



# NOAA LOW EARTH ORBIT (LEO) JPSS SATELLITE DATA NODD OFFICE HOURS



April 18, 2024 | 12:00 - 1:15pm EDT | Register [HERE](#)

*Hosted by NOAA National Environmental Satellite, Data, and Information Service (NESDIS), NOAA Open Data Dissemination (NODD), and NODD's cloud partner Google Cloud. Please join to learn more about NOAA's LEO Joint Polar Satellite System (JPSS) data (SNPP, NOAA 20 & 21), connect with NOAA and cloud subject matter experts, and share your use case.*



**Adrienne Simonson**  
NOAA Open Data  
Dissemination (NODD)



**Lihang Zhou**  
NOAA LEO Joint Polar  
Satellite System (JPSS)



**Tyler Russell**  
Google Research



**Mya Sears**  
NC Institute for Climate  
Studies (NCICS)

# GoogleMeet Webinar - Recorded

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- Webinar is recorded. Anyone with video display has to provide consent. Only hosts and presenters are asked to turn their video on.
- If do not wish to be part of the recording, please feel free to drop off.
- Meeting summary and presentation slides will be available on the NODD website
  - [NOAA.GOV/NODD](https://www.noaa.gov/nodd)





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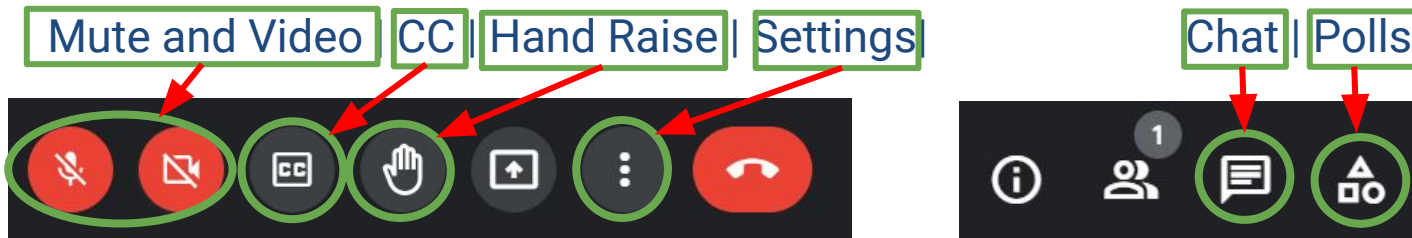


**Mya Sears**  
NC Institute for Climate  
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# GoogleMeet Webinar Logistics

## How to join the discussion!

- Keep yourself muted throughout (for call-in participants: to mute and unmute use \*6) and videos off
- Raise your hand if you have a question and we'll respond in the order of the queue
- The following features of Google Meet:



- This webinar will be recorded.
- You can also join by phone line only if you are having connectivity issues.

# Guidelines for Discussion

- Keep it brief
- Keep it respectful
- Use the chat function for links, references and/or resources
- Submit questions through the chat function or raise your hand
- Identify who the question is directed to where possible



# Quick Google Poll

## POLL1

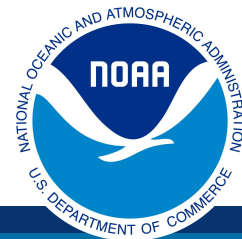
- How do you access JPSS satellite data today?
  - On-prem via NOAA
  - Cloud
  - Both/Either
  - 3rd party/Web-based Viewer
  - None/Other

## POLL2

- My primary goal for attending today is:
  - Technical use and access of JPSS data
  - To learn about cloud access to data (e.g. NODD Program)
  - Meet and engage with NOAA staff scientists
  - Learn about Google Cloud access and tools



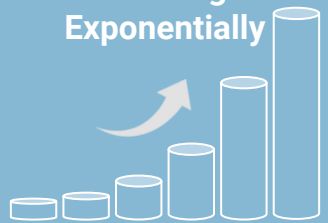
# NODD Disseminates NOAA Line Office Data



## Open and Free, with Value to the Public:

- From NOAA Line Offices via NODD to public cloud buckets of three CSPs =
  - An exponential number of users can access
- Harnesses the scalability of the cloud to improve data access
  - No egress costs for users or the agency
- No use restrictions or user registration
- Appropriate Metadata included

NOAA Data is Growing Exponentially



## TECHNOLOGY MODERNIZATION

Reduces stress on NOAA's on-premise dissemination systems

Improves services for users



## FULL & OPEN PUBLIC ACCESS

Supports Federal Data Strategy & Evidence Act Requirements

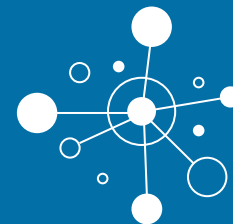
No egress costs



## ENABLES & ENGAGES USERS

Catalyzes innovation in environmental services

Enables interoperability



# Low Earth Orbit (LEO) Satellites

## SNPP, NOAA20, NOAA21: Operational Constellation



Launched into Low Earth Orbit—512 miles

**14x**

Orbits Earth 14 times pole-to-pole with SNPP

**2x**

Images entire globe twice a day



State of the art instrumentation to collect data on Earth's atmosphere, lands, and oceans



Sends more than 2,000 gigabytes of data to Earth every day





# The Joint Polar Satellite System (JPSS) is a Series of Five Satellites



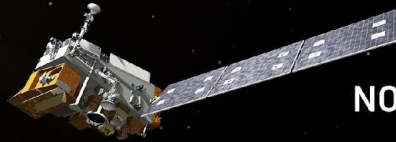
JPSS-4



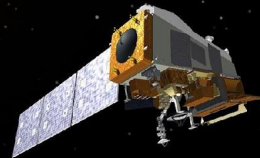
JPSS-3



NOAA-21



NOAA-20



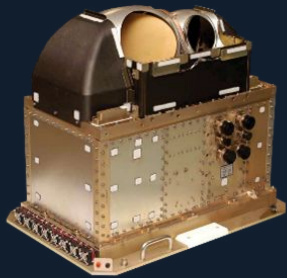
SUOMI-NPP



# JPSS Instruments

## ATMS

Advanced Technology  
Microwave Sounder



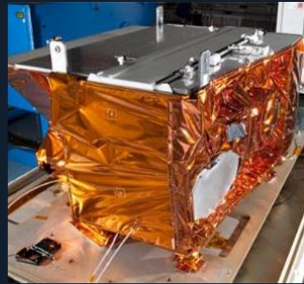
## CrIS

Cross-track  
Infrared Sounder



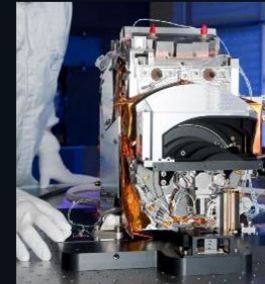
## VIIRS

Visible Infrared Imaging  
Radiometer Suite



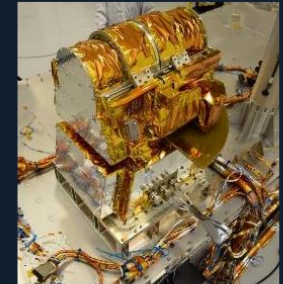
## OMPS

Ozone Mapping and  
Profiler Suite



## CERES

Clouds and the Earth's  
Radiant Energy System



ATMS and CrIS together provide high vertical resolution temperature and water vapor information needed to maintain and improve forecast skill out to 5 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks.

VIIRS provides many critical imagery products including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton and chlorophyll abundance.

Ozone spectrometers for monitoring ozone hole and recovery of stratospheric ozone and for UV index forecasts.

Scanning radiometer which supports studies of the Earth Radiation Budget (ERB).

*\*Discontinued after JPSS-1 (NOAA-20)*

**NORTHROP GRUMMAN**

**HARRIS**

**Raytheon**

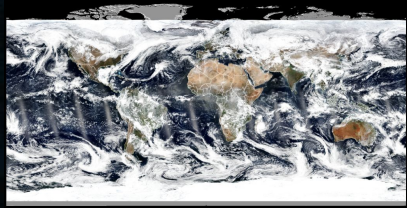


**NORTHROP GRUMMAN**



# LEO Measurements Contribute to All NOAA Mission Service Areas

## Imagery



## Soundings

### WEATHER READY NATION (WRN)

#### National Weather Service

1. Aviation Weather & Volcanic Ash (WRN-AWX)
2. Fire Weather (WRN-FWX)
3. Hydrology & Water Resources (WRN-IWX)
4. Marine Weather & Coastal Events (WRN-MWX)
5. Hurricane/Tropical Storms (WRN-HUR)
6. Routine Weather (WRN-RWX)
7. Severe Weather (WRN-SEV)
8. Space Weather (WRN-SWX)
9. Tsunami (WRN-TSU)
10. Winter Weather (WRN-WWX)

11. Science, Services and Stewardship

### HEALTHY OCEANS (HO)

#### National Marine Fisheries Service

1. Ecosystem Monitoring, Assessment & Forecast (HO-ECO)
2. Fisheries Monitoring, Assessment & Forecast (HO-FMA)
3. Habitat Monitoring & Assessment (HO-HAB)
4. Protected Species Monitoring (HO-PSM)

5. Science, Services and Stewardship

### RESILIENT COASTS (RC)

#### National Ocean Service

1. Coastal Water Quality (RC-CWQ)
2. Marine Transportation (RC-MTS)
3. Planning & Management (RC-PAM)
4. Resilience to Coastal Hazards & Climate Change (RC-RCC)

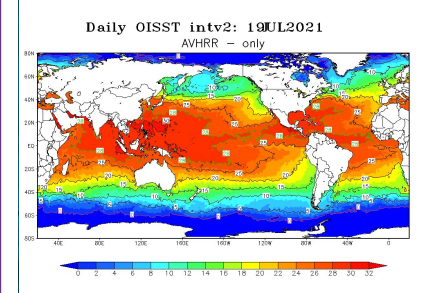
5. Science, Services and Stewardship

### CLIMATE (CLI)

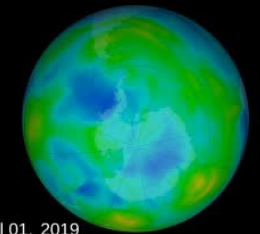
#### Office of Oceanic and Atmospheric Research

1. Assessments of Climate Changes & Its Impacts (CLI-ACC)
2. Climate Mitigation & Adaptation Strategies (CLI-CMA)
3. Climate Science & Improved Understanding (CLI-SIU)

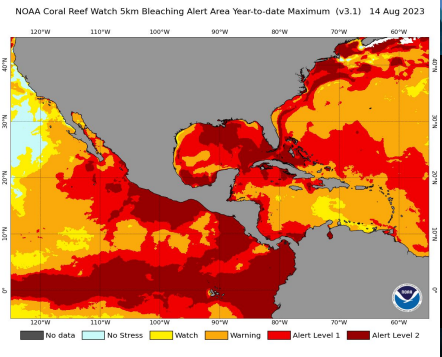
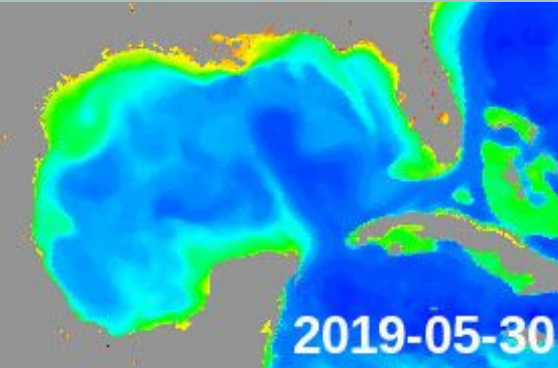
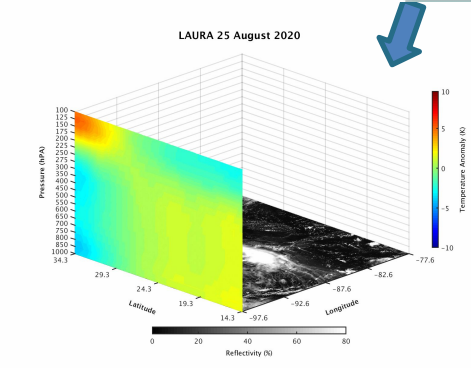
4. Climate Prediction and Projections (CLI\_CPP)



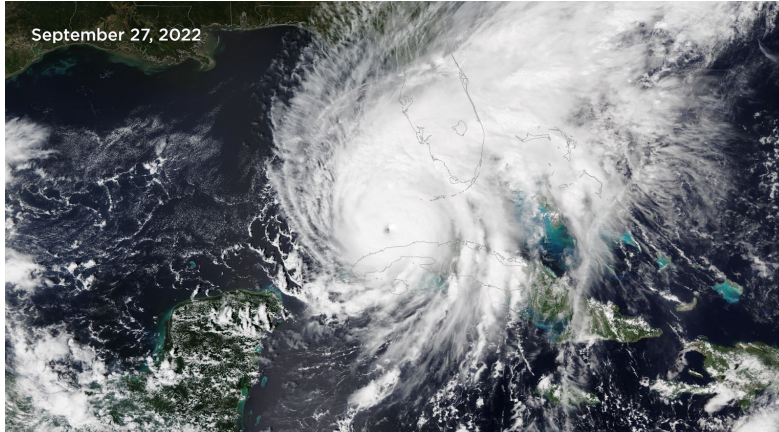
## Ozone Mapping



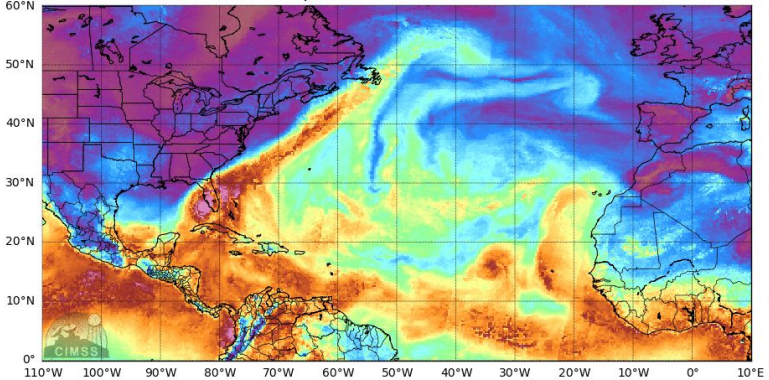
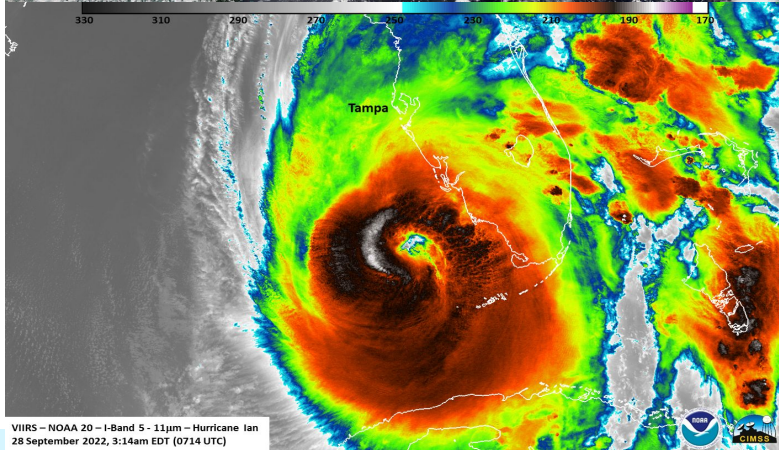
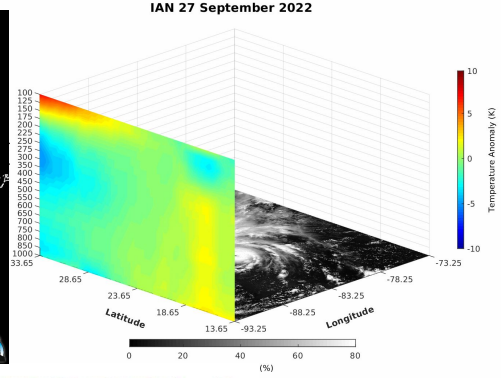
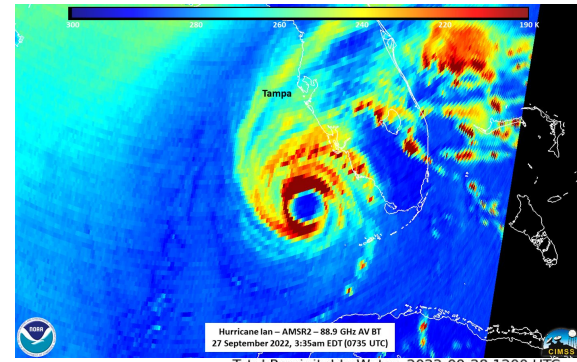
Jul 01, 2019  
Jul 01 — Dec 31



# Hurricane Ian (September 27-29, 2022)



Hurricane Ian as observed by JPSS satellites on September 27-29, 2022. Ian had intensified into a dangerous Category 4 storm by 5:00am EDT Wednesday, according to the NOAA NWS National Hurricane Center. Bringing with it heavy winds and rainfall amounts.



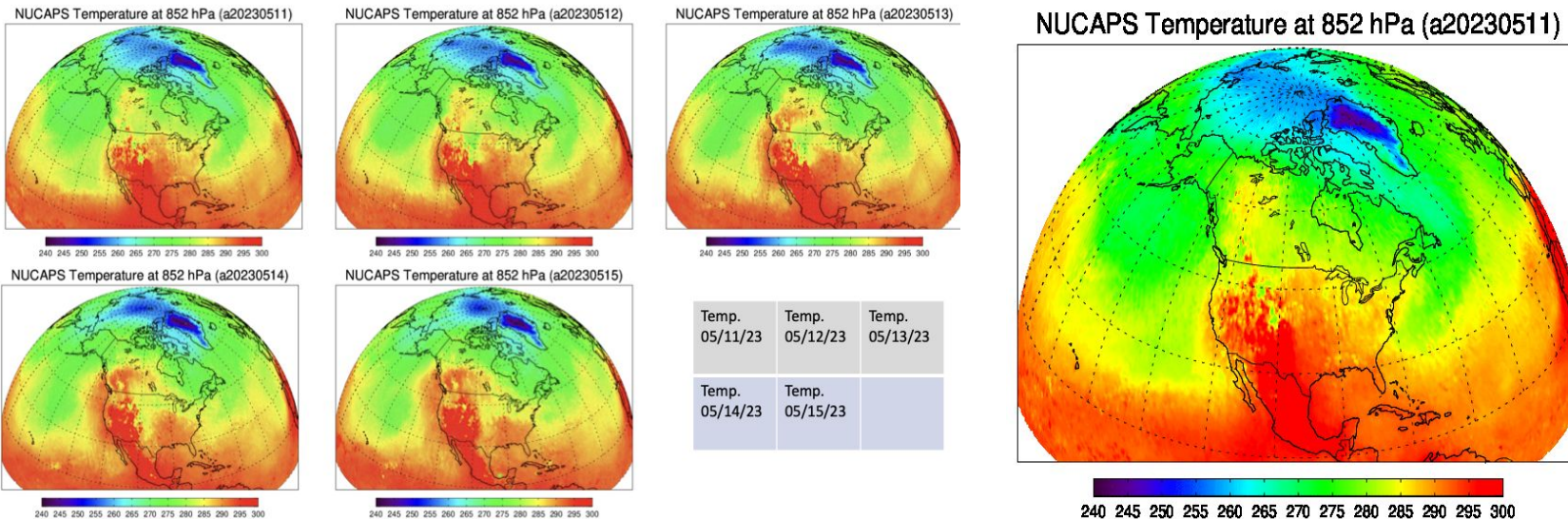
↑ **ATMS 3D View of the Hurricane.**

← **TPW (Total Precipitable Water) from ATMS MiRS Retrieval (Sept. 28-29, 2022).**

VIIRS - NOAA 20 - I-Band 5 - 11µm - Hurricane Ian  
28 September 2022, 3:14am EDT (0714 UTC)

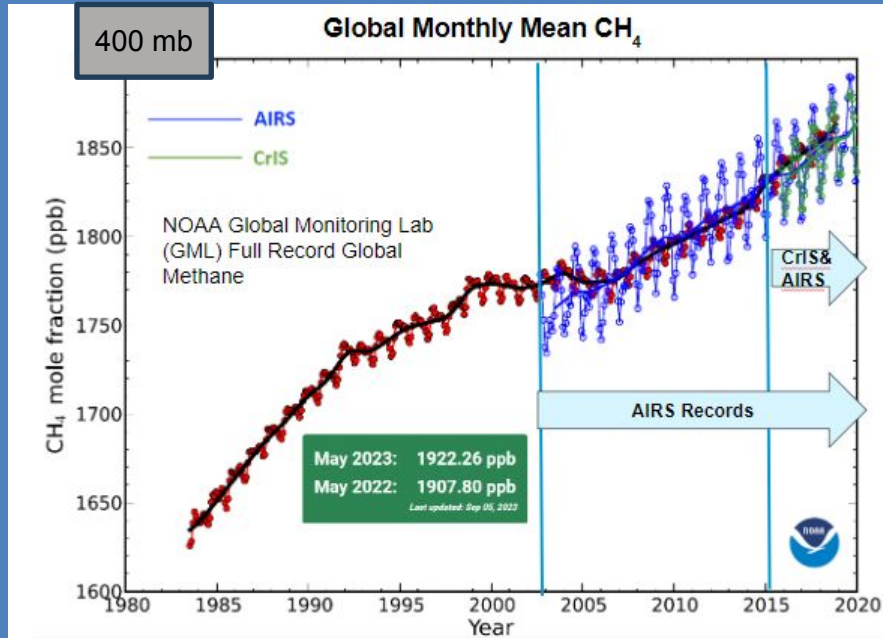


# Heatwave in US Pacific Northwest (May 11 – 15, 2023)



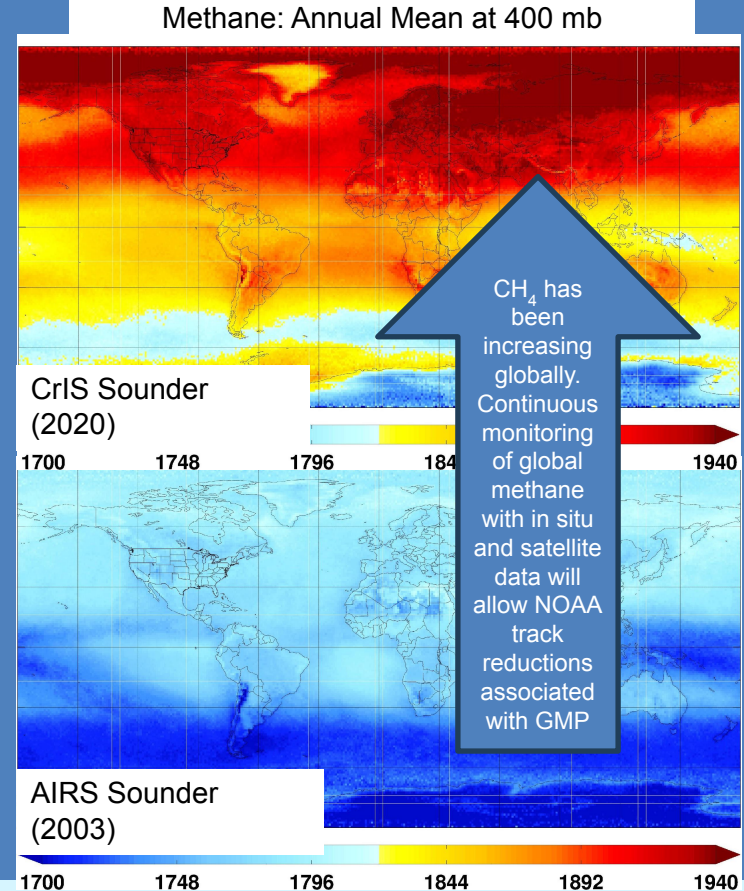
The mid-May western North America heatwave: the 852 hPa temperature retrieval using a moving 3-day composite (max) of NUCAPS data is shown in spherical projection. NOAA/STAR/NUCAPS Team

# LEO Satellites' GHG Capabilities - Methane

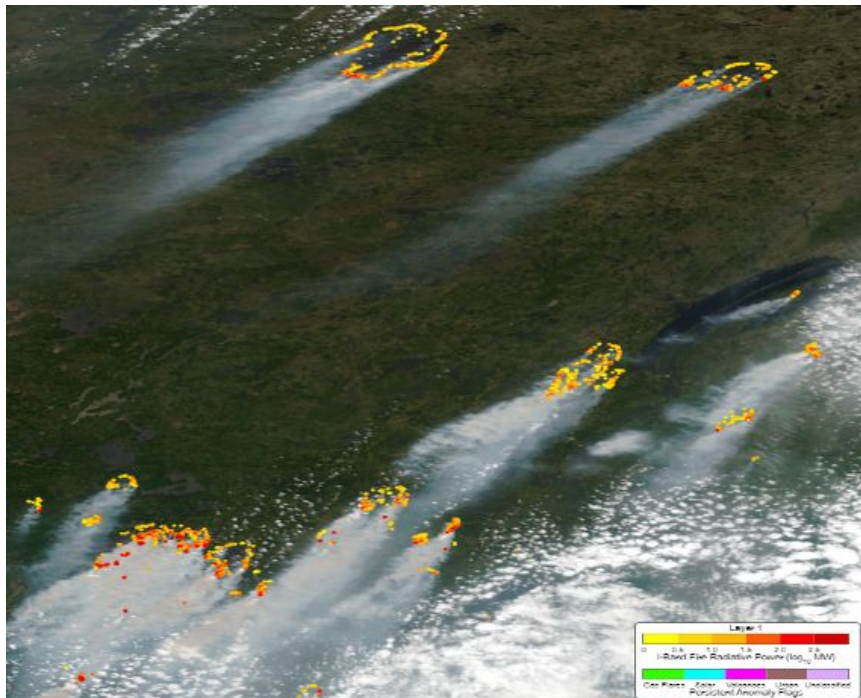


NASA Aura AIRS: Atmospheric Infrared Sounder  
NOAA-NASA Suomi NPP CrIS: Cross-track Infrared Sounder

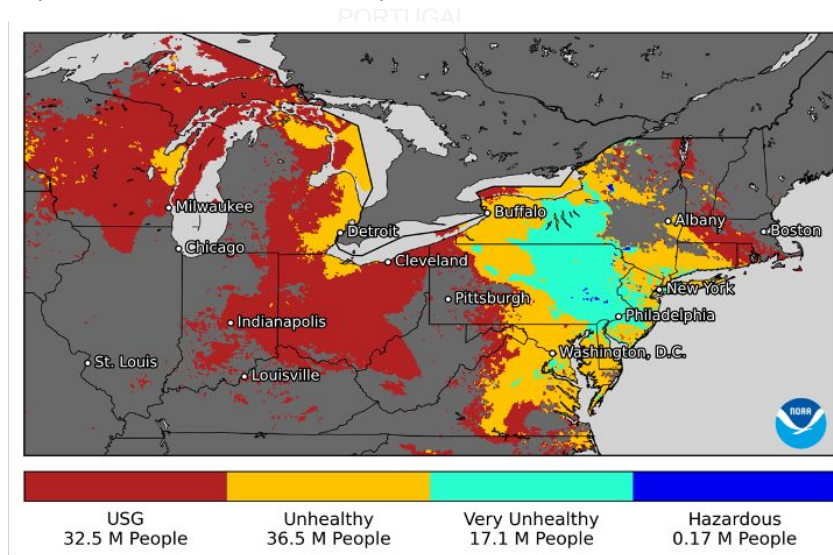
Zhou, L.; Warner, J.; Nalli, N.R.; Wei, Z.; Oh, Y.; Bruhwiler, L.; Liu, X.; Divakarla, M.; Pryor, K.; Kalluri, S.; et al. Spatiotemporal Variability of Global Atmospheric Methane Observed from Two Decades of Satellite Hyperspectral Infrared Sounders. *Remote Sens.* **2023**, *15*, 2992. <https://doi.org/10.3390/rs15122992>



# Canadian Fires (June 2023) Monitored by VIIRS



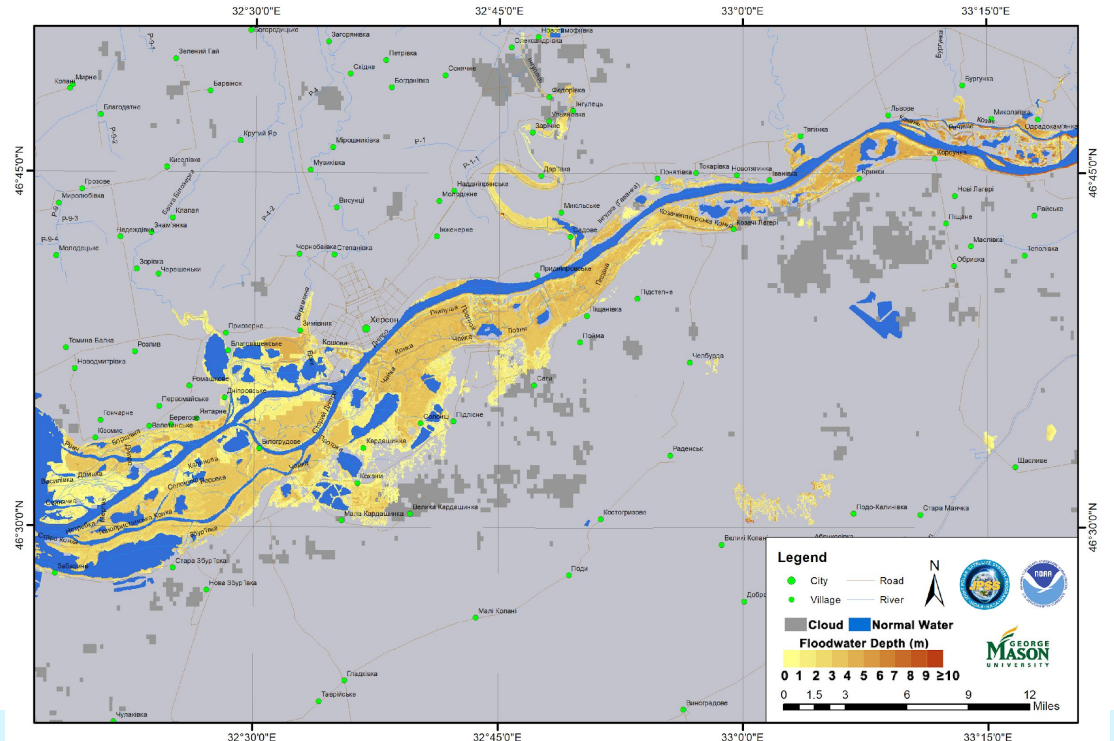
**Figure below** - Millions (“M”) of people in the U.S. were exposed to harmful particulate pollution (PM2.5) on June 3-10, broken down by Air Quality Index (AQI) level, estimated from measurements of aerosol optical depth made by VIIRS on the NOAA-20 and SNPP; gray indicates regions not impacted or no data. “USG” stands for “Unhealthy for Sensitive Groups”. (NOAA/STAR Aerosol Team)



# VIIRS Captured Flooding in Ukraine (June 5-9, 2023)

The Kakhovka Dam in Ukraine was breached in the early hours of 6 June 2023, causing extensive flooding along the lower Dnipro river. (GMU Flood Team)

Suomi-NPP&NOAA-20/VIIRS 30m Floodwater Depth Map in Ukraine, Jun. 07th, 2023





# Arctic Ice Streaming Down Strait between Greenland and Ellesmere Island



NOAA STAR  
Imagery Team

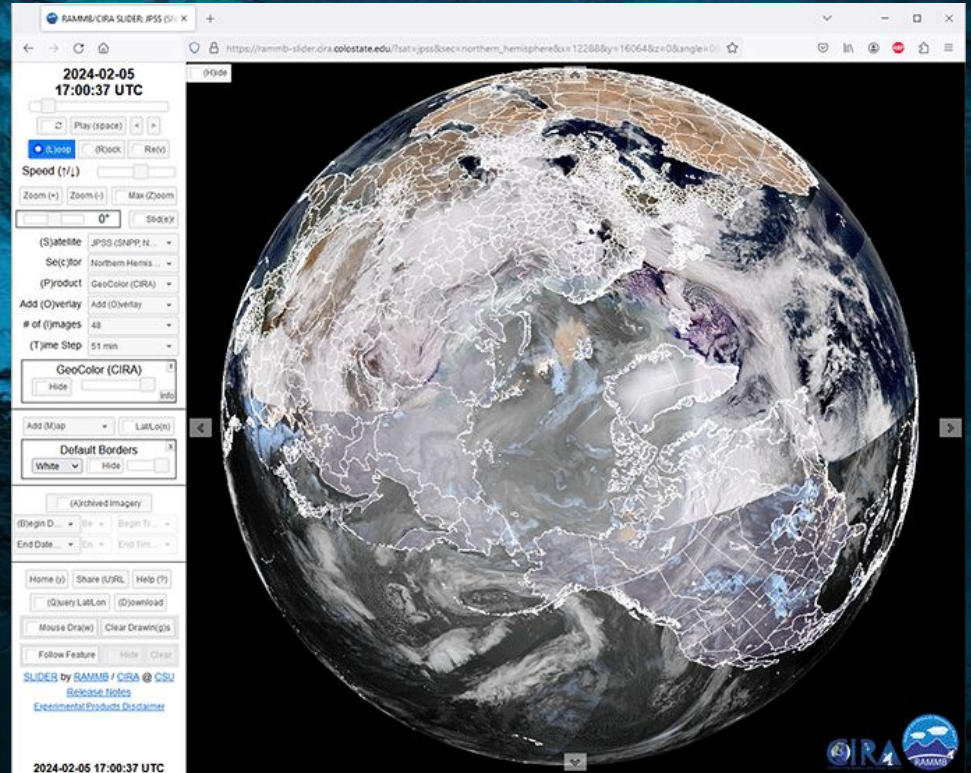
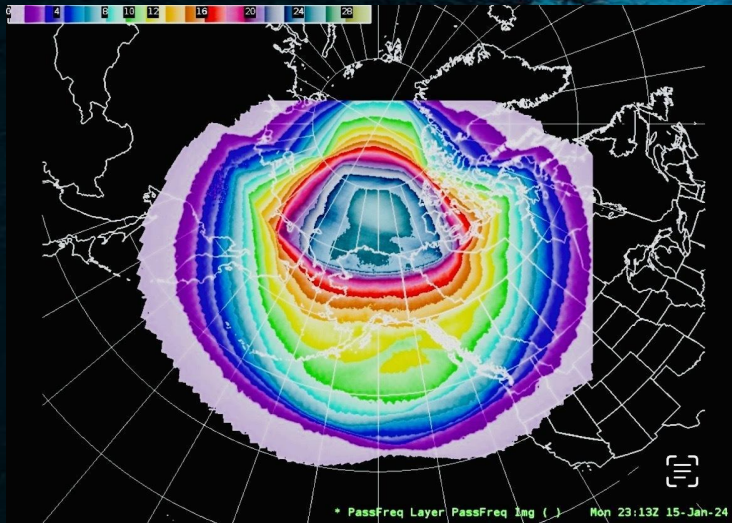




# NOAA-21 is Primary - Working together with NOAA-20, SNPP

## 3 JPSS Satellites VIIRS Sensor Coverage

- 24+ views of the Arctic
- 16+ views of Interior AK



Jennifer Delamere ([jsdelamere@alaska.edu](mailto:jsdelamere@alaska.edu)) @ University of Alaska Fairbanks Geographic Information Network of Alaska (GINA)

<https://rammb-slider.cira.colostate.edu/?sat=jpss>



# Where to Get the Data: Transparency and Accessibility

- **Transparency of the Science:** Detailed information on JPSS instruments, Science data products and documents (ATBDs, Cal Val Plans, Data Format, Product maturity status, README files, Requirements), Long term validation and science monitoring of SDR/EDR Products  
<https://www.star.nesdis.noaa.gov/jpss/>



- **Open Data:** JPSS Data is available through CLASS (Comprehensive Large Array of Stewardship System), PDA (Production Distribution and Access), and Direct Readout/GEONETCast. JPSS data is also now available in **NODD**, for free and easy public access.

## Near Real-Time JPSS Data via NOAA Open Data Dissemination (NODD)

NODD is working with the JPSS team and the Public Datasets programs of three cloud service providers:

- AWS - [Registry of Open Data](#)
- Google Cloud - [Marketplace](#)
- Microsoft - [Planetary Computer](#)

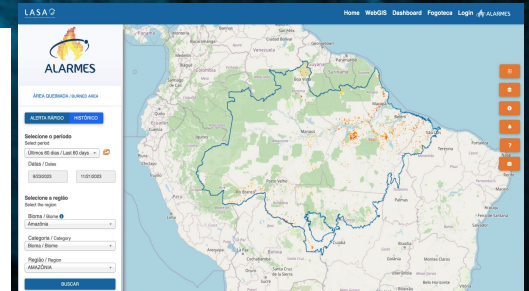
NODD leverages the ODPs' expertise, platforms, and tools in order to improve public access to NOAA data



- No egress costs for users
- No use restrictions
- Appropriate metadata provided
- User interaction & feedback: [NODD@NOAA.GOV](mailto:NODD@NOAA.GOV)

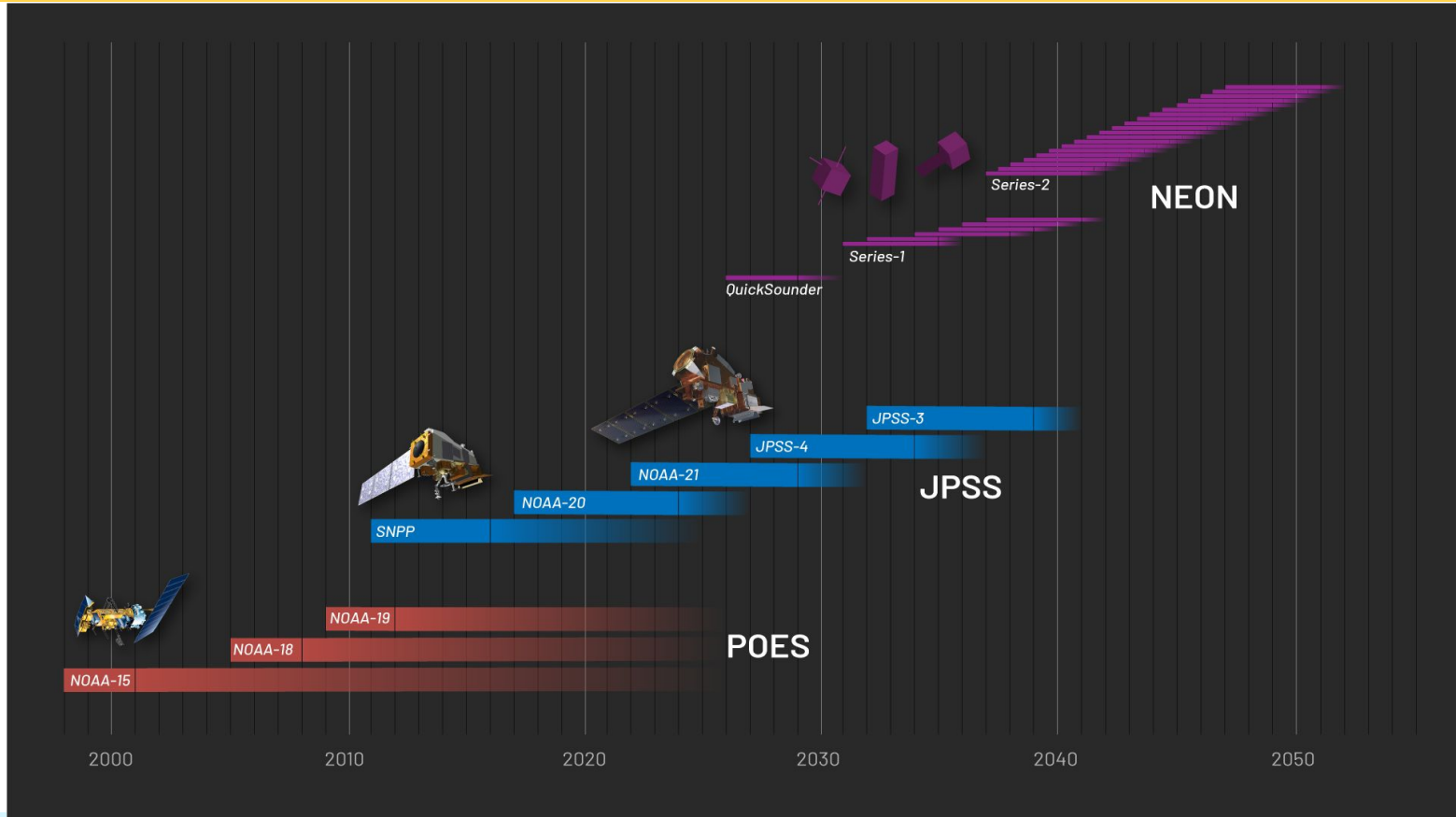
The VIIRS data on the NODD is currently supporting NRT fire-related applications in Brazil and Mexico.

<https://alarmes.lasa.ufjr.br/platfor m/webgis> (POC: Wilfrid Schroeder/NOAA NESDIS SAB)



**NOAA Supports Open Science - Free, easy, and timely access to JPSS Data**

# LEO and the Near Earth Observation Network (NEON)



2023

FROM THE NOAA NESDIS OFFICE OF  
LOW EARTH ORBIT (LEO) OBSERVATIONS

# JPSS

ANNUAL SCIENCE DIGEST

EXPLORING THE IMPACT  
AND APPLICATIONS OF  
JPSS DATA



*Download your copy today!*

[www.nesdis.noaa.gov/JPSS-digest](http://www.nesdis.noaa.gov/JPSS-digest)



# NOAA Public Datasets on Google Cloud - JPSS

04/18/2024



<b>Public Datasets on Google Cloud</b>	<b>01</b>
<b>Accessing and Using Public Datasets</b>	<b>02</b>
<b>Use Cases and Journeys</b>	<b>03</b>

# 01

## Public Datasets on Google Cloud

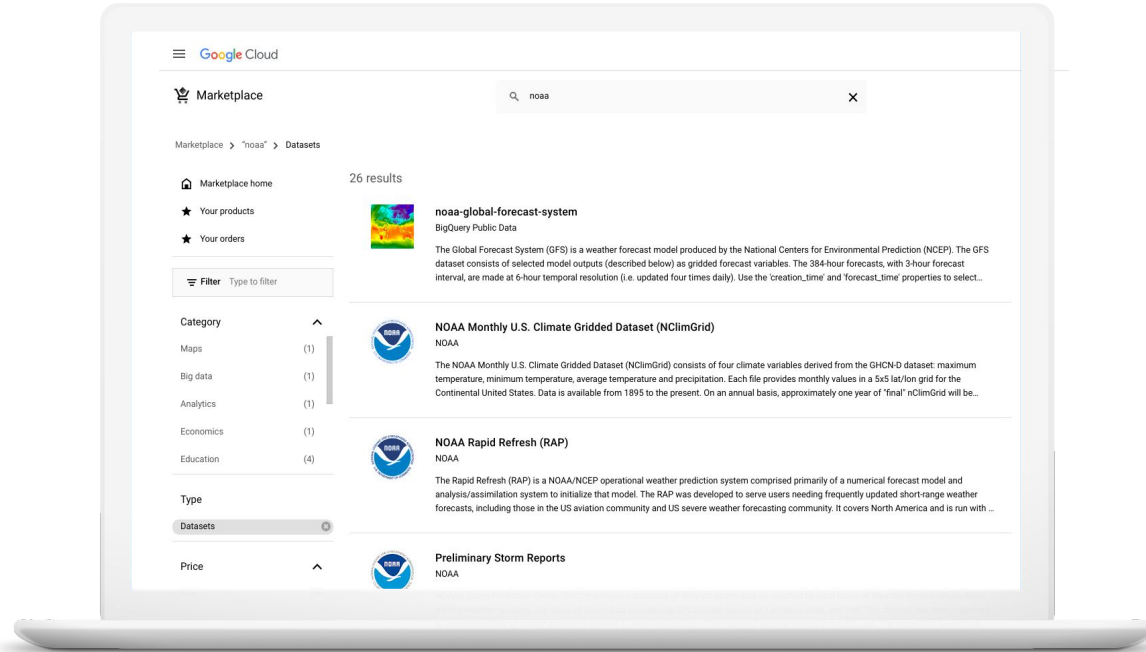




**Google Cloud Public Datasets** is a carefully curated and (mostly) Google managed dataset catalog from various sources all around the world, including weather data, shopping data, crypto, and even Google's own Search data.

# Datasets in Marketplace

- Google Cloud Marketplace is the source of truth for datasets in GCP
- Can search and filter through what's available
- No login required to browse dataset entries
- All consumption of raw (non-tabular, bucket) data is free
- BigQuery tabular data is charged per query
- JPSS data is available in the Marketplace!



# An explosion of satellite data



Source: NASA



# 70+ Petabytes

Growing daily

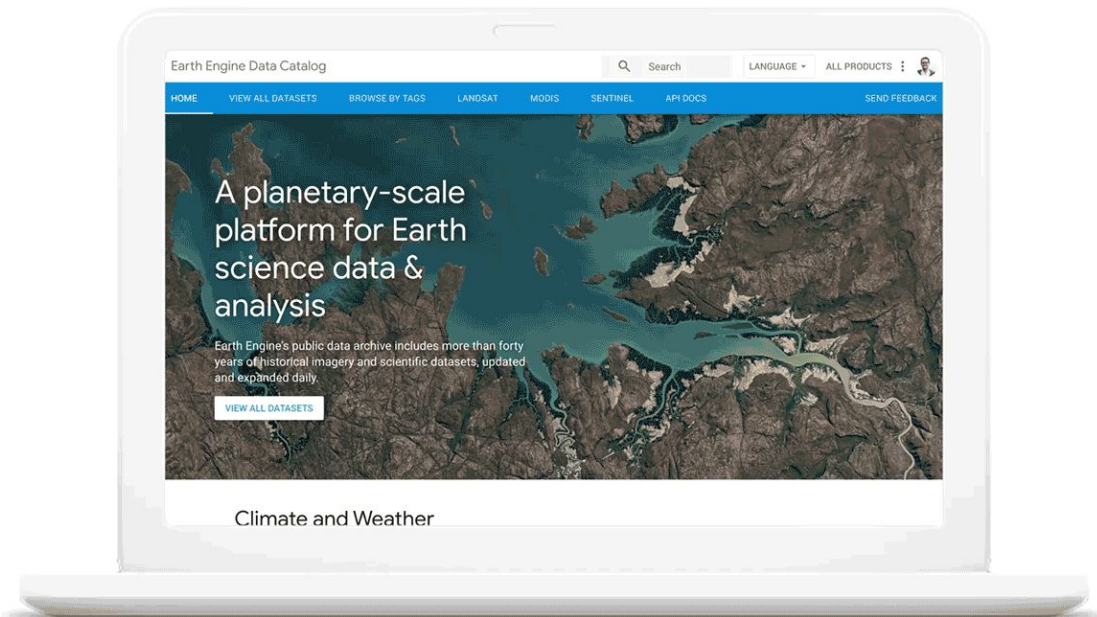
# 1 Petabyte

Monthly growth rate

# 700+

Curated datasets

# Continuously updated in near real-time



[developers.google.com/earth-engine/datasets/](https://developers.google.com/earth-engine/datasets/)

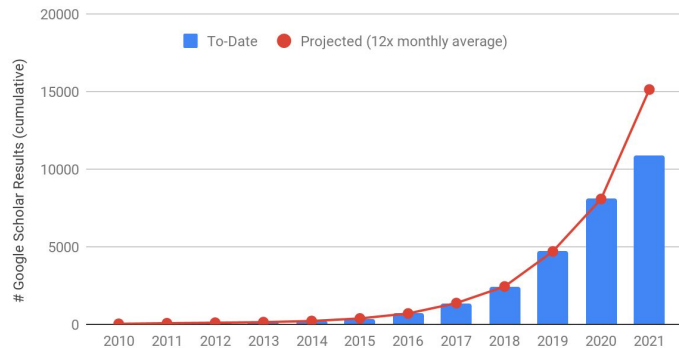
# 400k+

Scientists around  
the world

# 8,000+

Scientific papers

Google Scholar results referencing "google earth engine" - Cumulative



Remote Sensing of Environment

Volume 202, 1 December 2017, Pages 18-27

## Google Earth Engine: Planetary-scale geospatial analysis for everyone

Science

Home News Journals Topics Careers

### High-Resolution Global Maps of 21st-Century Forest Cover Change

M. C. Hansen<sup>1,2</sup>, P. V. Potapov<sup>1</sup>, R. Moore<sup>2</sup>, M. Hancher<sup>2</sup>, S. A. Turubanova<sup>1</sup>, A. Tyukavina<sup>1</sup>, D. Thau<sup>2</sup>, S. V. Stehman<sup>3</sup>, S. J. ...

nature

International journal of science

### High-resolution mapping of global surface water and its long-term changes

Jean-François Pekel<sup>✉</sup>, Andrew Cottam, Noel Gorelick & Alan S. Belward

Science

Home News Journals Topics Careers

### Tracking the global footprint of fisheries

David A. Kroodsma<sup>1,2</sup>, Juan Mayorga<sup>2,3</sup>, Timothy Hochberg<sup>1</sup>, Nathan A. Miller<sup>4</sup>, Kristina Boerder<sup>5</sup>, Francesco Ferretti<sup>6</sup>, Alex ...

# Google Earth has helped users find amazing things

The New York Times

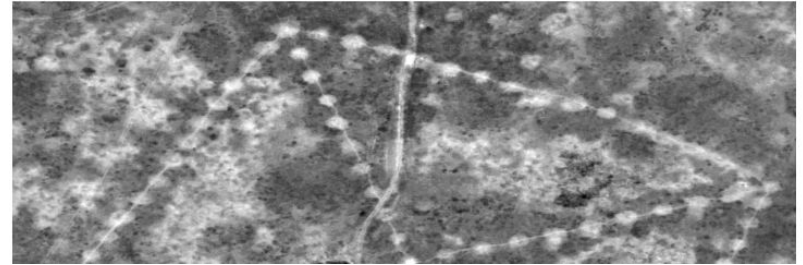
## *Hundreds of Mysterious Stone 'Gates' Found in Saudi Arabia's Desert*



How Google Earth helped find Mozambique's lost forest of Mount Mabu | video

The New York Times

## *NASA Adds to Evidence of Mysterious Ancient Earthworks*



News

## **Enthusiast uses Google to reveal Roman ruins**

Google Earth programme leads to remains of ancient villa.



# What is Earth Engine? | Code Editor

The screenshot shows the Google Earth Engine Code Editor interface. The interface is divided into several sections:

- API Docs:** Located at the top left, above the Scripts panel.
- Your Assets:** A panel on the left side showing a list of assets like Pixel Lon Lat, Polynomial, Zero Crossing, Image Collection, etc.
- Search:** A search bar at the top center.
- Your Code:** The central area containing a code editor with a script titled "Linear Fit".
- Data Inspector:** A panel on the right side showing the output of the code, including a point, pixels, and objects.
- Output Console:** A panel on the right side showing the console output.
- Batch Tasks:** A panel on the right side showing batch tasks.
- Output Map:** The bottom area showing a map of the United States with a colorful overlay representing the output of the code.
- Your scripts, Example scripts:** A label pointing to the Scripts panel on the left.
- Drawing Tools:** A label pointing to the drawing tools at the bottom left of the map.

[code.earthengine.google.com](https://code.earthengine.google.com)



# Featured NOAA datasets



## Joint Polar Satellite System (JPSS)

NOAA-20/21 and SNPP available from 2023-Present with VIIRS, ATMS, CRiS, and OMPS, etc. sensors with low latency and high resolution.

## Next Generation Radar (NEXRAD)

High-resolution S-band Doppler weather radars operated by the National Weather Service (NWS).

## Global Forecast System (GEFS)

A weather model created by the National Centers for Environmental Prediction (NCEP) that generates 21 separate forecasts to address underlying uncertainties in the input data.

## High Resolution Rapid Refresh (HRRR)

3-km resolution hourly updated, cloud-resolving, convection-allowing atmospheric model.

## Global Summary of the Day (GSOD)

A dozen daily averages computed from global hourly station data, covering 1929 to present.





# 02

## Accessing and Using Public Datasets



# Google Cloud Datasets Marketplace

The screenshot displays the Google Cloud Datasets Marketplace interface. At the top left, the 'Marketplace' logo is visible. A search bar at the top center contains the text 'Search Marketplace'. Below the search bar, the breadcrumb 'Marketplace > Data' is shown. On the left side, there is a navigation menu with options: 'Marketplace home', 'Your products', 'Your orders', and 'Producer Portal'. Below this is a 'Filter' section with the text 'Type to filter'. The 'Category' section lists: 'Analytics (36)', 'Big data (28)', 'Databases (6)', 'Machine learning (4)', and 'Generative AI (2)'. The 'Type' section has a dropdown menu set to 'Data'. The 'Price' section lists: 'Free (214)' and 'Paid (12)'. The main content area shows '226 results' and a grid of dataset cards. Each card includes a logo, title, provider, and a brief description. The datasets shown include: 'Cloud-to-Ground Lightning Strikes' (NOAA), 'ZoomInfo - Companies under 1,000 employees offering...' (ZoomInfo), 'D&B ID Graph' (Dun & Bradstreet), 'Solana Blockchain (Community Dataset)' (BigQuery Public Data), 'Google Community Mobility Reports' (BigQuery Public Datasets Program), 'D&B Strategic Database Marketing Record (SDMR)' (Dun & Bradstreet), 'COVID-19 Genome Sequence Dataset' (National Library of Medicine), 'Fantom Blockchain (Preview)' (BigQuery Public Data), 'GOES 16/18' (NOAA), 'AlphaFold Protein Structure Database' (BigQuery Public Data), 'Google's Diversity Annual Report Data' (BigQuery Public Datasets Program), 'ZoomInfo - Companies with the most marketing...' (ZoomInfo), 'D&B Corporate Family Tree+' (Dun & Bradstreet), 'ZoomInfo - Retail Companies headquartered in California' (ZoomInfo), and 'NYC TLC Trips' (City of New York). At the bottom of the grid, logos for 'planck', 'OP', and 'TRON' are visible.



# Where are public datasets stored?



**Google Cloud Storage** is a managed service for storing unstructured data. Buckets contain objects (a.k.a. files and folders) that contain the data and how they're organized. There are more than 80 buckets containing public datasets in various file formats.



**BigQuery** is Google's fully managed, serverless data warehouse for structured data. It supports querying using a dialect of SQL. There are more than 300 public BigQuery datasets spanning thousands of tables.

# Access Other NOAA Datasets: GEFS

The screenshot shows the Google Cloud Marketplace interface. At the top, there is a navigation bar with the Google Cloud logo and a 'Select a project' dropdown. Below this, the 'Marketplace' section is visible, with a search bar containing 'JPSS'. The search results show one result: 'NOAA Joint Polar Satellite System (JPSS)' by NOAA. The result card includes the NOAA logo, the product name, and a brief description: 'NOAA's Joint Polar Satellite System (JPSS) provides global observations that serve as the backbone of both short- and long-term forecasts, including those that help us predict and prepare for severe weather events. The five satellites scheduled in the fleet are the currently-flying NOAA/NASA Suomi National Polar-orbiting Partnership (Suomi NPP) satellite, NOAA-20, previously known as JPSS-1, NOAA-21, previously...'. On the left side of the marketplace, there are navigation links for 'Marketplace home', 'Your products', and 'Your orders'. Below these are filter options for 'Category', 'Type', and 'Price', each with a dropdown arrow and a count of results. The 'Category' filter shows 'Science & research' (1) and 'Climate' (1). The 'Type' filter shows 'Data' (1). The 'Price' filter shows 'Free' (1).

<https://console.cloud.google.com/marketplace/product/noaa-public/noaa-jpss>

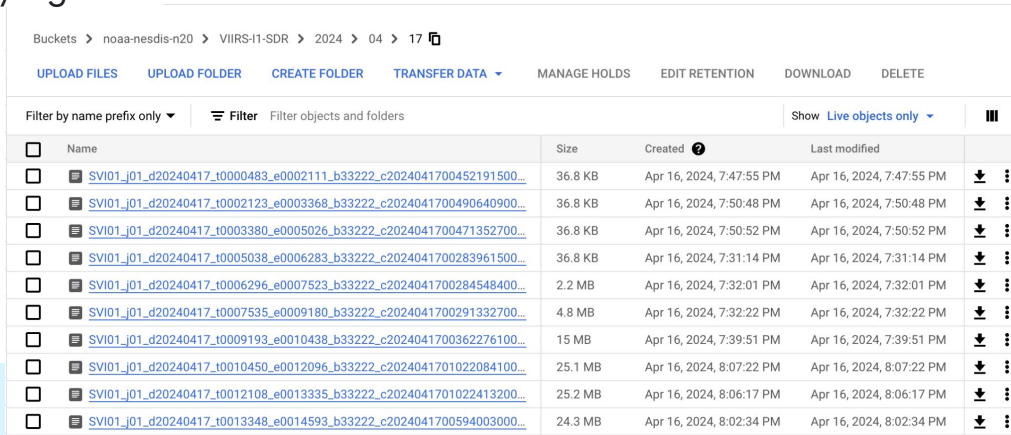
# Access JPSS data using a browser

1. The Google Cloud Storage bucket that stores the data is noaa-nesdis-n20 and noaa-nesdis-n21
2. Using a web browser, access the root of the bucket with the following URI\*  
<https://console.cloud.google.com/storage/browser/noaa-nesdis-n20>
3. You can examine multiple levels of the bucket by appending the path to the URI above.

For example, to access the data from April 17, 2024 in the M3 band, use the URI

<https://console.cloud.google.com/storage/browser/noaa-nesdis-n20/VIIRS-I1-SDR/2024/04/17>

\*You will be asked to sign in if you are not currently signed in



<input type="checkbox"/>	Name	Size	Created	Last modified	
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0000483_e0002111_b33222_c2024041700452191500...</a>	36.8 KB	Apr 16, 2024, 7:47:55 PM	Apr 16, 2024, 7:47:55 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0002123_e0003368_b33222_c2024041700490640900...</a>	36.8 KB	Apr 16, 2024, 7:50:48 PM	Apr 16, 2024, 7:50:48 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0003380_e0005026_b33222_c2024041700471352700...</a>	36.8 KB	Apr 16, 2024, 7:50:52 PM	Apr 16, 2024, 7:50:52 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0005038_e0006283_b33222_c2024041700283961500...</a>	36.8 KB	Apr 16, 2024, 7:31:14 PM	Apr 16, 2024, 7:31:14 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0006296_e0007523_b33222_c2024041700284548400...</a>	2.2 MB	Apr 16, 2024, 7:32:01 PM	Apr 16, 2024, 7:32:01 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0007535_e0009180_b33222_c2024041700291332700...</a>	4.8 MB	Apr 16, 2024, 7:32:22 PM	Apr 16, 2024, 7:32:22 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0009193_e0010438_b33222_c2024041700362276100...</a>	15 MB	Apr 16, 2024, 7:39:51 PM	Apr 16, 2024, 7:39:51 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0010450_e0012096_b33222_c2024041701022084100...</a>	25.1 MB	Apr 16, 2024, 8:07:22 PM	Apr 16, 2024, 8:07:22 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0012108_e0013335_b33222_c2024041701022413200...</a>	25.2 MB	Apr 16, 2024, 8:06:17 PM	Apr 16, 2024, 8:06:17 PM	⬇ ⋮
<input type="checkbox"/>	<a href="#">SVI01_j01_d20240417_t0013348_e0014593_b33222_c2024041700594003000...</a>	24.3 MB	Apr 16, 2024, 8:02:34 PM	Apr 16, 2024, 8:02:34 PM	⬇ ⋮

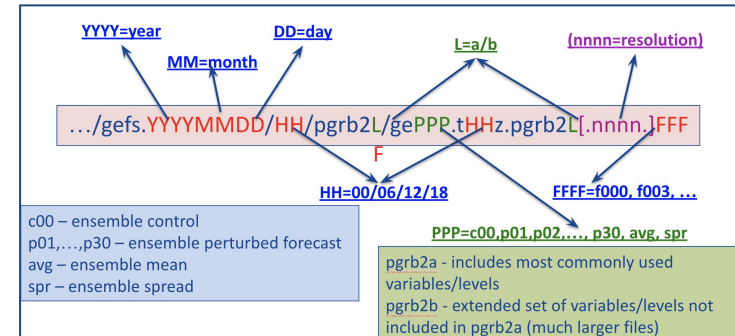
# What about model data? Accessing GEFs!

1. The Google Cloud Storage bucket that stores the data is gfs-ensemble-forecast-system
2. Using a web browser, access the root of the bucket with the following URI\*  
<https://console.cloud.google.com/storage/browser/gfs-ensemble-forecast-system>
3. You can examine multiple levels of the bucket by appending the path to the URI above.

For example, to access the path gefs.20230815/06/atmos/bufr, use the URI

<https://console.cloud.google.com/storage/browser/gfs-ensemble-forecast-system/gefs.20230815/06/atmos/bufr>

\*You will be asked to sign in if you are not currently signed in



Google Cloud | Select a project | Search (/) for resources, docs, products, and more

Bucket details

gfs-ensemble-forecast-system

OBJECTS | CONFIGURATION | PERMISSIONS | PROTECTION | LIFECYCLE | OBSERVABILITY | INVENTORY REPORTS

Buckets > gfs-ensemble-forecast-system

UPLOAD FILES | UPLOAD FOLDER | CREATE FOLDER | TRANSFER DATA | MANAGE HOLDS | DOWNLOAD | DELETE

Filter by name prefix only | Filter | Filter objects and folders | Show deleted data

<input type="checkbox"/>	Name	Size	Type	Created	Storage class	Last modified	Public access	Version history	Encryption	Retention expiration date	Holds
<input type="checkbox"/>	gfs.20210101/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210102/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210103/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210104/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210105/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210106/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210107/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210108/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210109/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210110/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210111/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210112/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210113/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210114/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210115/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210116/	-	Folder	-	-	-	-	-	-	-	-
<input type="checkbox"/>	gfs.20210117/	-	Folder	-	-	-	-	-	-	-	-

Google Cloud | Select a project | Search (/) for resources, docs, products, and more

Bucket details

gfs-ensemble-forecast-system

OBJECTS | CONFIGURATION | PERMISSIONS | PROTECTION | LIFECYCLE | OBSERVABILITY | INVENTORY REPORTS

Buckets > gfs-ensemble-forecast-system > gfs.20230815 > 06 > atmos > bufr

UPLOAD FILES | UPLOAD FOLDER | CREATE FOLDER | TRANSFER DATA | MANAGE HOLDS | DOWNLOAD | DELETE

Filter by name prefix only | Filter | Filter objects and folders | Show deleted data

<input type="checkbox"/>	Name	Size	Type	Created	Storage class	Last modified	Public
<input type="checkbox"/>	avg/	-	Folder	-	-	-	-
<input type="checkbox"/>	c00/	-	Folder	-	-	-	-
<input type="checkbox"/>	geavg.t06z.bufsnd.tar.gz	74.4 MB	binary/octet-stream	Aug 15, 2023, 4:07:34 AM	Standard	Aug 15, 2023, 4:07:34 AM	Value
<input type="checkbox"/>	gec00.t06z.bufsnd.tar.gz	76.4 MB	binary/octet-stream	Aug 15, 2023, 3:52:20 AM	Standard	Aug 15, 2023, 3:52:20 AM	Value
<input type="checkbox"/>	gep01.t06z.bufsnd.tar.gz	76.6 MB	binary/octet-stream	Aug 15, 2023, 4:05:08 AM	Standard	Aug 15, 2023, 4:05:08 AM	Value
<input type="checkbox"/>	gep02.t06z.bufsnd.tar.gz	76.7 MB	binary/octet-stream	Aug 15, 2023, 4:05:08 AM	Standard	Aug 15, 2023, 4:05:08 AM	Value
<input type="checkbox"/>	gep03.t06z.bufsnd.tar.gz	76.5 MB	binary/octet-stream	Aug 15, 2023, 4:05:09 AM	Standard	Aug 15, 2023, 4:05:09 AM	Value
<input type="checkbox"/>	gep04.t06z.bufsnd.tar.gz	76.7 MB	binary/octet-stream	Aug 15, 2023, 4:05:07 AM	Standard	Aug 15, 2023, 4:05:07 AM	Value
<input type="checkbox"/>	gep05.t06z.bufsnd.tar.gz	76.5 MB	binary/octet-stream	Aug 15, 2023, 4:05:07 AM	Standard	Aug 15, 2023, 4:05:07 AM	Value
<input type="checkbox"/>	gep06.t06z.bufsnd.tar.gz	76.7 MB	binary/octet-stream	Aug 15, 2023, 4:05:07 AM	Standard	Aug 15, 2023, 4:05:07 AM	Value

https://console.cloud.google.com/storage/browser/gfs-ensemble-forecast-system

# Access JPSS data using the command line

**gsutil** is a Python application that lets you access Cloud Storage buckets and contents from the command line.

To list objects from the root of the bucket:

```
$ gsutil ls gs://noaa-nesdis-n21

gs://noaa-nesdis-n21/ATMS-SCIENCE-RDR/
gs://noaa-nesdis-n21/ATMS-SDR-GEO/
gs://noaa-nesdis-n21/ATMS-SDR/
gs://noaa-nesdis-n21/ATMS-TDR/
gs://noaa-nesdis-n21/ATMS_BUFR/
gs://noaa-nesdis-n21/CRIS-SCIENCE-RDR/
...
```

Using `gcloud storage` has a similar effect:

```
$ gcloud storage ls gs://noaa-nesdis-n21
```



# Access JPSS data using the command line

To copy an entire prefix (directory tree) and its contents to the current directory\*

```
$ gsutil -m cp gs://noaa-nesdis-n21/VIIRS-I1-SDR/2024/04/17 .
```

\*The -m flag enables multiprocessing to parallelize object downloads. Note that data for a single date is more than 25 GB in size!

Again, using gcloud storage has a similar effect (without the -m flag):

```
$ gcloud storage cp gs://noaa-nesdis-n21/VIIRS-I1-SDR/2024/04/17 .
```

(For more info, see <https://cloud.google.com/sdk/gcloud/reference/storage>)

# 03

## Use Cases and Journeys



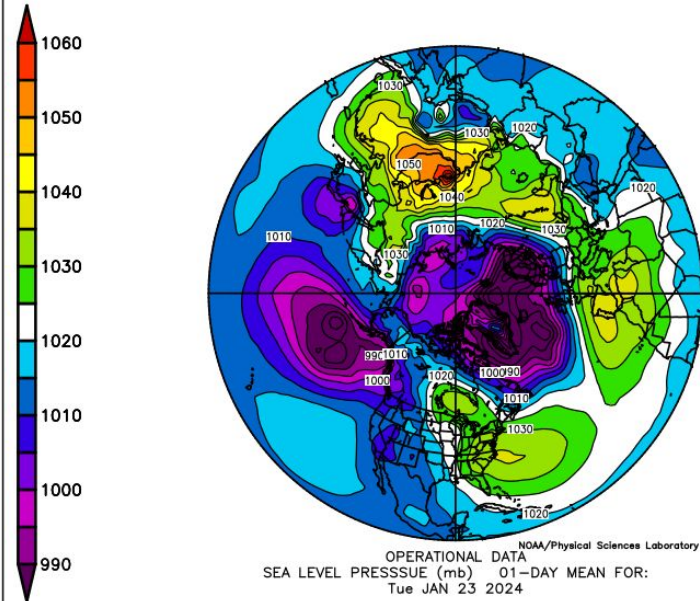


## Weather Satellites: An Invaluable Resource

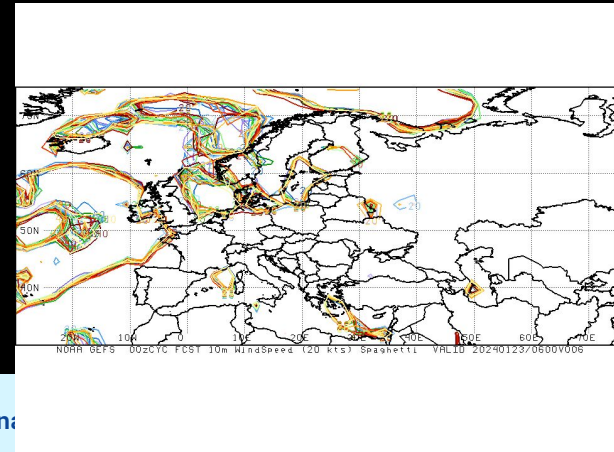
- Nearly unlimited use cases. Weather observations for agriculture, transportation, finance, and energy sectors
- Climate change monitoring
- Disaster/risk management
  - Wildfires
  - Extreme Floods
  - Hurricanes, Tropical Storms, and Extreme Weather

# Global Weather Models: Another Invaluable Resource

- Global weather model ensembles [available](#)
  - Use 30 perturbed + 1 control forecast to increase your certainty in how much uncertainty a model has!



- Global weather models [available](#) in high resolution 4x per day for:
  - Business Analytics
  - Operational Forecast Needs
  - ML training and validation



# Code example for JPSS VIIRS data on GCP

Try this on your  
own [Colab!](#)



# pytroll/satpy

Python package for earth-observing satellite data processing



98 Contributors  
104 Used by  
1k Stars  
282 Forks



## Setup

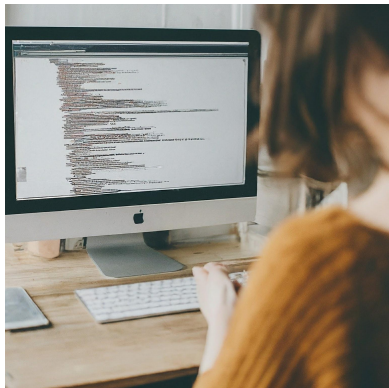
Setup your environment for all the tools you will need to accomplish the task of visualizing some data.



```
!pip install -q satpy pyspectral
```

```
from satpy.scene import Scene  
from satpy import find_files_and_readers  
import h5py  
import gcsfs  
from google.colab import auth  
from google.cloud import storage  
from datetime import datetime  
import pandas as pd  
import numpy as np  
import re
```

```
auth.authenticate_user()
```



## Instantiate clients and set search limits

For a free Colab,  
you'll want to make  
sure you are  
processing only one  
true color image at a  
time using this code.

```
bucket_name = "noaa-nesdis-n21"
```

```
year = '2023'  
month = '08'  
day = '09'  
start_hour = '23'  
start_minute = '49'  
end_hour = '23'  
end_minute = '50'
```

```
start_limiter = datetime(int(year), int(month), int(day),  
int(start_hour), int(start_minute), 0)  
end_limiter = datetime(int(year), int(month), int(day), int(end_hour),  
int(end_minute), 0)
```

```
# Instantiates a client  
storage_client = storage.Client()
```

```
# Instantiate file system  
fs = gcsfs.GCSFileSystem(anon=True)
```



## Make some functions!

Let's make functions to help us identify files of interest and to return a list of interesting data.

```
def list_blobs(bucket_name, prefix, delimiter=None):
    """Lists all the blobs in the bucket."""

    storage_client = storage.Client()
    blobs = storage_client.list_blobs(bucket_name, prefix=prefix,
    delimiter=delimiter)
    # Note: The call returns a response only when the iterator is
    consumed.
    results = []
    for blob in blobs:
        # print(blob.name)
        results.append(blob.name)
    return results

def parse_dates_from_filename(f):
    start =
    pd.Timestamp(datetime.strptime("_".join(re.findall(r"_[dt](\d+)",
    f.split('/')[1])), "%Y%m%d_%H%M%S%f"))
    return start
```





**Identify the files we want to work with...**

**Isolate the files you want to work with and add some additional parsed data.**

```
# Create a dataframe and add datetime field from filenames
dfr = pd.DataFrame(results, columns=['Files'])
dfr['Date'] = dfr.Files.apply(parse_dates_from_filename)
```

```
#Fetch data from an important time
lets_get = dfr[(dfr.Date >= start_limiter) &
              (dfr.Date < end_limiter)]
```

```
# Get Filenames
lets_get = lets_get.Files.to_list()
print('Filtered to:', len(lets_get))
```

```
# Show first 5 files
lets_get[0:5]
```

# Open and process files

Process data from each of the 6 bands listed to make a true color representation of JPSS data.

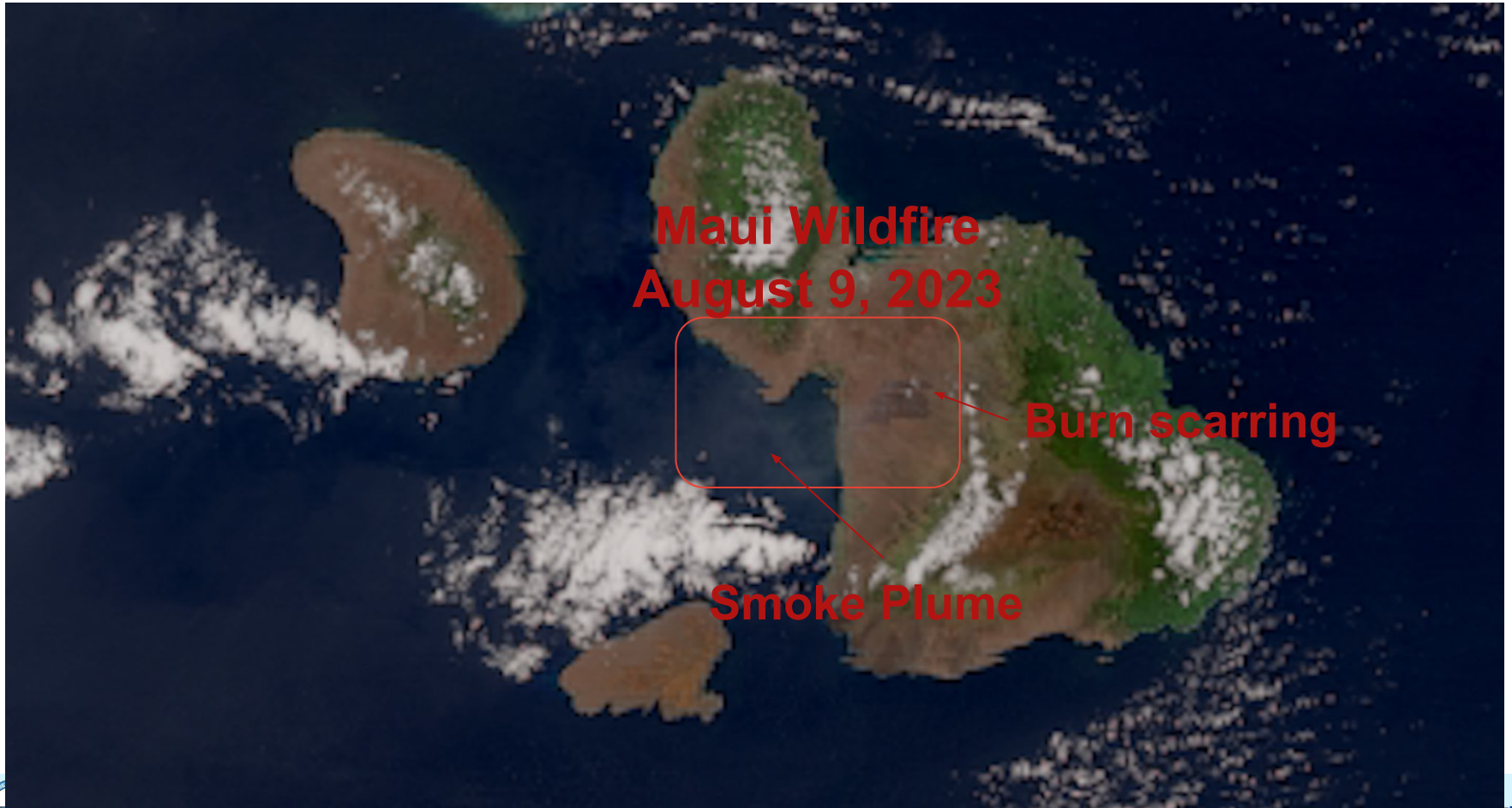
```
results = []
target_data = [
    'VIIRS-M3-SDR',
    'VIIRS-M4-SDR',
    'VIIRS-M5-SDR',
    'VIIRS-I1-SDR',
    'VIIRS-MOD-GEO',
    'VIIRS-IMG-GEO',
]

for target in target_data:
    stuff = list_blobs(bucket_name, f"{target}/{year}/{month}/{day}/",
                       None)
    dfr = pd.DataFrame(stuff, columns=['Files'])
    dfr['Date'] = dfr.Files.apply(parse_dates_from_filename)
    dfr.Files = dfr.Files.apply(lambda x: 'gs://' + bucket_name + '/' + x)
    results.extend(dfr[(dfr.Date >= start_limiter) & (dfr.Date <
                                                         end_limiter)].Files.to_list())

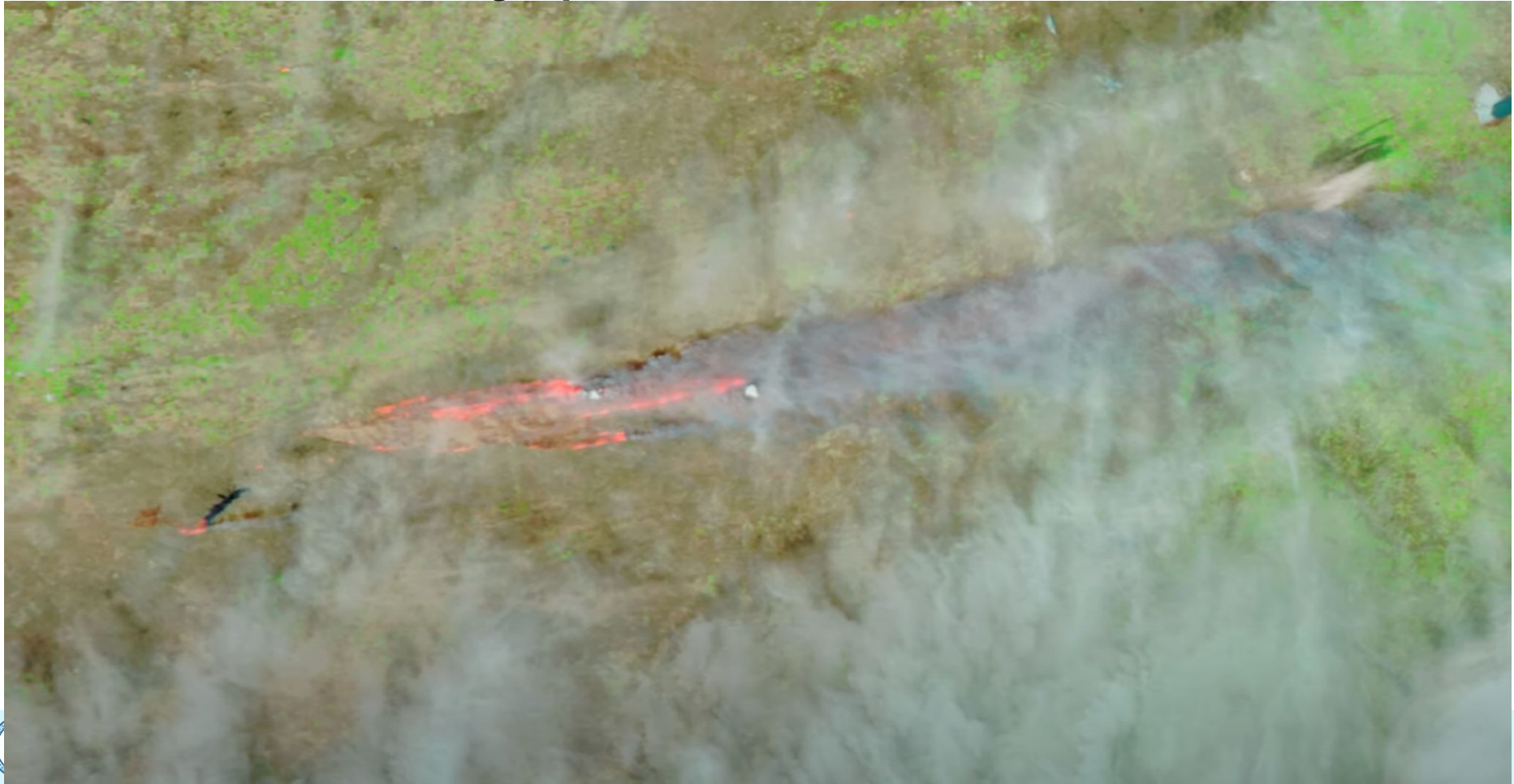
print(f'Found {int(len(results)/len(target_data))} snapshots to
      combine.')
scene = Scene(filenamees=results, reader='viirs_sdr')
scene.load(['true_color'])
natscn = scene.resample(resampler='native')
natscn.show('true_color')
```



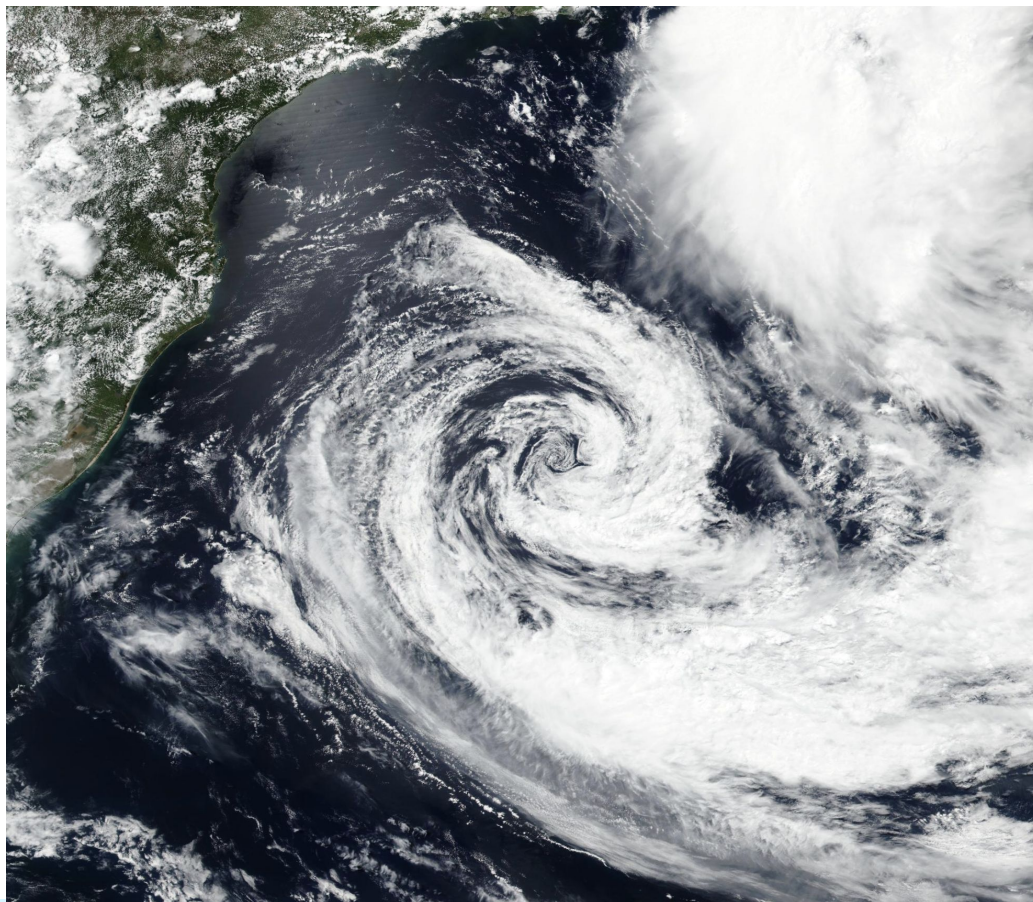
# JPSS Imagery from Maui Wildfire Aug 2023



# JPSS Imagery from Texas Wildfires Feb 2024



# Tropical Storm Ikará Offshore Brazil Feb 2024





# Thank you.

Questions? Email us at:  
[cloud-public-dataset-conferences@google.com](mailto:cloud-public-dataset-conferences@google.com)

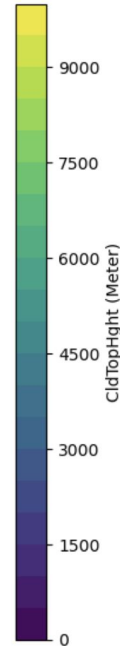
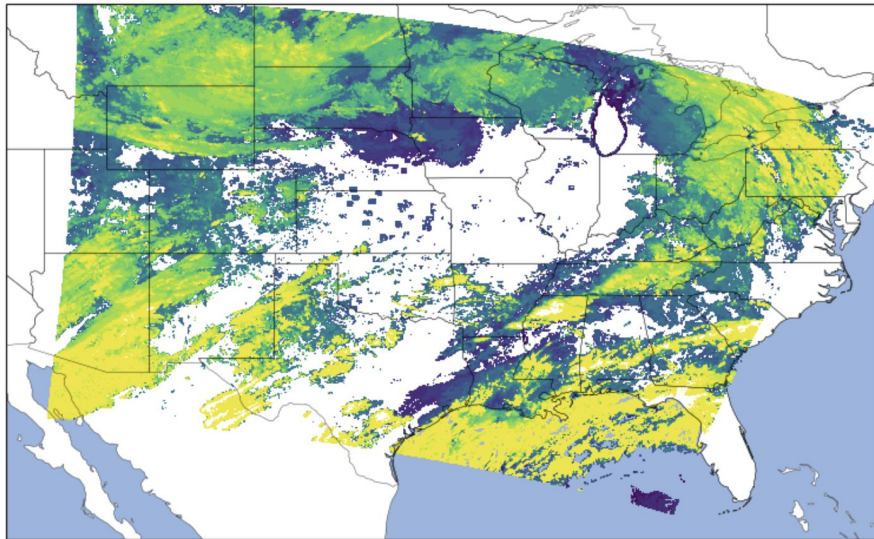
Google Cloud



# Jupyter Notebook Demo

```
# Show the plot  
plt.show()
```

noaa-nesdis-n21 CldTopHght 08 April 2024 at approx 08 UTC



Data variables:	
quality_informat...	uint8 ...
StartRow	int32 ...
StartColumn	int32 ...
AchsMode	float64 ...
NumOfQualityFl...	float32 ...
Shadow_Mask	(Rows, Columns) float32 ...
Latitude_Pc	(Rows, Columns) float32 ...
Longitude_Pc	(Rows, Columns) float32 ...
CldTopTemp	(Rows, Columns) float32 ...
CldTopTempLow	(Rows, Columns) float32 ...
CldTopPres	(Rows, Columns) float32 ...
CldTopPresLow	(Rows, Columns) float32 ...
CldTopHght	(Rows, Columns) float32 ...
CldTopEmss	(Rows, Columns) float32 ...
CldOptDpth	(Rows, Columns) float32 ...
CloudHgtQF	(Rows, Columns) float32 ...
CldHgtFlag	(Rows, Columns, CldHgt(FigCnst)) float32 ...
ProcOrder	(Rows, Columns) float32 ...
Cost	(Rows, Columns) float32 ...
InverFlag	(Rows, Columns) float32 ...
TcError	(Rows, Columns) float32 ...
PcError	(Rows, Columns) float32 ...

## Resources

### JPSS Product Documentation:

- <https://www.star.nesdis.noaa.gov/jps/AlgorithmMaturity.php> (Variable explanations)
- [https://www.star.nesdis.noaa.gov/jps/JPSS\\_products.php](https://www.star.nesdis.noaa.gov/jps/JPSS_products.php) (Product description)
- [https://www.ospo.noaa.gov/Products/Suites/jps-r/count\\_JRR\\_product.html?product=aerosol](https://www.ospo.noaa.gov/Products/Suites/jps-r/count_JRR_product.html?product=aerosol) (JRR product visualization)
- <https://www.nesdis.noaa.gov/our-satellites/currently-flying/joint-polar-satellite-system/jps-satellite-and-instruments> (About the satellites)
- <https://rammb2.cira.colostate.edu/training/visit/jps-imagery-for-users/> (Data visualization)
- <https://weather.ndc.nasa.gov/sport/jpsppg/viirs.html> (Real-time product visualization)

### Coding Sources:

- <https://github.com/jps-nod4/python-scripts/tree/main>
- <https://medium.com/the-barometer/plotting-noaa-dnb-nighttime-data-using-python-h5py-cartopy-daeef240b0f>
- <https://github.com/modern-tools-workshop/AMS-python-workshop-2023>
- [https://www.met.ed.ac.uk/education\\_training/course/54](https://www.met.ed.ac.uk/education_training/course/54)
- [https://www.star.nesdis.noaa.gov/atmospheric-composition-training/python\\_abi\\_level2\\_download.php](https://www.star.nesdis.noaa.gov/atmospheric-composition-training/python_abi_level2_download.php)

# Questions and Discussion

- Please be brief in your questions / comments
- Use the chat or raise your hand for questions
- Identify who the question is directed to where possible
  - As questions are answered, we will go to the next in the chat queue and call on you to unmute yourself and ask your question.
  - We appreciate there may be questions that cannot be answered immediately and even those that we won't have an opportunity to get to: please be patient as we build our understanding and summary responses.





# Resources

We invite you to stay engaged with NOAA!

- **NOAA JPSS:**
  - <https://www.nesdis.noaa.gov/our-satellites/currently-flying/joint-polar-satellite-system>
- **NOAA Open Data Dissemination:**
  - [noaa.gov/nodd](https://noaa.gov/nodd)
  - Email: [NODD@noaa.gov](mailto:NODD@noaa.gov)
- **Google JPSS:**
  - <https://console.cloud.google.com/marketplace/product/noaa-public/noaa-jpss?hl=en&project=nmfs-trusted-images>

