

National Aeronautics and  
Space Administration



# EXPLORE EARTH

**Science Directorate**

**Atmospheric Science Data Center (ASDC)**

**Hazem Mahmoud, Ph.D.**

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ASDC Science Lead

4/24/2024

A vibrant space-themed background featuring a large blue circle on the right side. The background is filled with a colorful nebula in shades of blue and green, a bright yellow sun, and several planets including Saturn, Mars, and the Moon. The Earth is visible at the bottom left, showing its blue oceans and white clouds.

# EXPLORE EARTH

## Agenda

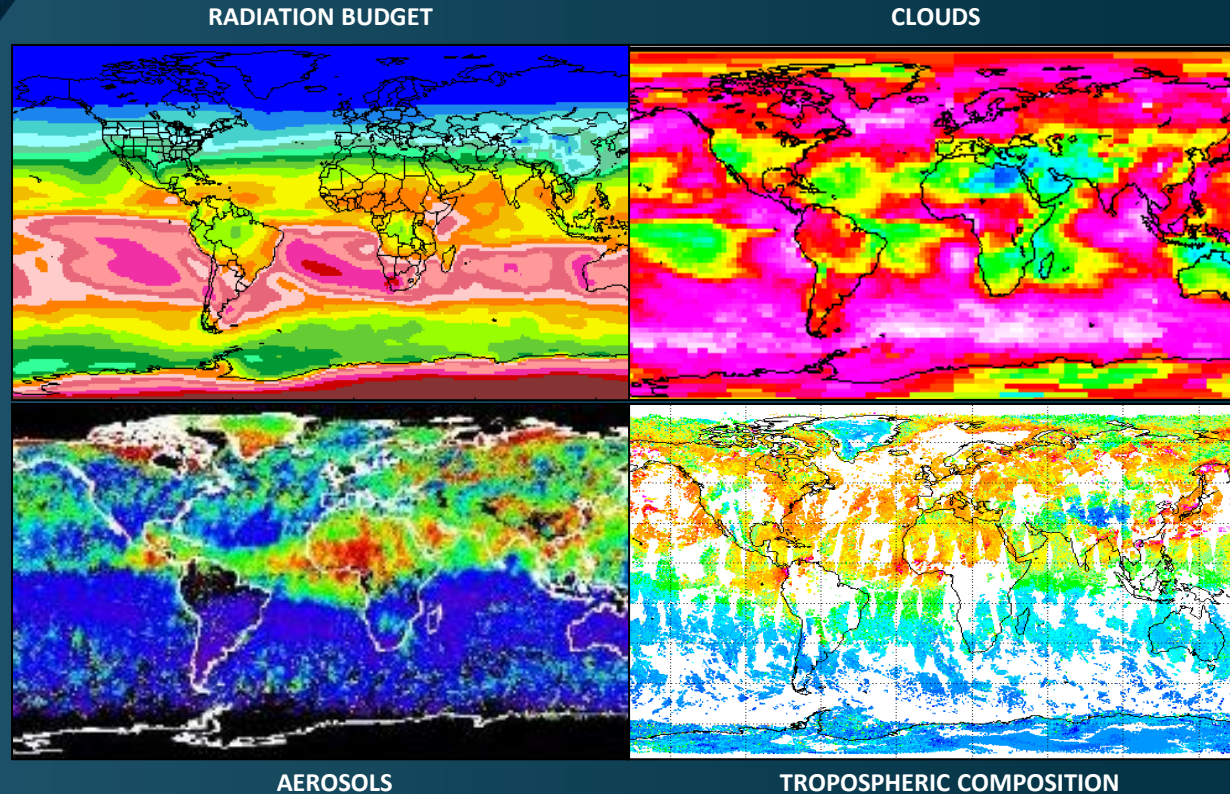
**ASDC Overview**

**Health and Air Quality Tools and Services**

**User Support and Outreach**



# ASDC at a Glance



- ✓ 44+ Science projects
  - MISR ◦ MOPITT ◦ MAIA ◦ TEMPO ◦ CERES
  - TEMPO & CALIPSO → RSIG (EPA)
  - Airborne field campaigns (KORUS AQ, DISCOVER AQ, FIREX AQ)
- ✓ 1100+ unique science products
- ✓ Data usage (2022)
  - 3.5 Petabytes ◦ 160,000 users
  - 158 countries
- ✓ Data archive (2022)
  - 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

A vibrant space-themed background featuring a large blue and green nebula, a bright yellow sun, and several celestial bodies including Saturn, Mars, and the Moon. The scene is framed by a large, stylized blue and yellow circular graphic on the left side.

# ASDC Suborbital Updates

STAQS (TEMPO validation)

SCOAPE-II (second deployment to SCOAPE)

PACE-PAX (PACE validation)

ASIA-AQ

AERONET

Pandora



The background of the slide is a cosmic scene featuring a blue nebula in the upper right and an orange nebula in the lower left, with numerous stars scattered throughout. A dark blue horizontal band is positioned across the middle of the image, containing the title text.

# Health and Air Quality Tools and Services

# Earthdata Search

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

Historical Urban Population: 3700 BC - AD 2000

1 Granule 1700-01-01 to 2000-12-31

The Historical Urban Population, 3700 BC - AD 2000, originally developed by the Yale School of Forestry & Environmental Studies, is the first spatially explicit...

GEOS5 • CIESIN\_SEDAC\_USPAT\_HUP v1.00 - SEDAC



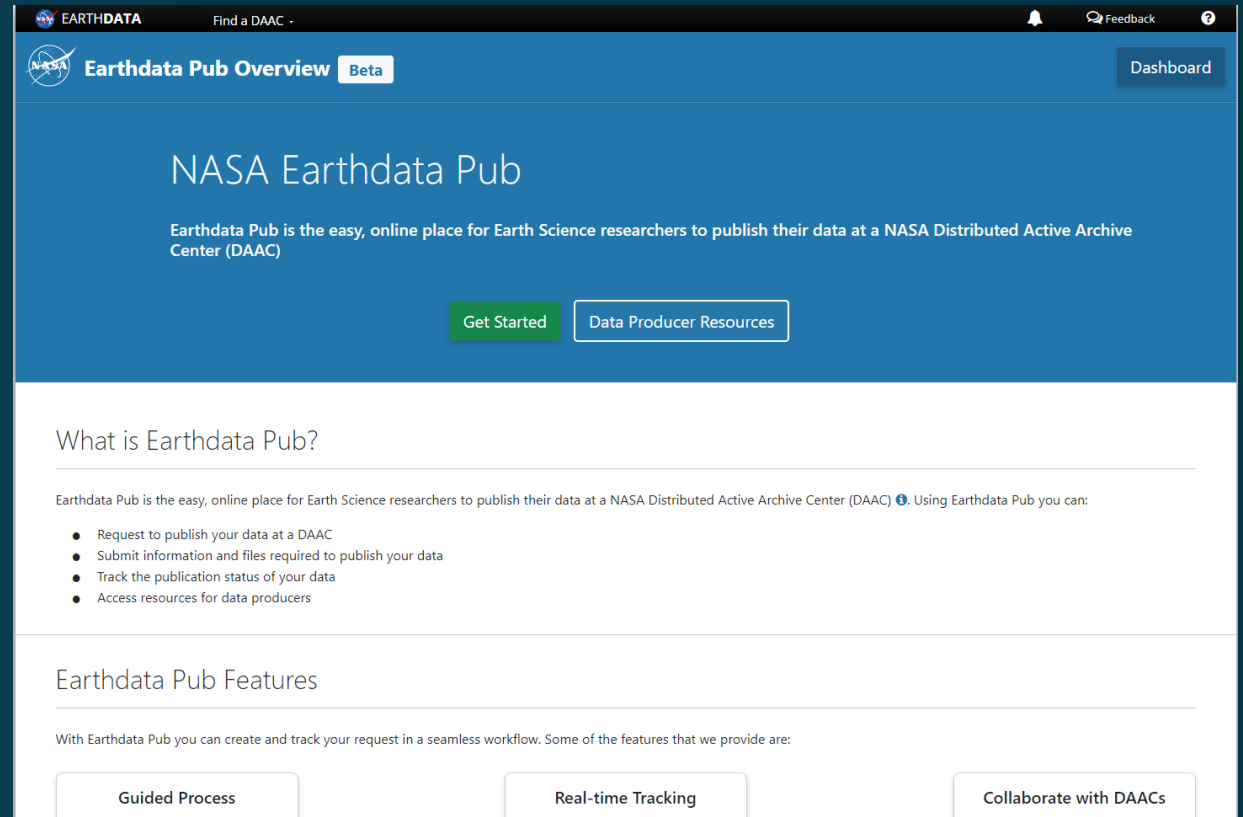
The screenshot displays the Earthdata Search interface. On the left, there is a sidebar with filters for Temporal, Day/Night, and Data Access. The main content area shows search results for 'TEMPO NO2 tropospheric column PROXY', listing granules with their IDs, start/end dates, and download links. On the right, a world map is shown with a blue circle highlighting a region in the North Atlantic, and a tooltip indicating a specific time: '2014-04-30 22:17:56'.

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



# Earthdata Pub

- Request to publish your data at a DAAC
- Submit information and files required to publish your data
- Track the publication status of your data
- Access resources for data producers



EARTHDATA Find a DAAC - Feedback

NASA Earthdata Pub Overview Beta Dashboard

## NASA Earthdata Pub

Earthdata Pub is the easy, online place for Earth Science researchers to publish their data at a NASA Distributed Active Archive Center (DAAC)

[Get Started](#) [Data Producer Resources](#)

### What is Earthdata Pub?

Earthdata Pub is the easy, online place for Earth Science researchers to publish their data at a NASA Distributed Active Archive Center (DAAC). Using Earthdata Pub you can:

- Request to publish your data at a DAAC
- Submit information and files required to publish your data
- Track the publication status of your data
- Access resources for data producers

### Earthdata Pub Features

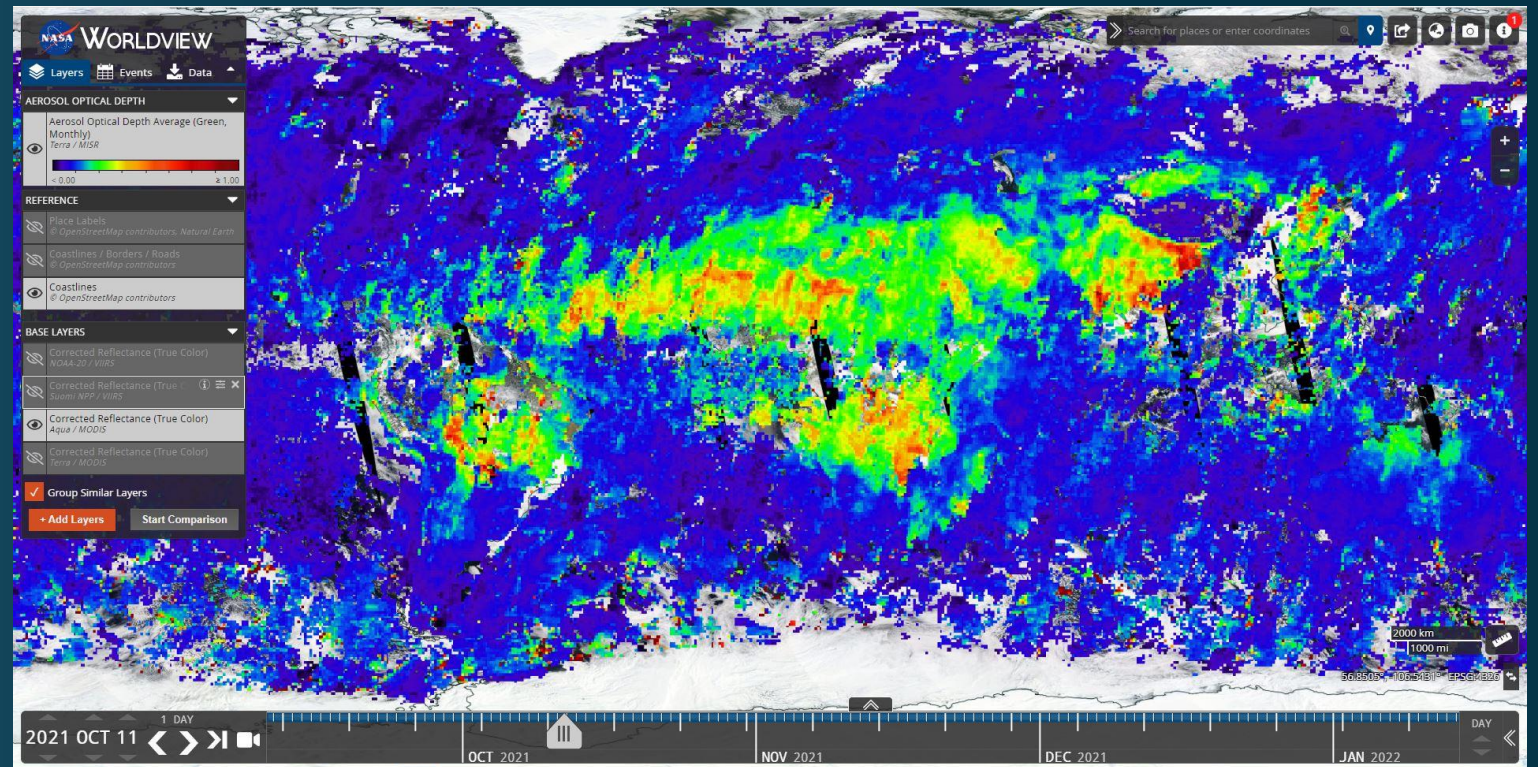
With Earthdata Pub you can create and track your request in a seamless workflow. Some of the features that we provide are:

[Guided Process](#) [Real-time Tracking](#) [Collaborate with DAACs](#)

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

# Worldview / Global Imagery Browse Service (GIBS)

- Browse Imagery
- Animations
- Event Information
- GIBS API



<https://worldview.nasa.gov>



# OPeNDAP

- API Access
- Subsetting & Aggregation
- File Conversions

The screenshot shows the OPeNDAP Data Access Form for the dataset CERES\_EBAF\_Edition4.1\_200003-202111.nc. The interface includes a header with the OPeNDAP logo and a welcome message. Below the dataset name, there are several action buttons: 'Get as ASCII', 'Get as Coverage/JSON', 'Get as NetCDF 3', 'Get as NetCDF 4', 'Binary (DAP) Object', and 'Show Help'. A 'Data URL' field contains the URL: https://opendap.larc.nasa.gov/opendap/CERES/EBAF/Edition4.1/CERES\_EBAF\_Edition4.1\_200003-202111.nc. Under 'Global Attributes', the 'NC\_GLOBAL' section is expanded. The 'Variables' section lists several variables with their respective ranges and units, each with a checkbox and an 'attributes' link. The variables listed are: lon (lon= 0 ..359), lat (lat= 0 ..179), ctime (ctime= 0 ..11), climatology\_bounds (ctime= 0 ..11 [ sec= 0 ..1]), time (time= 0 ..260), toa\_sw\_all\_mon (time= 0 ..260 [ lat= 0 ..179] [ lon= 0 ..359]), toa\_lw\_all\_mon (time= 0 ..260 [ lat= 0 ..179] [ lon= 0 ..359]), toa\_net\_all\_mon (time= 0 ..260 [ lat= 0 ..179] [ lon= 0 ..359]), toa\_sw\_clr\_c\_mon (time= 0 ..260 [ lat= 0 ..179] [ lon= 0 ..359]), toa\_lw\_clr\_c\_mon (time= 0 ..260 [ lat= 0 ..179] [ lon= 0 ..359]), and toa\_net\_clr\_c\_mon (time= 0 ..260 [ lat= 0 ..179] [ lon= 0 ..359]).

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

# ArcGIS Enterprise in the Earthdata Cloud

- Geospatial Services
- Maps
- StoryMaps
- Applications

Studying the 2019-2020 Australian Bushfires Using NASA Data

Introduction 1) Conditions for Fire Activit... 2) An Unprecedented Fire Seaso... 3) Atmospheric Composition 4) Particulate Matter & Pu... Exploring NASA's Data

### MISR Plume Height

The geographic region where the plume height data is aggregated.

We can tell the height of a cloud or smoke plume above Earth's surface by viewing it from space at different angles. A plume located high above the surface will appear to move considerably relative to the underlying surface when viewed at different angles, whereas a plume closer to the surface will appear to shift less.

The Multi-angle Imaging SpectroRadiometer (MISR) instrument aboard the NASA Terra satellite

Exaggerated (20x) Plume Height on 12/16/19 Active Aerosol Plume (AAP) project, V. Flower, R. Kahn, K. Junghenn-Noyes

Waiting for services7.arcgis.com... | Jarmin, FAO, NOAA, USGS | Source: USGS, NGA, NASA, OGIAR, GEBCO, N. Robinson, NCEAS, NLS, OS, NMA, Geodatasy/reisen and the GIS User Community | Active Aerosol Plume (AAP) Project, V. Flower, R. Kahn, ... Powered by Esri

<https://gis.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 GIOVANNI logo, the tagline "The Bridge Between Data and Science v 4.38", and 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):** Fields for start and end dates and times, with a "Valid Range: 2000-04-01 to 2022-05-01" and a note "Please specify a start date."
- Select Region (Bounding Box or Shape):** A text input field containing "-180, -90, 180, 90".
- Select Variables:** A sidebar menu with categories: Observations (9), Disciplines (Atmospheric Chemistry (9)), Measurements, and Platform / Instrument (AIRS (68), GEOS-CHEM (2), MERRA-2 Model (138), MODIS-Aqua (3), MODIS-Terra (2), MOPITT (9), OMI (7), TOMS EP (1), TOMS Meteor-3 (1), TOMS Nimbus-7 (1)).
- Search and Results:** A search bar with "Keyword:" and "Search Clear" buttons. Below it, a table lists variables with columns for Variable, Units, Source, Temp. Res., Spat. Res., Begin Date, End Date, and Vert. Slice.

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	500 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	500 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/cm²	MOPITT	Monthly	1.0 °	2000-04-01	2022-05-01	-
<input type="checkbox"/> Thermal-Only CO Total Column (Nighttime/Ascending) (MOP03TM.v008)	mol/cm²	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	500 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/cm²	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. Hogue", "Privacy", "Powered By", and "Contact Us" links. On the right side of the footer, there are "Reset" and "Plot Data" buttons.

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

# Sub-Orbital Order Tool (SOOT)

- Search and Access Sub-Orbital Data
- Merge to Common Time Scale

## Sub-Orbital Order Tool (SOOT) Power User Interface

Welcome to the [Sub-Orbital Order Tool \(SOOT\)](#) which is designed to promote suborbital research and analysis. Here you can discover and access the airborne and field campaign data archived at the Atmospheric Science Data Center (ASDC). The SOOT Power User Interface is intended for experienced airborne data users and airborne science teams.

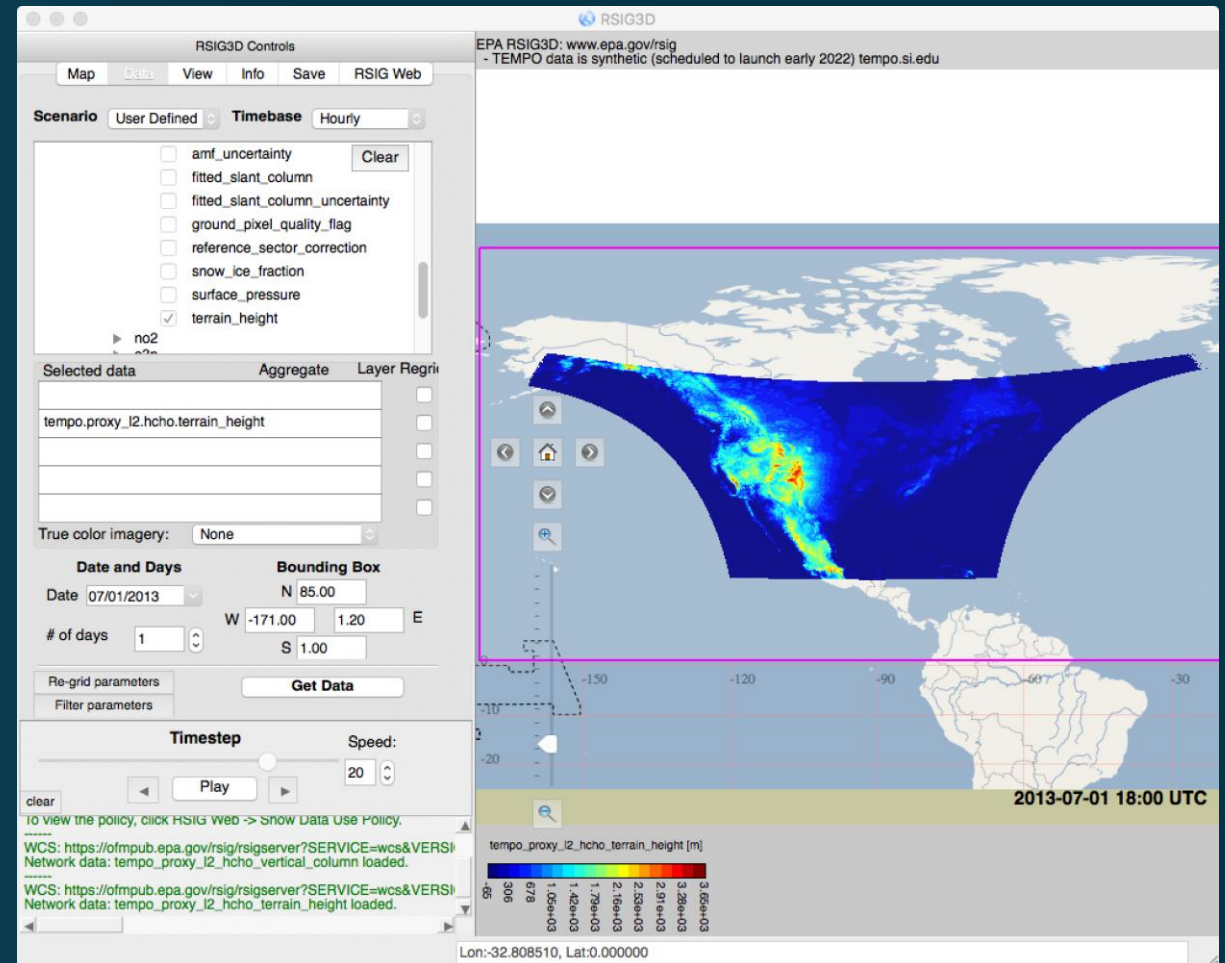
Select a campaign and deployment: 

 <b>ACEPOL</b> Support Documentation 2017	 <b>ACTIVATE</b> Support Documentation 2020 2021 2022	 <b>Aeolus Cal/Val</b> Support Documentation 2019
 <b>AJAX</b> Support Documentation 2011 2012 2013 2014 2015 2016 2017 2018	 <b>ARISE</b> Support Documentation 2014	 <b>CAMP2EX</b> 2018 2019
 <b>DCOTSS</b> 2021	 <b>FIREX-AQ</b> 2019	 <b>LISTOS</b> Support Documentation 2017 2018 2019
 <b>LMOS 2017</b> Support Documentation 2017	 <b>NAAMES</b> Support Documentation 2015 2016 2017 2018	 <b>ORACLES</b> 2016 2017 2018



# EPA Remote Sensing Information Gateway (RSIG)

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



# Earthdata Website

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

The screenshot shows the Earthdata website homepage. At the top, there is a navigation bar with the NASA EarthData logo and the tagline "OPEN ACCESS FOR OPEN SCIENCE". The main navigation menu includes "Data", "Topics", "Learn", "Engage", and "About". Below the navigation bar is a large banner featuring a curved row of colorful circular icons representing various Earth science disciplines. The central text reads "Your Gateway to NASA Earth Observation Data" and "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." Below this text are three buttons: "Get Started", "Find Data", and "Use Data".

Below the banner is a section titled "Data Pathfinders" with a sub-header "Agriculture & Water". The text describes how Data Pathfinders help users navigate data products and learning how to use them. A "View All >" link is provided. To the right of the text is a large image of a field with a white line graph overlaid, flanked by left and right navigation arrows.

At the bottom of the page is a "Resource Spotlight" section. It features three colored boxes with icons and text: a green box for "Agriculture" (NASA data provide vital), an orange box for "Open Science" (Open Science empowers an), and a teal box for "Environmental Justice" (Combine Earth science with).

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



The background of the slide is a cosmic scene featuring a dark blue and green nebula in the upper right and a bright orange and yellow nebula in the lower left. Numerous stars of various colors are scattered throughout the field of view.

# User Support and Outreach

# 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 such as "FILTER BY BEST ANSWER", "WITH A BEST ANSWER", "WITHOUT A BEST ANSWER", "FILTER BY TEXT", "SELECTED TAG MATCH", "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, including "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 table of "QUESTIONS AND COMMENTS" with columns for "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 6.5 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>





# Example question

Hello – I'm a lung doctor and researcher. I was trying to find out if TEMPO collects particulate matter air pollution (PM2.5) data but couldn't find this on your website. Are you able to answer the question and point me to the right data source. I know the data are new and in beta testing. Many thanks!

Best  
Laura

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Laura C. Myers, MD MPH CPPS

Research Scientist I, Division of Research, Kaiser Permanente Northern California  
Pulmonary Intensivist, Diablo Service Area

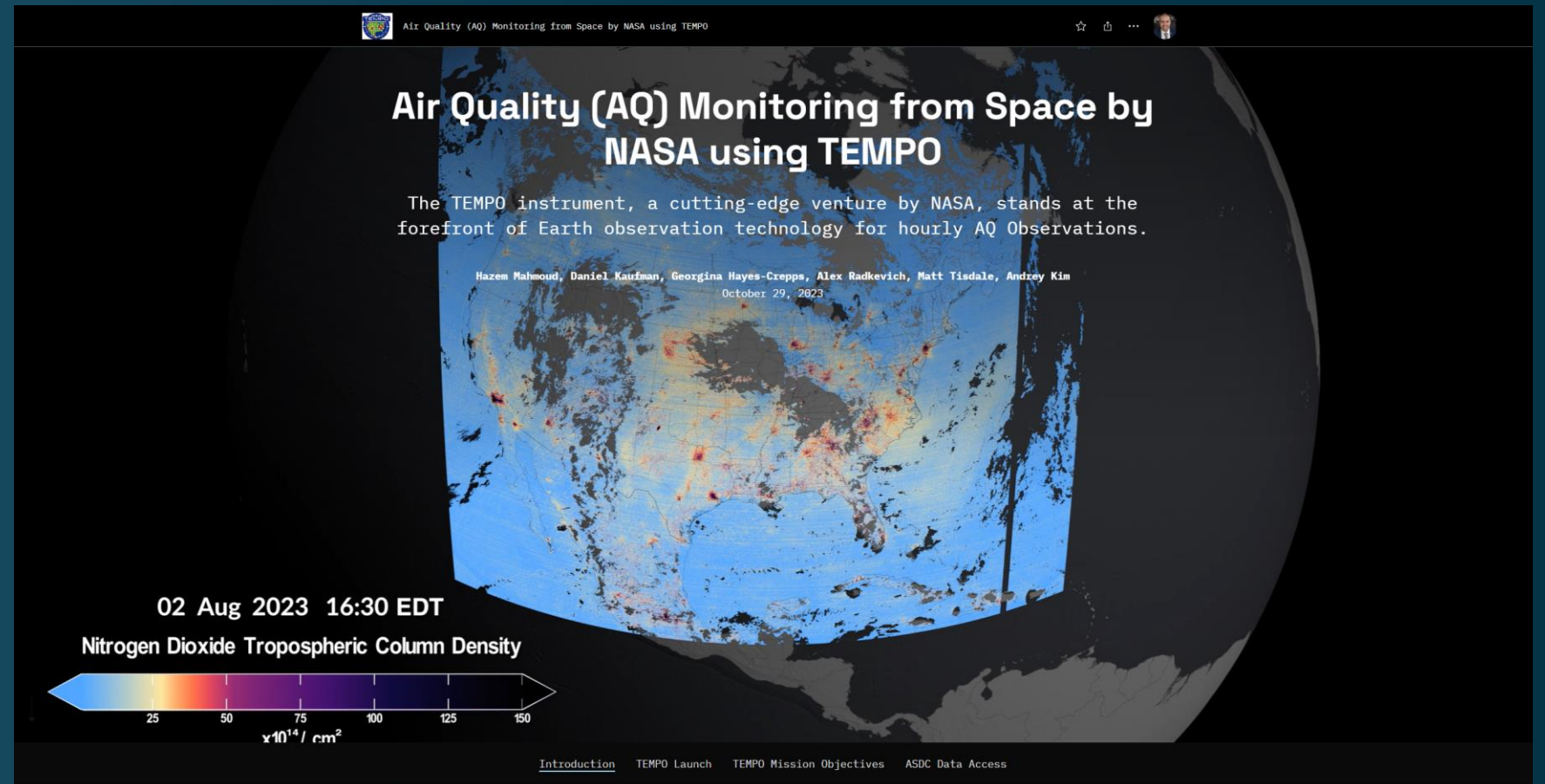
A vibrant space-themed background featuring a large blue nebula, a bright yellow sun, and several celestial bodies including Saturn, Mars, and the Moon. The scene is set against a dark starry sky. A large, semi-transparent blue circle is overlaid on the right side of the image, containing the text.

# Outreach

- Local in-person Bootcamp with coordination with VA Space Grant.
- Participation and attendance at various science team meetings.
- Openscapes workshops, Tutorials and Cookbooks.
- Airborne and Field Data Workshop.
- HAQAST
- AGU
- EGU
- AMS
- ESIP



# TEMPO Storymap



# TEMPO Storymap metrics

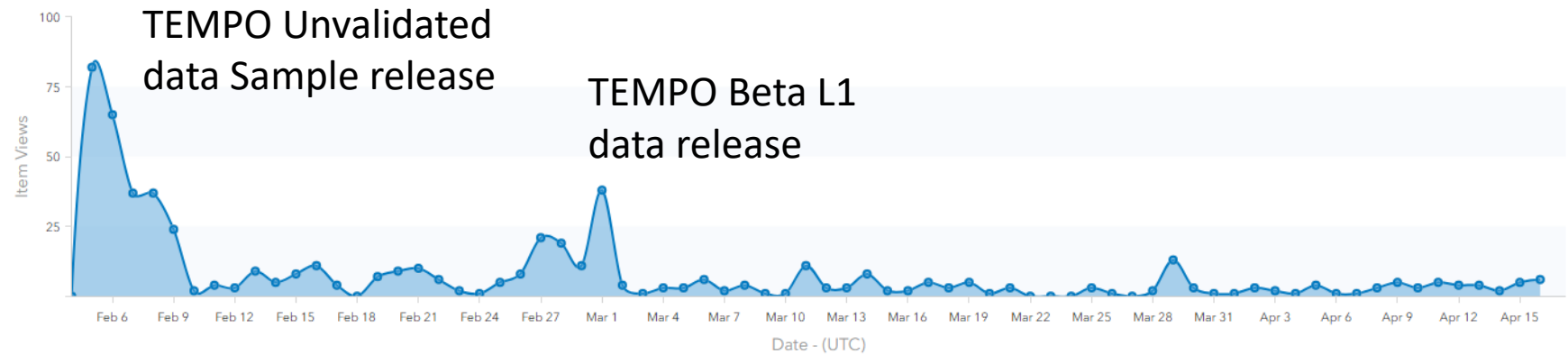
Item Views this Period

572

Avg Item Views Per Day

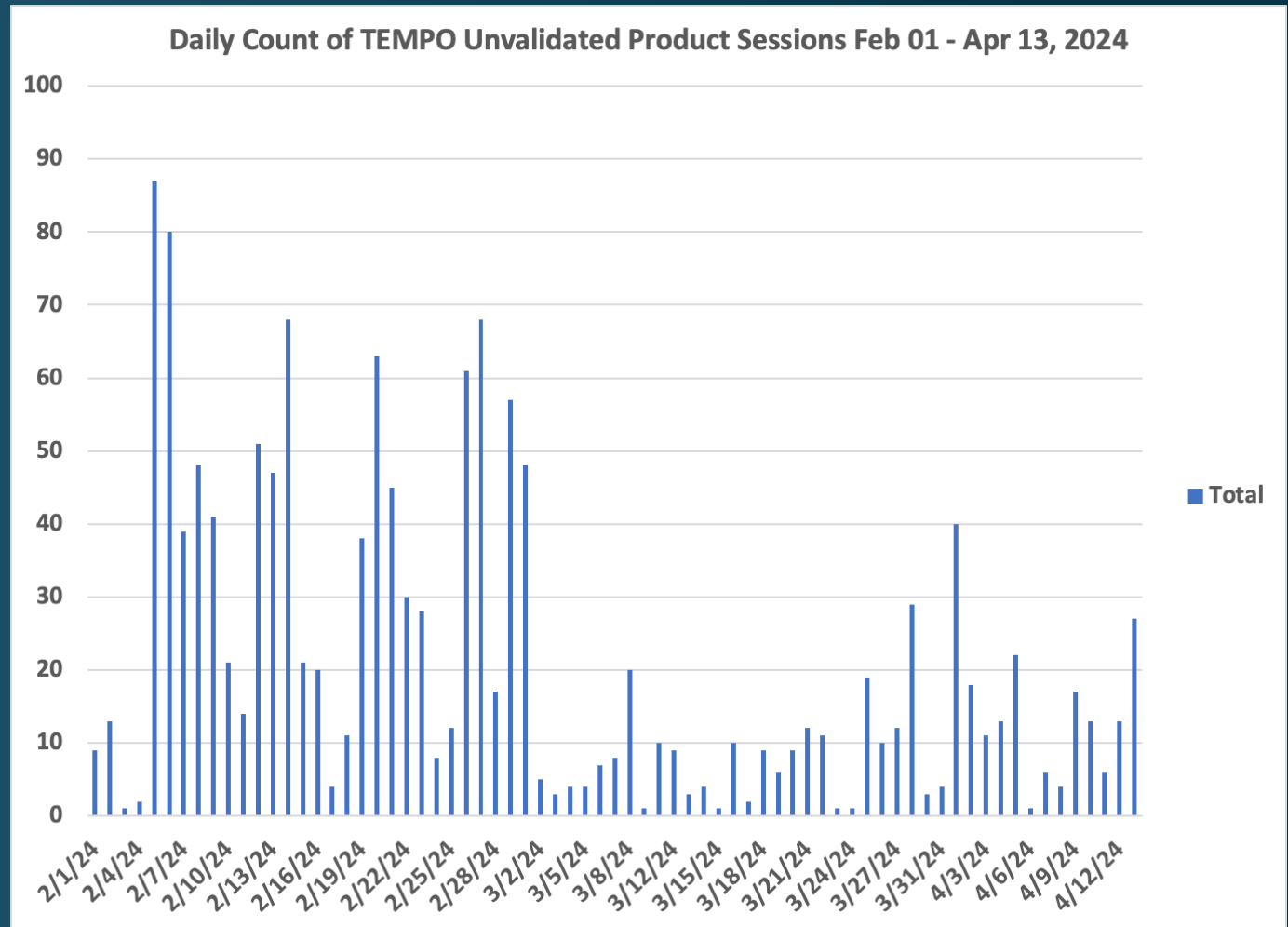
7.84

Usage Time Series

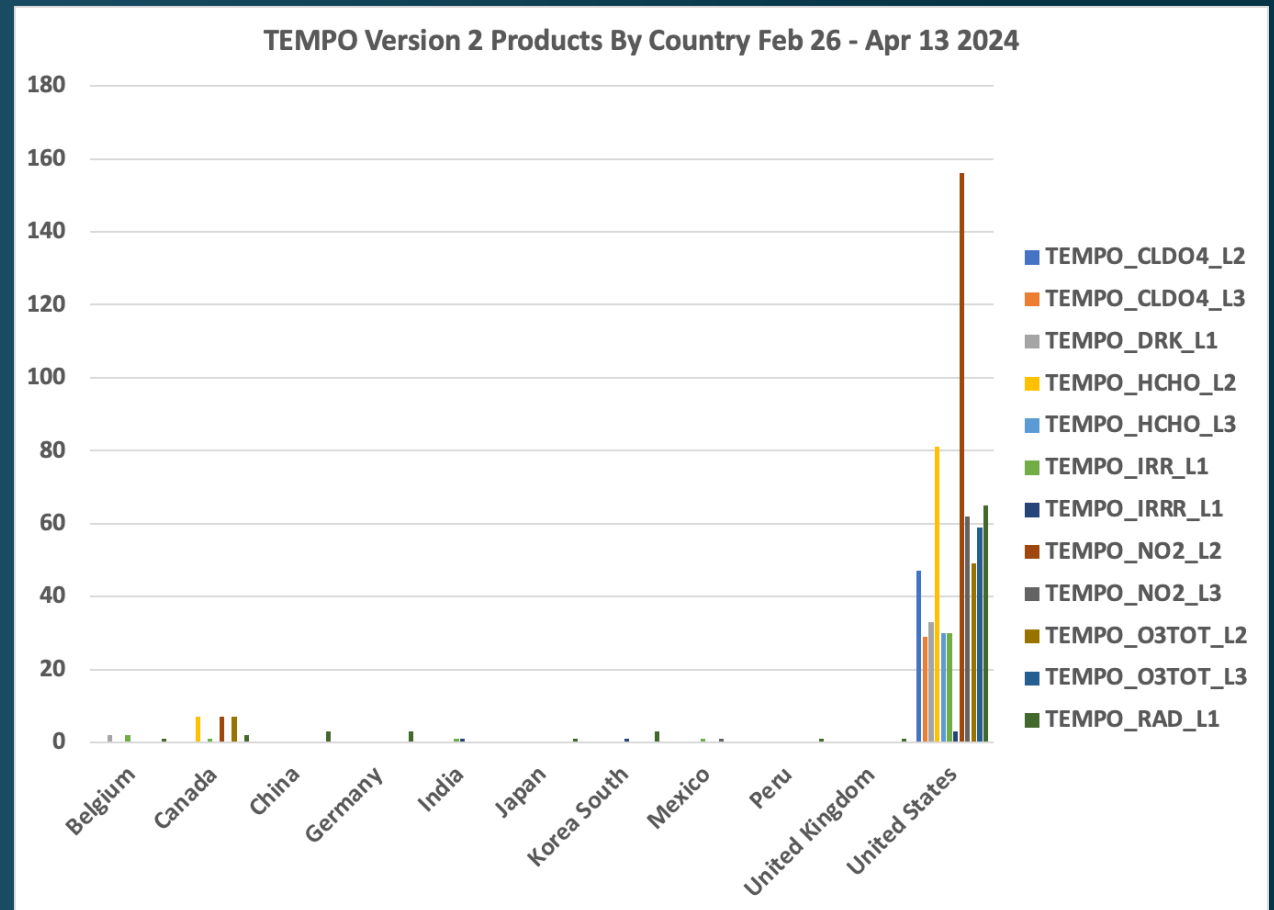




# Unvalidated TEMPO data



# TEMPO Products per Country







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4/24/2024

A vibrant space-themed background featuring a large Earth in the lower right, a bright sun in the lower left, and various celestial bodies including Saturn, Mars, and the Moon. The scene is set against a backdrop of colorful nebulae and stars.

# New Suborbital DAAC Assignments

STAQS (TEMPO validation)

SCOAPE-II (second deployment to SCOAPE)

PACE-PAX

ASIA-AQ

AERONET

Pandora



A vibrant space-themed background featuring a large blue and white nebula, a bright yellow sun, and several planets including Saturn, Mars, and the Moon. The scene is set against a dark blue starry sky. A large, semi-transparent blue circle is overlaid on the right side of the image, containing the title and list of data releases.

# Recent Public Data Releases

SOLVE (legacy mission, 1999-2003)

SONEX (legacy mission, 1997)

POLARIS (legacy mission, 1997)

TOTE-VOTE (legacy mission, 1995-1996)

TRACE-A (part of GTE/TRACE, 1992) – released in the Earthdata Cloud

ACCLIP (2022)

More legacy missions are scheduled to be archived!

A vibrant space-themed background featuring a large blue circle on the right side. The background is filled with various celestial bodies: a bright yellow sun in the lower left, a large blue planet with white clouds in the center, a smaller brown planet with a ring system in the upper left, and a large blue planet with white clouds in the center. The sky is a mix of blue, green, and yellow, with numerous stars and nebulae scattered throughout.

# Suborbital Preservation

Completed suborbital preservation activities for NAAMES

Contributed to discussions at ESDSWG suborbital preservation breakout sessions (will continue to participate in any ongoing conversations/work surrounding this topic)



# Worldview

ASDC Suborbital team has begun the process of adding suborbital datasets to Worldview (per feedback from our User Working Group)

Goal is to help promote suborbital data findability and accessibility

Currently undergoing testing for QA/QC



A vibrant space-themed background featuring a large blue and white nebula, a bright yellow sun, and several planets including Saturn, Mars, and the Moon. The scene is set against a dark starry sky. The right side of the image is partially obscured by a dark blue circular graphic element.

# Outreach Efforts

3 presentations at the AMS Annual Meeting

Assisted with planning the Second Airborne and Field Data Workshop

Published StoryMaps highlighting AJAX, TOLNet Stratospheric Intrusion Event, and a user guide for AJAX

Participation and attendance at various science team meetings