprocessed into V04; will be added to services

## Cloud Fraction

- 2-day Rolling Archive Near Real-Time (V02)



**EARTHDATA**

## NO2 Troposphere

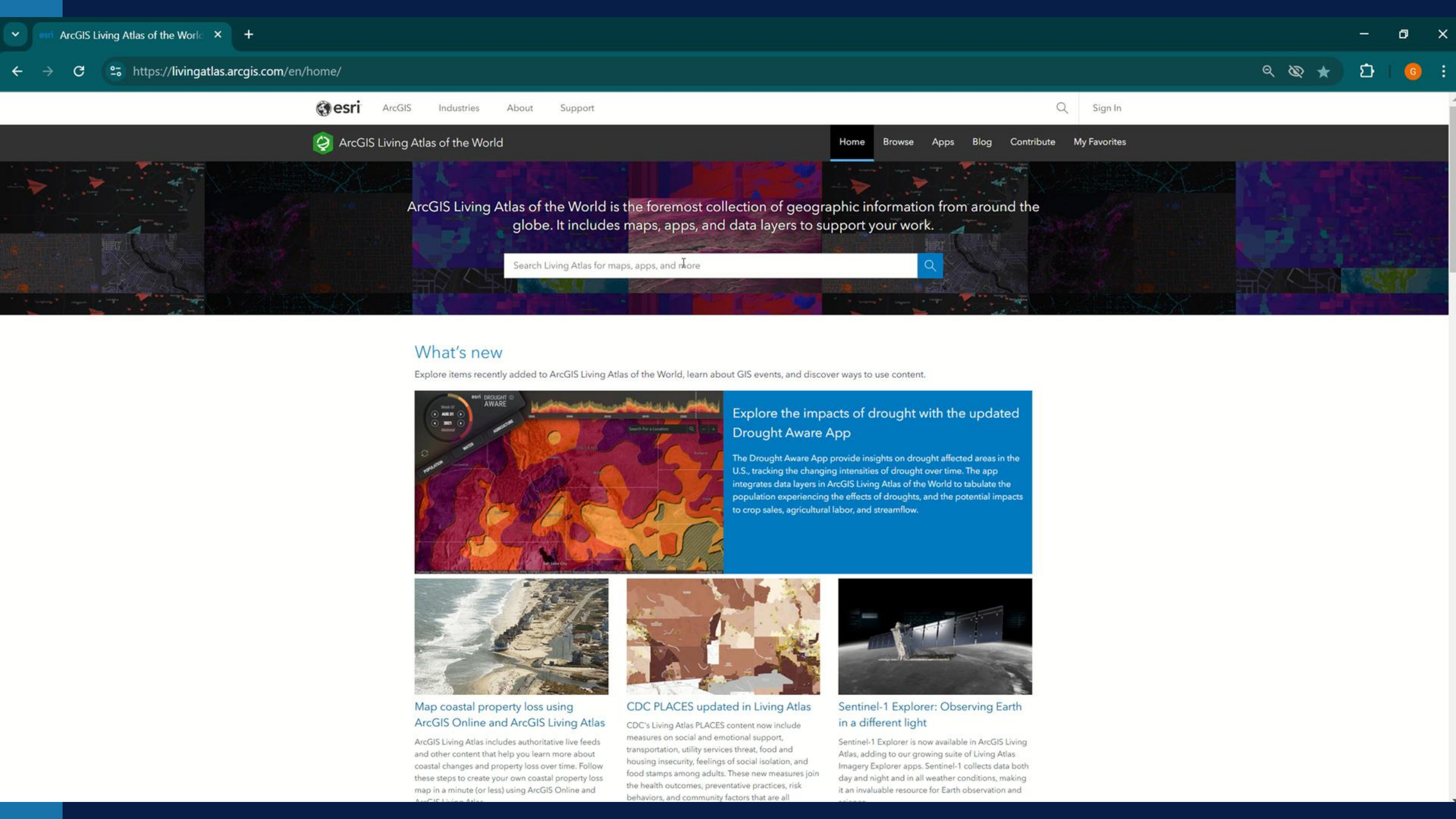
- Aug 2023-Sept 2025 (V03)
- Sept 2025-present (V04)
- 2-day Rolling Archive Near Real-Time (V02)

## HCHO Vertical Column

- Aug 2023-Sept 2025 (V03)
- Sept 2025-present (V04)
- 2-day Rolling Archive Near Real-Time (V02)

## Ozone Total Column

- Aug 2023-Sept 2025 (V03)
- Sept 2025-present (V04)



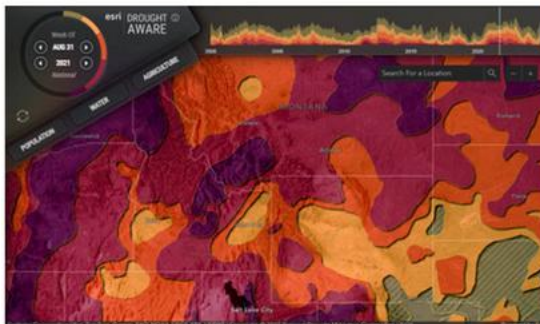
ArcGIS Living Atlas of the World is the foremost collection of geographic information from around the globe. It includes maps, apps, and data layers to support your work.

Search Living Atlas for maps, apps, and more



## What's new

Explore items recently added to ArcGIS Living Atlas of the World, learn about GIS events, and discover ways to use content.



### Explore the impacts of drought with the updated Drought Aware App

The Drought Aware App provide insights on drought affected areas in the U.S., tracking the changing intensities of drought over time. The app integrates data layers in ArcGIS Living Atlas of the World to tabulate the population experiencing the effects of droughts, and the potential impacts to crop sales, agricultural labor, and streamflow.



### Map coastal property loss using ArcGIS Online and ArcGIS Living Atlas

ArcGIS Living Atlas includes authoritative live feeds and other content that help you learn more about coastal changes and property loss over time. Follow these steps to create your own coastal property loss map in a minute (or less) using ArcGIS Online and ArcGIS Living Atlas.



### CDC PLACES updated in Living Atlas

CDC's Living Atlas PLACES content now include measures on social and emotional support, transportation, utility services threat, food and housing insecurity, feelings of social isolation, and food stamps among adults. These new measures join the health outcomes, preventative practices, risk behaviors, and community factors that are all



### Sentinel-1 Explorer: Observing Earth in a different light

Sentinel-1 Explorer is now available in ArcGIS Living Atlas, adding to our growing suite of Living Atlas Imagery Explorer apps. Sentinel-1 collects data both day and night and in all weather conditions, making it an invaluable resource for Earth observation and

Clipboard: Paste, Copy, Copy Path

Navigate: Explore, Bookmarks, Go To XY

Layer: Add Data From Path, Add Data, XY Table To Point, Add Graphics Layer

Selection: Select, Select By Attributes, Select By Location, Attributes, Clear, Zoom To

Inquiry: Measure, Locate, Infographics, Coordinate Conversion

Labeling: Pause, Lock, View Unplaced, Convert, More

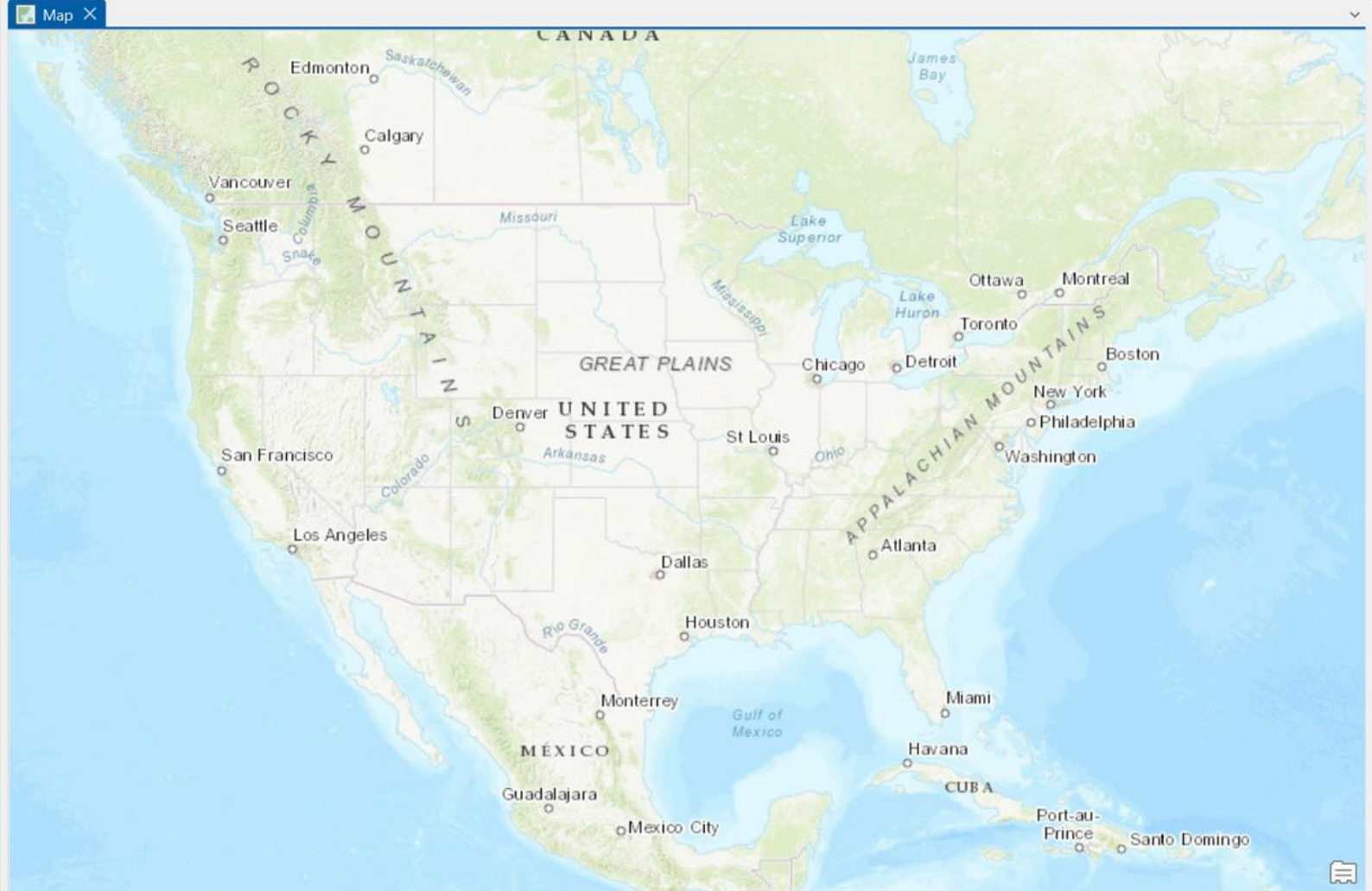
Offline: Download Map, Sync, Remove

Contents

Search

Drawing Order

- Map
  - World Topographic Map



Catalog

Project Portal Computer Favorites

Search Project

- Maps
- Toolboxes
- Databases
- Styles
- Folders
- Locators

Configure Extent

Variable: Ozone\_Column\_Amou  
 StdTime: 2024-10-12T18:54:47  
 StdZ: [dropdown]

Temporal Profile | Summary Statistics | Aggregate | Anomaly | Trend | Find Argument Statistics

Data Management

Contents

Search

Drawing Order

- Map
- dtl\_cnty
- TEMPO Total Column Ozone August 2023...**

Value

500  
100

Charts

- Change in mean Total Ozone Column...
- World Topographic Map

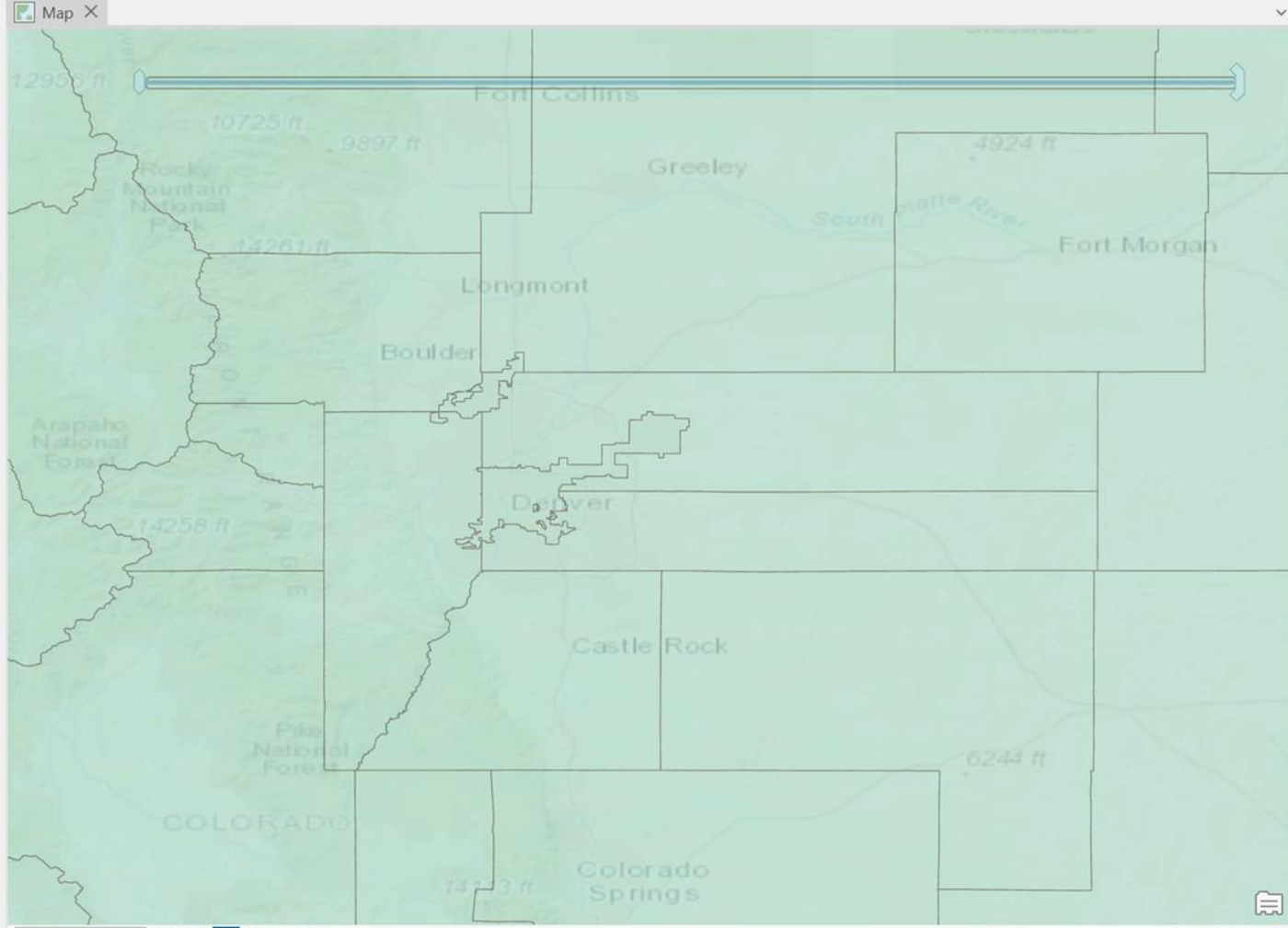
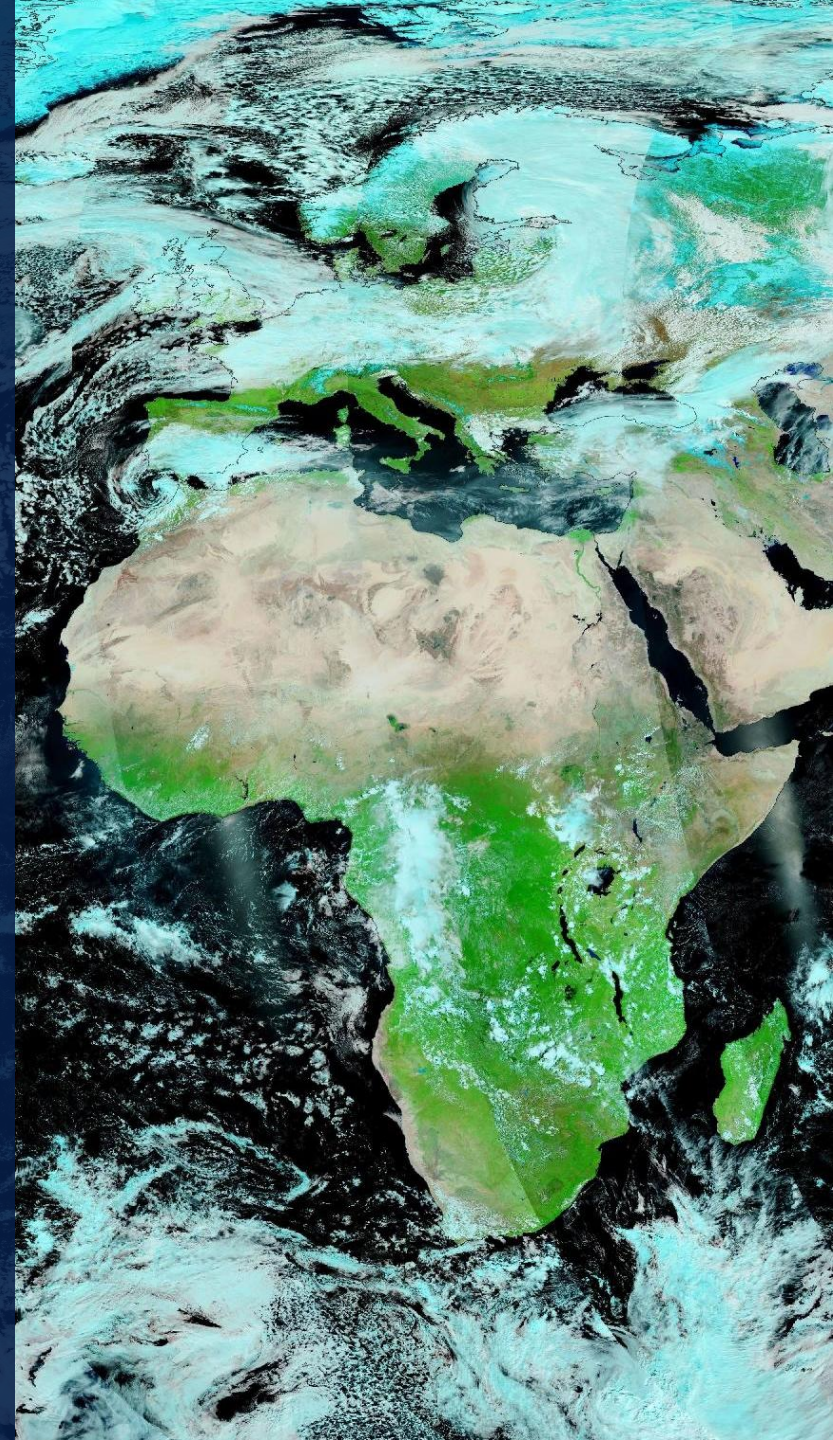


Chart Properties

Open a chart to view the Chart Properties.

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# Additional Resources



# GIS Resources

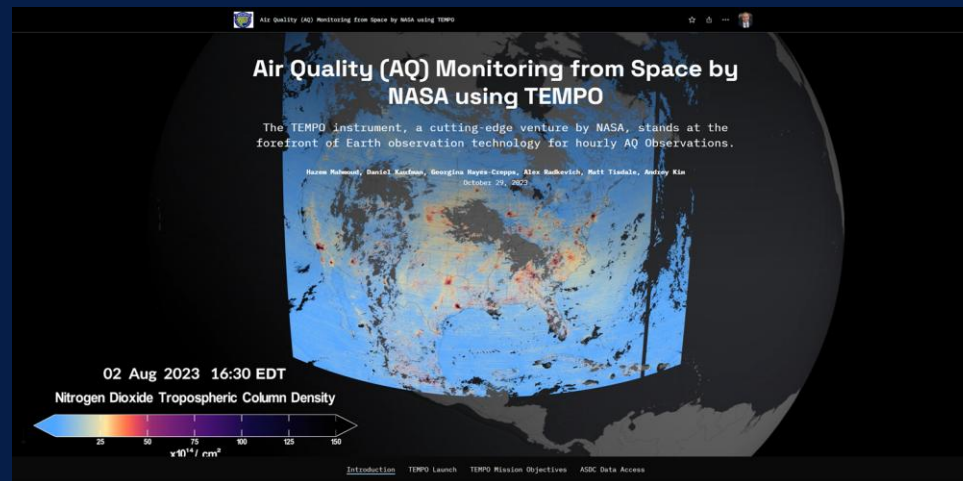
- [Esri Living Atlas of the World](#)
- [NASA Earthdata GIS Portal](#)
- [Accessing Worldview Imagery in GIS](#)
- [Temporal Profile Chart \(ArcGIS Pro\)](#)
- [ArcGIS REST API](#)
- Jupyter notebook (ASDC GitHub):
  - [Accessing, Analyzing, & Visualizing TEMPO data through ArcGIS Image Services Programmatically \(Point\) OR “pretty view” as html](#)
  - Earthdata GIS GitHub:
  - [Tutorials \(including TEMPO\)](#)
- Two TEMPO ESRI blog posts for TEMPO GIS analysis:
  - [Visualizing & Accessing TEMPO NO2 Data: Building an Application with ArcGIS Living Atlas and ArcGIS Experience Builder Visualizing TEMPO NO2 Data in ArcGIS \(esri.com\)](#)
  - [Performing Multidimensional Analysis with TEMPO Nitrogen Dioxide Data TEMPO Analysis in ArcGIS Pro: Multidimensional Insights \(esri.com\)](#)



# Recorded Trainings

- [Finding Your TEMPO: An Introduction to the Mission, Products, and Data Services for Air Quality Observations over North America](#)
- [Geostationary Remote Sensing of Trace Gases for Air Quality Applications in North America](#)

## [TEMPO Storymap](#)



EARTHDATA

# Earthdata Forum

**Science Data Users** can seamlessly search for information even if they do not know which DAAC the data belongs to.

**Scientists & Data Providers** can effectively assist their user community in more accurately using their products.

**DAACs & Subject Matter Experts (SMEs)** can quickly link users to existing resources.

**DAAC User Services** can swiftly provide inquirers with an authoritative source related to DAAC data products & services.

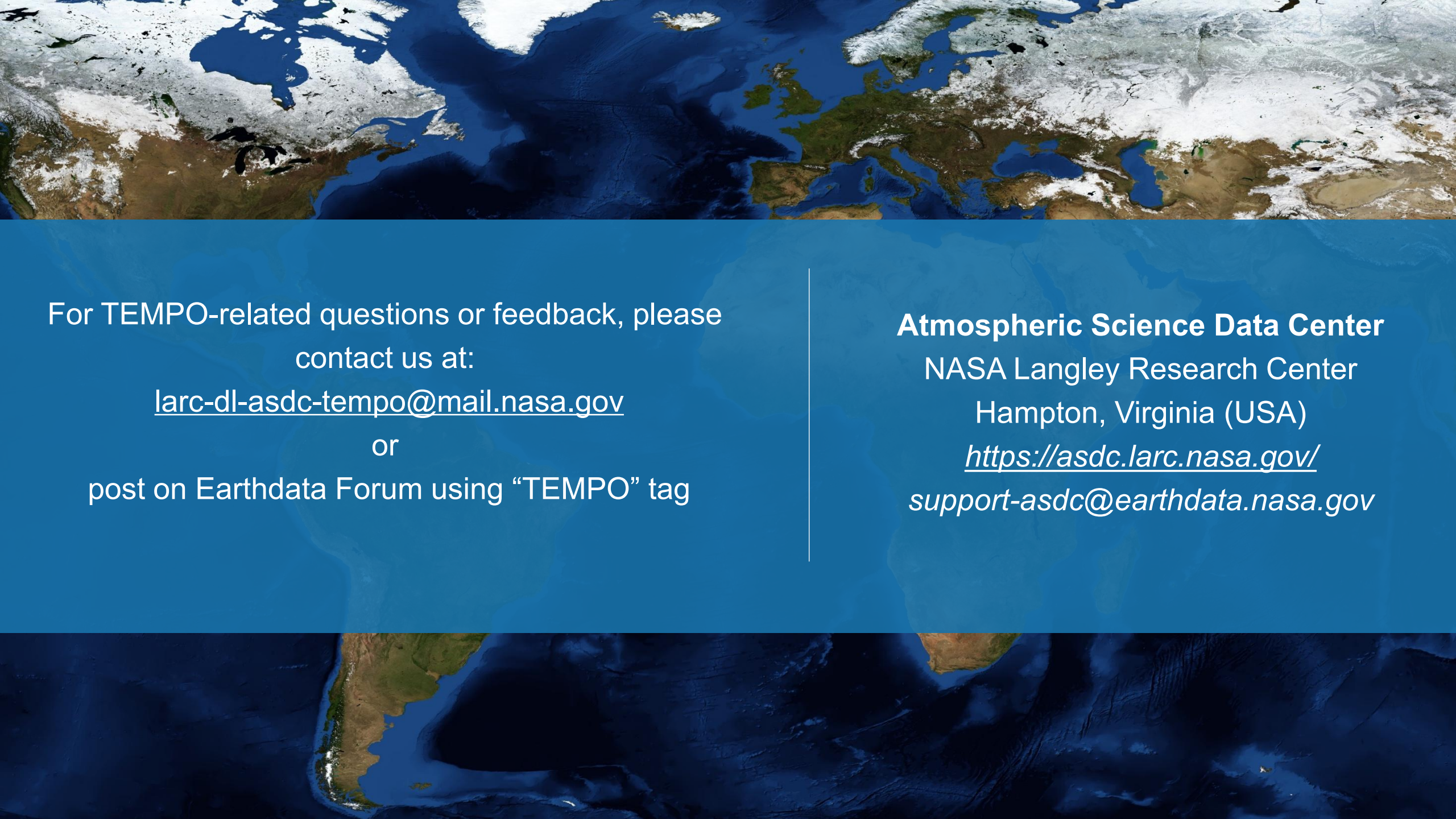
**Tag** posts with “ASDC” or “TEMPO”

The screenshot shows the Earthdata Forum website. At the top, there is a navigation bar with the Earthdata logo, a search bar for DAACs, and a feedback icon. Below the navigation bar is a header section with the NASA logo, the text "EARTHDATA Forum BETA", and a welcome message: "Welcome to the Earthdata User Forum! Here, subject matter experts from several NASA Distributed Active Archive Centers (DAAC) can discuss general questions, research needs and data applications. Users can query how to access, view and interpret the data." Below the header is a blue navigation bar with links for "Quick links", "FAQ", "Data Recipes", and "Login". The main content area has a "Home" link and a "Post a New Question" button. There is a search bar with the placeholder text "Search for keywords, tags..." and an "Advanced Search" link. Below the search bar is a "SEARCH BY TAGS" section with four dropdown menus: "Discipline", "DAAC", "Major Projects", and "Services/Usage", each with a "Select" option and an information icon. A "Submit" button is located below the dropdowns. Below the "SEARCH BY TAGS" section is a "FORUM" section with a table of forum posts. The table has columns for "FORUM", "QUESTIONS", "POSTS", and "LAST POST". The first row shows a post titled "All Questions/Comments" with 215 questions and 452 posts, last posted by "GES DISC - zliu" on Fri Feb 21, 2020 10:18 am America/New\_York.

FORUM	QUESTIONS	POSTS	LAST POST
<b>All Questions/Comments</b> Please enter here to ask a question about any NASA Science related topics!	215	452	<b>Where can I find more FAQs fr...</b> by <b>GES DISC - zliu</b> Fri Feb 21, 2020 10:18 am America/New_York



<https://forum.earthdata.nasa.gov/>



For TEMPO-related questions or feedback, please  
contact us at:

[larc-dl-asdc-tempo@mail.nasa.gov](mailto:larc-dl-asdc-tempo@mail.nasa.gov)

or

post on Earthdata Forum using “TEMPO” tag

**Atmospheric Science Data Center**

NASA Langley Research Center

Hampton, Virginia (USA)

<https://asdc.larc.nasa.gov/>

[support-asdc@earthdata.nasa.gov](mailto:support-asdc@earthdata.nasa.gov)

# EARTHDATA

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earthdata.nasa.gov

## Thank You

**Atmospheric Science Data Center**

NASA Langley Research Center

Hampton, Virginia (USA)

<https://asdc.larc.nasa.gov/>

[support-asdc@earthdata.nasa.gov](mailto:support-asdc@earthdata.nasa.gov)