

National Aeronautics and
Space Administration



EXPLORE EARTH

TEMPO tools and services by the NASA Atmospheric
Sciences Data Center

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1/27/2025

A vibrant space-themed background featuring a variety of celestial bodies. In the foreground, the blue and white horizon of Earth is visible. Above it, the dark, cratered surface of the Moon is prominent. Further out, the orange and red hues of Mars are seen, along with the yellowish planet Saturn with its rings. The background is filled with a dense field of stars and a bright yellow sun or star in the lower-left quadrant. The overall color palette is dominated by blues, yellows, and oranges, creating a dynamic and cosmic atmosphere.

EXPLORE EARTH

Agenda

ASDC Overview

TEMPO Data Lifecycle

Tools and Services

User Support

Earth Science Data and Information System *ESDIS*

NASA's Distributed Active Archive Centers (DAACs)

A federated approach to data management

Land Process DAAC
Land Cover, Surface Reflectance, Radiance, Temperature, Topography, Vegetation Indices

Physical Oceanography DAAC
Gravity, Sea Surface Temperature, Ocean Winds, Ocean Surface Topography, Sea Surface Salinity, Ocean Circulation

National Snow and Ice Data Center DAAC
Frozen Ground, Glaciers, Ice Sheets, Sea Ice, Snow, Soil Moisture, Cryosphere, Climate Interactions

Alaska Satellite Facility DAAC
Synthetic Aperture Radar (SAR) Products

Global Hydrometeorology Resource Center DAAC
Hazardous Weather, Lightning, Tropical Cyclones, Storm-Induced Hazards

Oak Ridge National Laboratory DAAC
Biogeochemical Dynamics, Ecological Data, Environmental Processes

Atmospheric Science Data Center
Radiation Budget, Clouds, Aerosols, Tropospheric Composition

Socioeconomic Data and Applications Center
Human Interactions, Land Use, Environmental Sustainability, Geospatial Data

Ocean Biology DAAC
Ocean Color, Sea Surface Temperature, Sea Surface Salinity

Crustal Dynamics Data Information System
Space Geodesy, Solid Earth

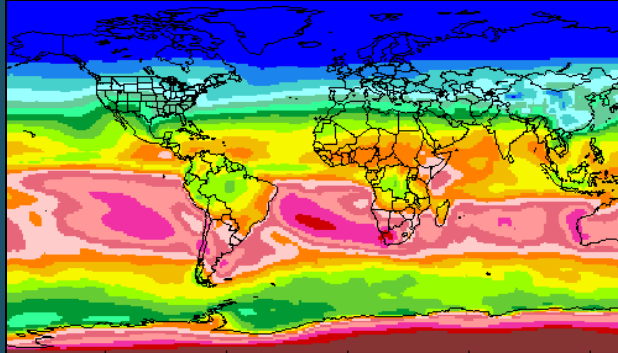
Goddard Earth Sciences Data and Information Services Center
Global Precipitation, Solar Irradiance, Atmospheric Composition and Dynamics, Global Modeling

Level 1 and Atmosphere Archive and Distribution System DAAC
MODIS Level-1 and Atmosphere Data Products

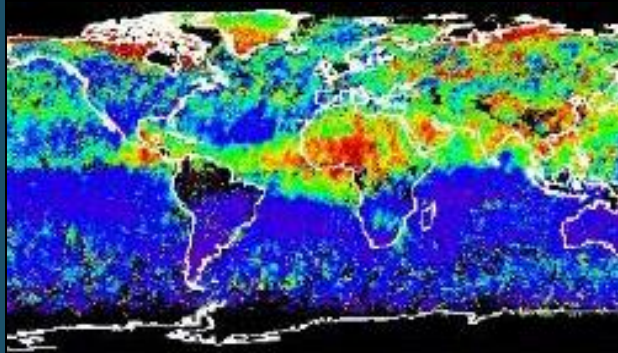
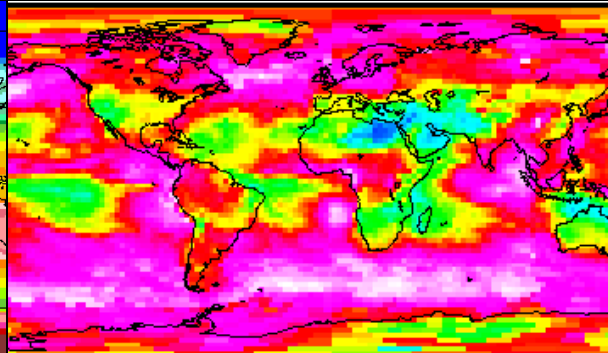


ASDC at a Glance

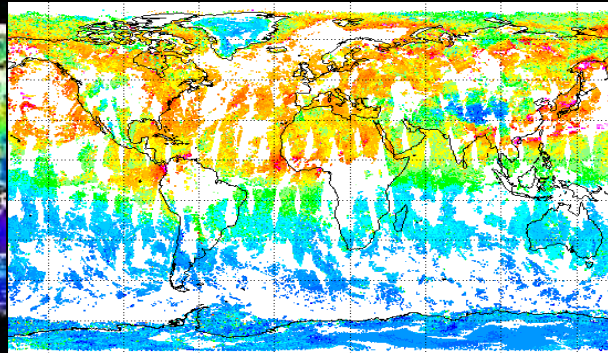
RADIATION BUDGET



CLOUDS



AEROSOLS



TROPOSPHERIC COMPOSITION

- ✓ 110+ Science projects
 - MISR ◦ MOPITT ◦ MAIA ◦ TEMPO ◦ CERES
 - TEMPO & CALIPSO → RSIG (EPA)
 - Airborne field campaigns (KORUS AQ, DISCOVER AQ, FIREX AQ)
- ✓ 1500+ unique science products
- ✓ Data usage (2022)
 - 3.5 Petabytes ◦ 160,000 users
 - 158 countries
- ✓ Data archive (2022)
 - 8+ 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

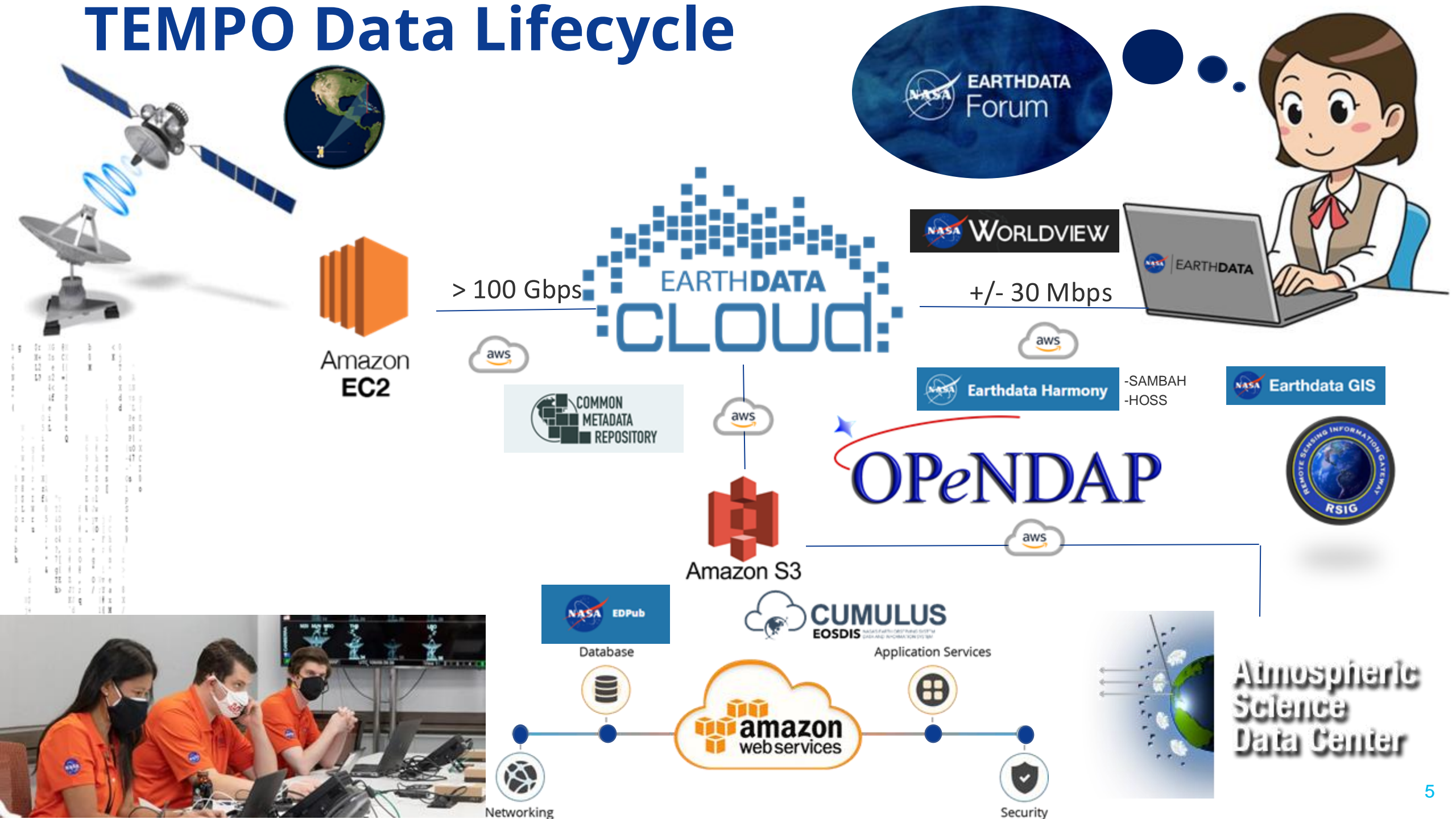
Archive preservation & provenance

Distribute tools and services

Process create higher level products

Outreach & Support research community

TEMPO Data Lifecycle

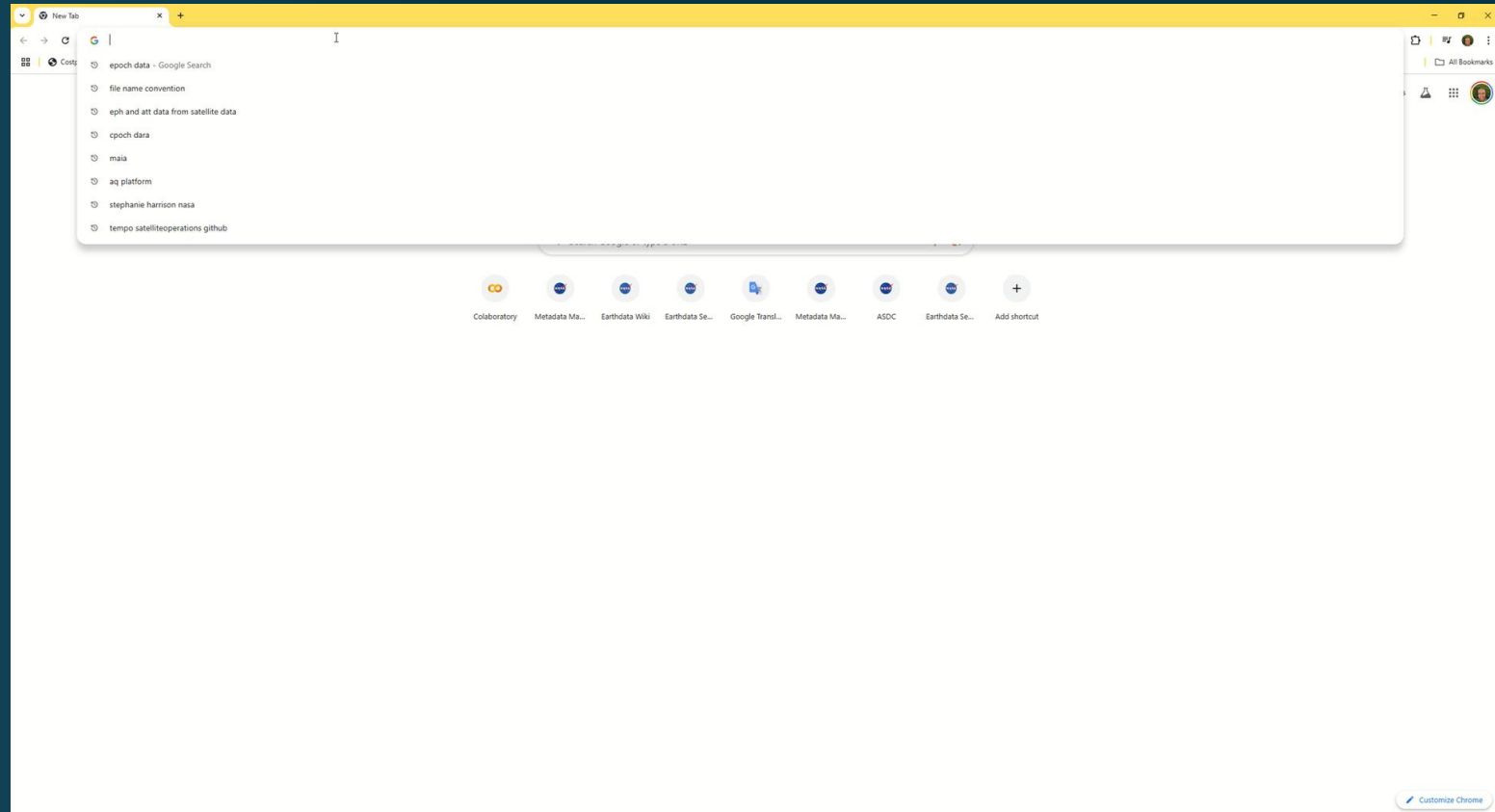


The background of the slide is a composite of two cosmic images. The top half features a dark blue and black space filled with numerous small stars and a prominent, bright blue nebula on the right side. The bottom half features a warm orange and yellow space filled with many small stars and a greenish-yellow nebula on the right side. A dark blue horizontal band runs across the middle of the slide, containing the text.

Tools and Services

Earthdata Search

- Search and Order
 - On Premise
 - Amazon Web Services
- Subsetting & Aggregation
- Browse Imagery
- File Conversions
- Application Programming Interface (API) Access



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



Name	Date modified	Type	Size
C2930725014-LARC_CLOUD_batch_of_2_starting_from_TEMPO_NO2_L2_V03_20240909T001234Z_S015G05_product_vertical_column_troposphere_subsetted_stitched_20240909T233845Z_C2930725014-LARC_CLOUD_merged.nc4	1/24/2025 7:22 PM	NC4 File	710 KB

- Quick access
- Desktop
- Downloads
- Documents
- Pictures
- AMS
- DAAC Scientist
- Pictures
- PREFIRE
- This PC
- 3D Objects
- Desktop
- Documents
- Downloads
- Music
- Pictures
- Videos
- Windows (C:)
- Network
- Linux

Worldview / Global Imagery Browse Service (GIBS)

- Browse Imagery
- Animations
- Event Information
- GIBS API

The screenshot displays the NASA Worldview web application. On the left, a sidebar contains navigation options: 'Layers', 'Events', and 'Data'. Below these are sections for 'OVERLAYS' (Place Labels, Coastlines/Borders/Roads, Coastlines) and 'BASE LAYERS' (Corrected Reflectance from various satellite sensors like NOAA-21, NOAA-20, Suomi NPP, Aqua, and Terra/MODIS). A 'Start Comparison' button is visible at the bottom of the sidebar. The main map area shows a satellite view of Earth with a search bar at the top right. A 'Welcome to NASA Worldview' panel is overlaid on the right, featuring a grid of story thumbnails. The thumbnails include: 'El Niño Impacts Around the Globe', 'Surface Water Extent', 'Atmospheric Rivers', 'Assessing Floodwaters: Explore flooding using the Near Real-Time MODIS Global Flood Product', 'Night Lights from NASA's Black Marble', 'Harmonized Landsat Sentinel-2', 'Satellite Detections of Fire (2021 update)', and 'Introduction to Worldview'. A timeline at the bottom of the interface shows the current date as 2025 JAN 25, with navigation arrows and a '1 DAY' interval. The system clock at the bottom right indicates 11:28 PM on 1/24/2025.

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

OPeNDAP

- API Access
- Subsetting & Aggregation
- File Conversions

DAP4 Data Request Form TEMPO

https://opendap.earthdata.nasa.gov/collections/C2930764281-LARC_CLOUD/granules/TEMPO_O3TOT_L3_V03_20241001T202756Z_S009.nc.dmr

OPeNDAP DAP4 Data Request Form

dataset: TEMPO_O3TOT_L3_V03_20241001T202756Z_S009.nc

Actions Download Encoding: Choose One... Get Data !! Attention !!

Data URL https://opendap.earthdata.nasa.gov/collections/C2930764281-LARC_CLOUD/granules/TEMPO_O3TOT_L3_V03_20241001T202756Z_S009.nc

Copy encoded Data URL Copy raw Data URL

Global Attributes View/Hide

Global Dimensions View/Hide

Variables

longitude [/longitude= 0..-7749] [Type is: float64]

attributes

latitude [/latitude= 0..-2949] [Type is: float64]

attributes

time [/time= 0..0] [Type is: float64]

attributes

weight [/latitude= 0..-2949] [/longitude= 0..-7749] [Type is: float64]

attributes

product [Type is: General]

attributes

member variables

qa_statistics [Type is: General]

attributes

member variables

support_data [Type is: General]

attributes

member variables

geolocation [Type is: General]

attributes

member variables

debug

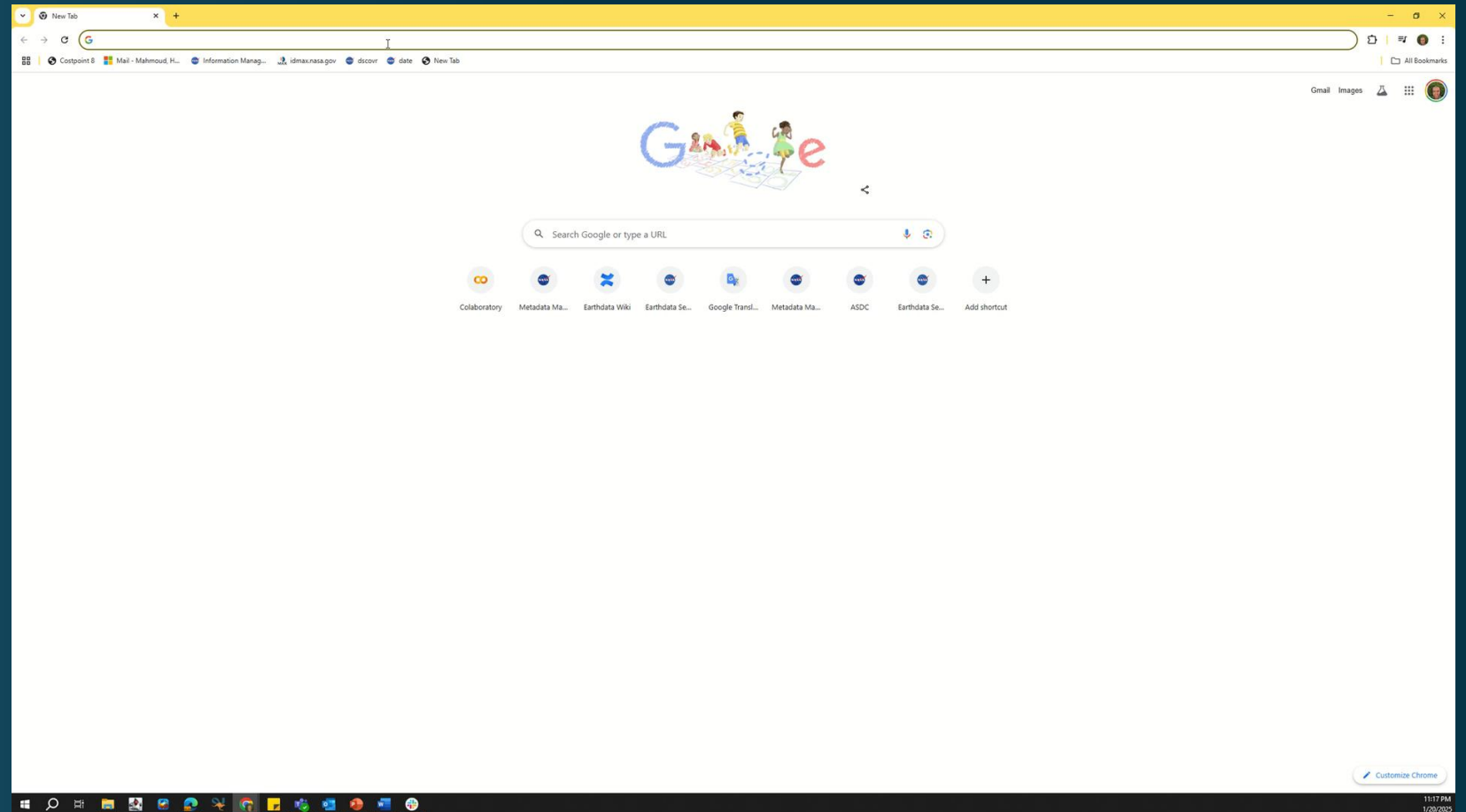
OPeNDAP Hyrax (1.17.0-166)

Hyrax development sponsored by NSF, NASA, and NOAA

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

ArcGIS Enterprise in the Earthdata Cloud

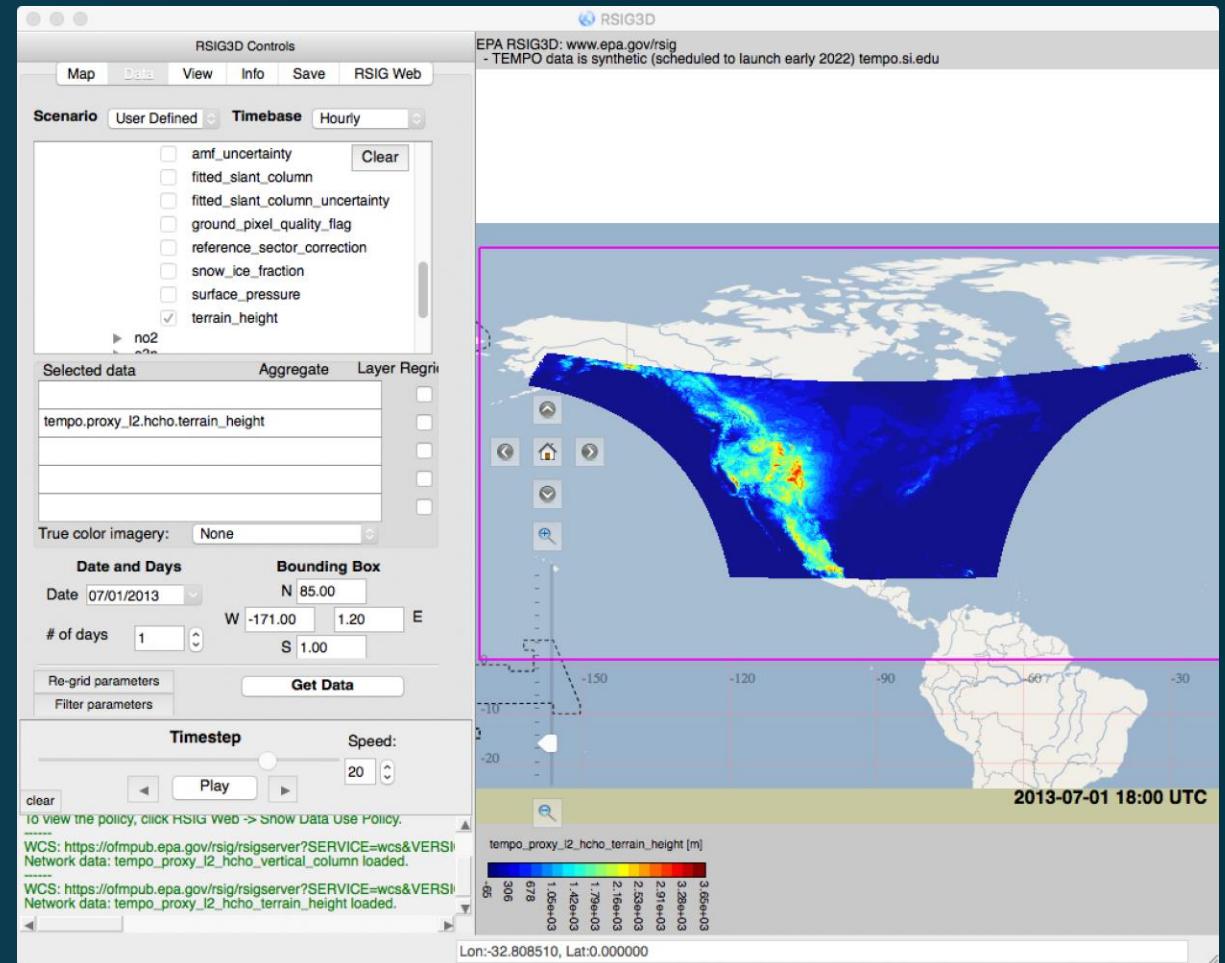
- Geospatial Services
- Maps
- StoryMaps
- Applications



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

EPA Remote Sensing Information Gateway (RSIG)

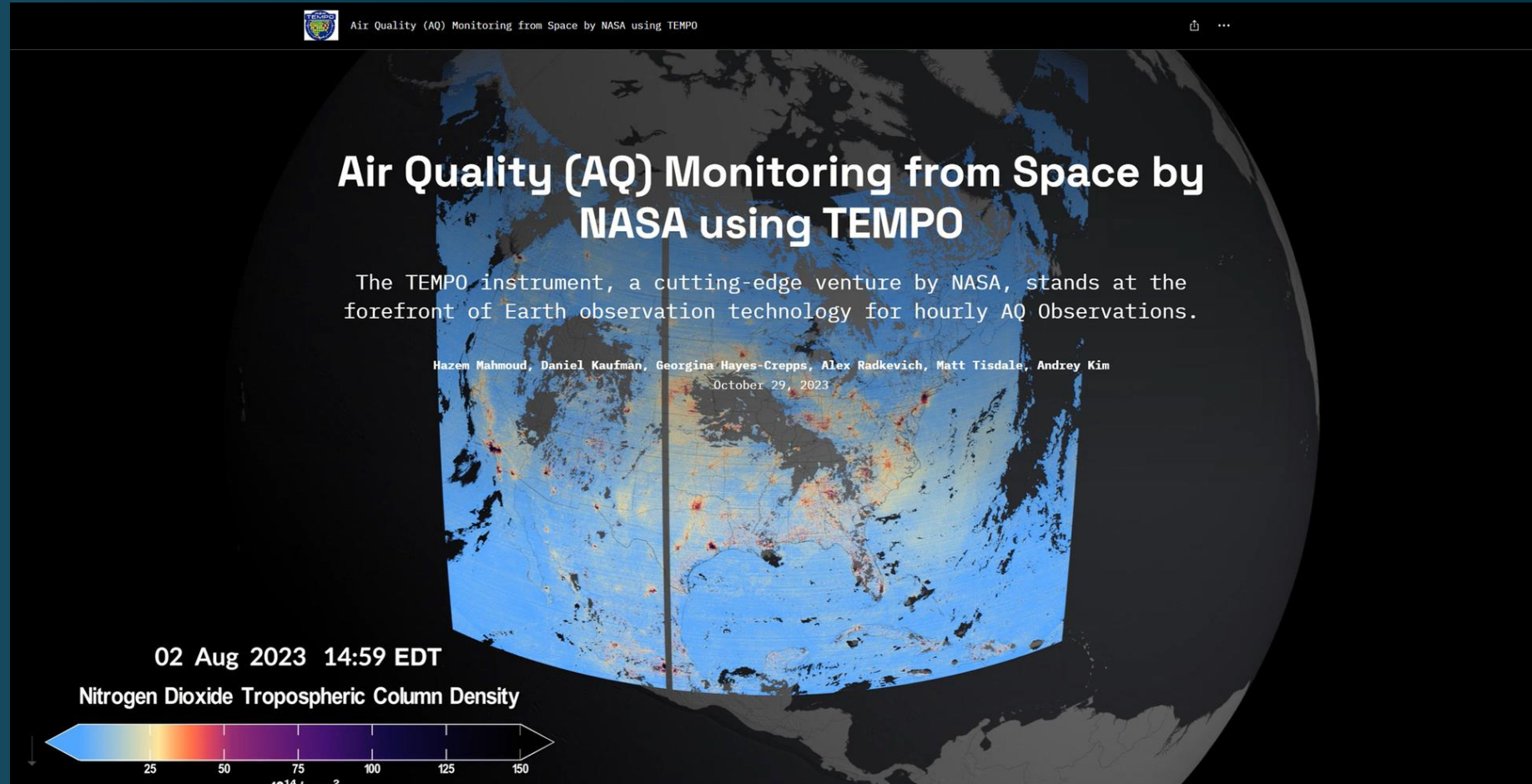
- Visualization (2D/3D) & Animations
- Subsetting to CMAQ Modeling Grids
- File Conversions
- API Access



The background of the slide is a cosmic scene. The top half features a dark blue and black space filled with numerous small, bright stars and a prominent, glowing blue nebula on the right side. The bottom half is dominated by a bright orange and yellow nebula on the left, which transitions into a greenish-blue nebula on the right. The text 'User Support' is centered in a white, sans-serif font across a dark blue horizontal band that spans the width of the slide.

User Support

TEMPO Storymap



Earthdata Forum

- View Existing Questions/Answers
- Ask New Questions to Subject Matter Experts
- Science and Technical Support

The screenshot displays the Earthdata Forum website. At the top, there is a navigation bar with the Earthdata logo and a search bar. Below the navigation bar, there is a header section with the text "Welcome to the Earthdata Forum! Here, the scientific user community and subject matter experts from NASA Distributed Active Archive Centers (DAACs), and other contributors, discuss research needs, data, and data applications." The main content area is divided into two columns. The left column contains a "FILTER RESULTS" section with various filter options: "FILTER BY BEST ANSWER", "With a Best Answer" (checked), "Without a Best Answer", "FILTER BY TEXT", "SELECTED TAG MATCH" (ANY, HYBRID, ALL), "FILTER BY DISCIPLINE", "FILTER BY DAAC", "FILTER BY PROJECTS", "FILTER BY SERVICES/USAGE", "FILTER BY DATES", and "FILTER BY AUTHOR". The right column contains an "ANNOUNCEMENTS" section with several items: "FLASHFlux Data", "UPDATE: Terra data and imagery outage starting October 10th 2022", "GCMD Keywords Version 14.5 Released", "Disaster Assessment Using Synthetic Aperture Radar: Open, Online NASA ARSET Training Invitation", and "Best Practices For Using Machine Learning Keywords in Collection and Service Records in the CMR". Below the announcements is a "QUESTIONS AND COMMENTS" table with columns for "QUESTIONS AND COMMENTS", "REPLIES", and "LAST POST". The table lists several questions, including "Can I get weather details?", "SAGE III on ISS Version 5.21 Release", "Solar radiation", "CALIPSO Data Download Doesn't work", "Climate scenarios 2.6, 4.5 and 8.5 downscaled data download", "ACCESS TO DATA CONTENT", "Release Announcement of New CALIPSO V2.00 Lidar Level 2 Polar Stratospheric Cloud Data Product", and "Data discrepancy between CERES and ERA5".

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



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Science Directorate

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01/27/2025

AQI by EPA

AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Pollutant	Averaging Time	2005 AQGs	2021 AQGs
PM _{2.5} , µg/m ³	Annual	10	5
	24-hour ^a	25	15
PM ₁₀ , µg/m ³	Annual	20	15
	24-hour ^a	50	45
O ₃ , µg/m ³	Peak season ^b	-	60
	8-hour ^a	100	100
NO ₂ , µg/m ³	Annual	40	10
	24-hour ^a	-	25
SO ₂ , µg/m ³	24-hour ^a	20	40
CO, mg/m ³	24-hour ^a	-	4

AIR POLLUTION - THE SILENT KILLER



REGIONAL ESTIMATES ACCORDING TO WHO REGIONAL GROUPINGS:



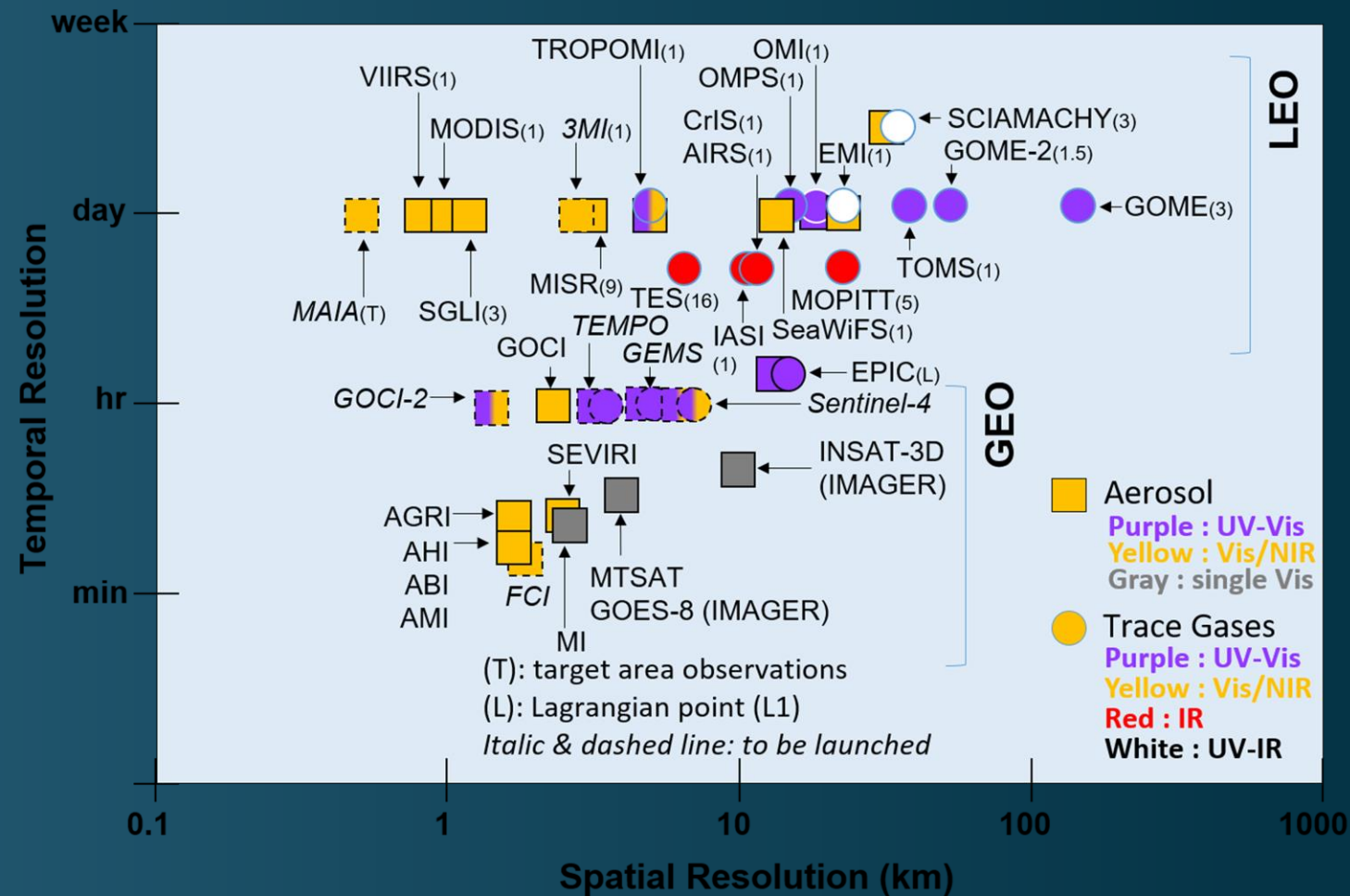
WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.

CLEAN AIR FOR HEALTH

#AirPollution



AQ from Space



Kim et al. (BAMS 2020)

ASDC Data and User Services

📁 TEMPO	Add files via upload	4 months ago
📁 TOLNet	Add files via upload	last week
📁 images	Add files via upload	2 years ago
📄 README.md	Update README.md	2 weeks ago
📄 ncompare-example-usage.ipynb	add URLs for two example MOPITT data files	10 months ago

📖 README

ASDC_Data_Tutorials_and_User_Services

This GitHub page serves as a comprehensive resource for end users seeking tutorials on various missions conducted by the Atmospheric Science Data Center (ASDC). The page's primary objective is to provide step-by-step guidance and instructions on utilizing the NASA missions archived and distributed by ASDC DAAC. By offering these tutorials, the page aims to enhance the knowledge and proficiency of end users, enabling them to leverage the valuable resources made available by ASDC effectively. This GitHub page facilitates the seamless transfer of expertise from ASDC to end users, fostering a collaborative environment that drives innovation and progress in space-related endeavors.

https://github.com/nasa/ASDC_Data_and_User_Services/tree/main/TEMPO

Earthdata Website

- Data Tools
- Data Recipes
- Data Pathfinders
- Webinars and Tutorials

The screenshot shows the NASA Earthdata website homepage. At the top, there is a navigation bar with the NASA logo, the text "EARTHDATA OPEN ACCESS FOR OPEN SCIENCE", and links for "Data", "Topics", "Learn", "Engage", and "About". Below the navigation bar is a circular arrangement of ten colorful icons representing various Earth science disciplines. The main heading reads "Your Gateway to NASA Earth Observation Data". Below this, a paragraph states: "The Earth Science Data Systems (ESDS) Program provides full and open access to NASA's collection of Earth science data for understanding and protecting our home planet. Begin your Earthdata exploration by clicking on any of the discipline icons above." Three green buttons labeled "Get Started", "Find Data", and "Use Data" are positioned below the text. The lower section of the page features a "Data Pathfinders" section with a "View All >" link and a "Resource Spotlight" section. The "Resource Spotlight" section includes three highlighted areas: "Agriculture" (with the text "NASA data provide vital"), "Open Science" (with the text "Open Science empowers an"), and "Environmental Justice" (with the text "Combine Earth science with").

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

Giovanni

- Time Series
- Time Averaged Maps
- Comparisons
- Vertical Cross Sections

The screenshot shows the Giovanni Data Selection interface. The top navigation bar includes the NASA logo, the text "EARTHDATA Find a DAAC", and the Giovanni logo with the tagline "The Bridge Between Data and Science v 4.38". There are links for "Feedback", "Help", and "Log out (mstisdal)".

The main interface is divided into several sections:

- Select Plot:** A dropdown menu set to "Time Averaged Map".
- Select Date Range (UTC):** A date range selector showing "YYYY - MM - dd 00 : 00 to YYYY - MM - dd 23 : 59". The valid range is "2000-04-01 to 2022-05-01". A red message says "Please specify a start date."
- Select Region (Bounding Box or Shape):** A text input field containing "-180, -90, 180, 90".
- Select Variables:** A sidebar with expandable sections: "Observations (9)", "Disciplines" (with "Atmospheric Chemistry (9)" selected), "Measurements", and "Platform / Instrument" (with "MOPITT (9)" selected). Other options include "Spatial Resolutions", "Temporal Resolutions", and "Portal".
- Search Results:** A table showing 9 of 1967 matching variables. The table has columns for Variable, Units, Source, Temp Res, Spat Res, Begin Date, End Date, and Vert. Slice. The selected variable is "Multispectral CO Mixing Ratio Profile (Daytime/Descending) (MOP03JM v008)".

Variable	Units	Source	Temp Res	Spat Res	Begin Date	End Date	Vert. Slice
<input type="checkbox"/> Thermal-Only CO Mixing Ratio Profile (Daytime/Descending) (MOP03TM v008)	ppbv	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	900 hPa
<input type="checkbox"/> Thermal-Only CO Mixing Ratio Profile (Nighttime/Ascending) (MOP03TM v008)	ppbv	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	900 hPa
<input type="checkbox"/> Thermal-Only CO Surface Mixing Ratio (Daytime/Descending) (MOP03TM v008)	ppbv	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-
<input type="checkbox"/> Thermal-Only CO Surface Mixing Ratio (Nighttime/Ascending) (MOP03TM v008)	ppbv	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-
<input type="checkbox"/> Thermal-Only CO Total Column (Daytime/Descending) (MOP03TM v008)	mol/cm ²	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-
<input type="checkbox"/> Thermal-Only CO Total Column (Nighttime/Ascending) (MOP03TM v008)	mol/cm ²	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-
<input checked="" type="checkbox"/> Multispectral CO Mixing Ratio Profile (Daytime/Descending) (MOP03JM v008)	ppbv	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	900 hPa
<input type="checkbox"/> Multispectral CO Surface Mixing Ratio (Daytime/Descending) (MOP03JM v008)	ppbv	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-
<input type="checkbox"/> Multispectral CO Total Column (Daytime/Descending) (MOP03JM v008)	mol/cm ²	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-

At the bottom of the interface, there is a footer with the NASA logo, "Responsible NASA Official: Angela Li", "Web Curator: M. Hsieh", "Privacy", "Powered By", and "Contact Us". There are also "Reset" and "Plot Data" buttons.

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



Figure Q1-2 Ozone in the atmosphere. Ozone is present throughout the troposphere and stratosphere. This profile shows schematically how ozone changes with altitude in the tropics. Most ozone resides in the stratospheric "ozone layer." The vertical extent or thickness of this layer varies from region to region and with season over the globe (see Q4). Increases in ozone occur near the surface as a result of pollution from human activities.

Ozone in the Atmosphere

