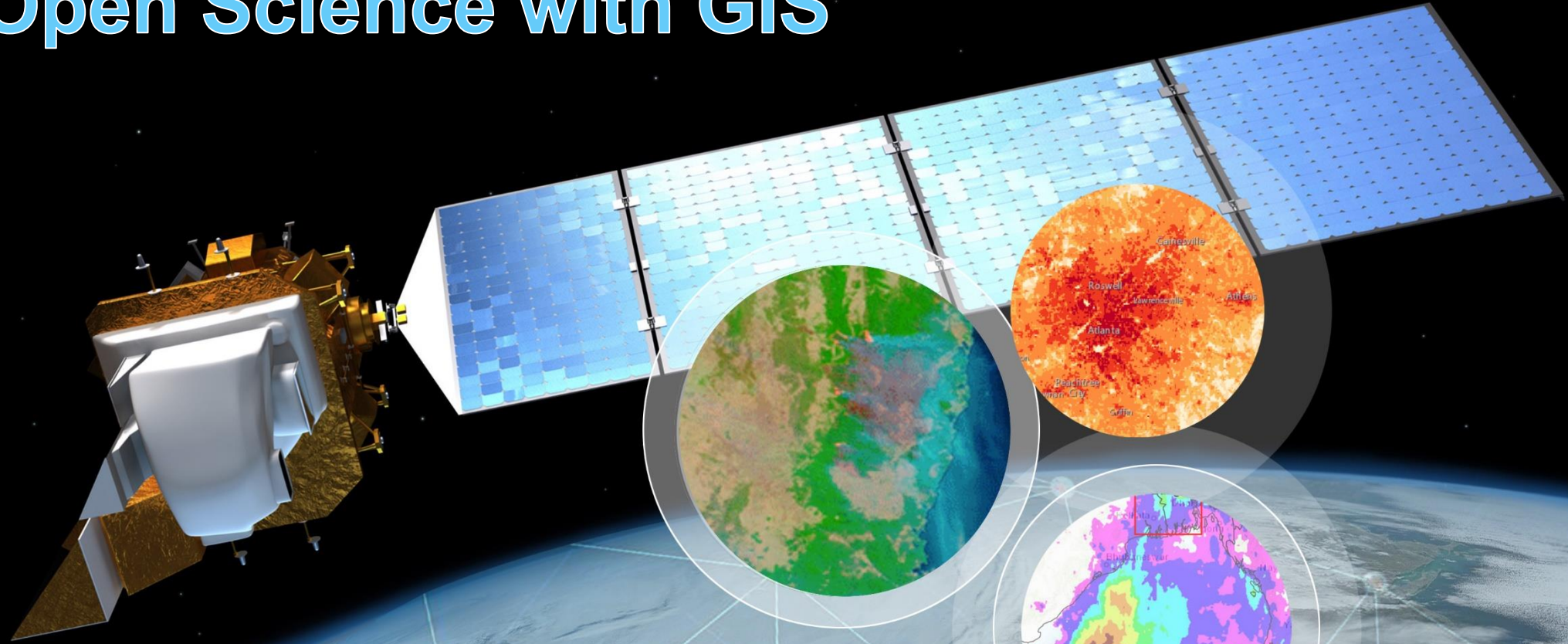


Using NASA Earth Observations to Enable Open Science with GIS

National Aeronautics and
Space Administration





Agenda

Intro to Earth Science

Data & Content

Discovery, Access and Use

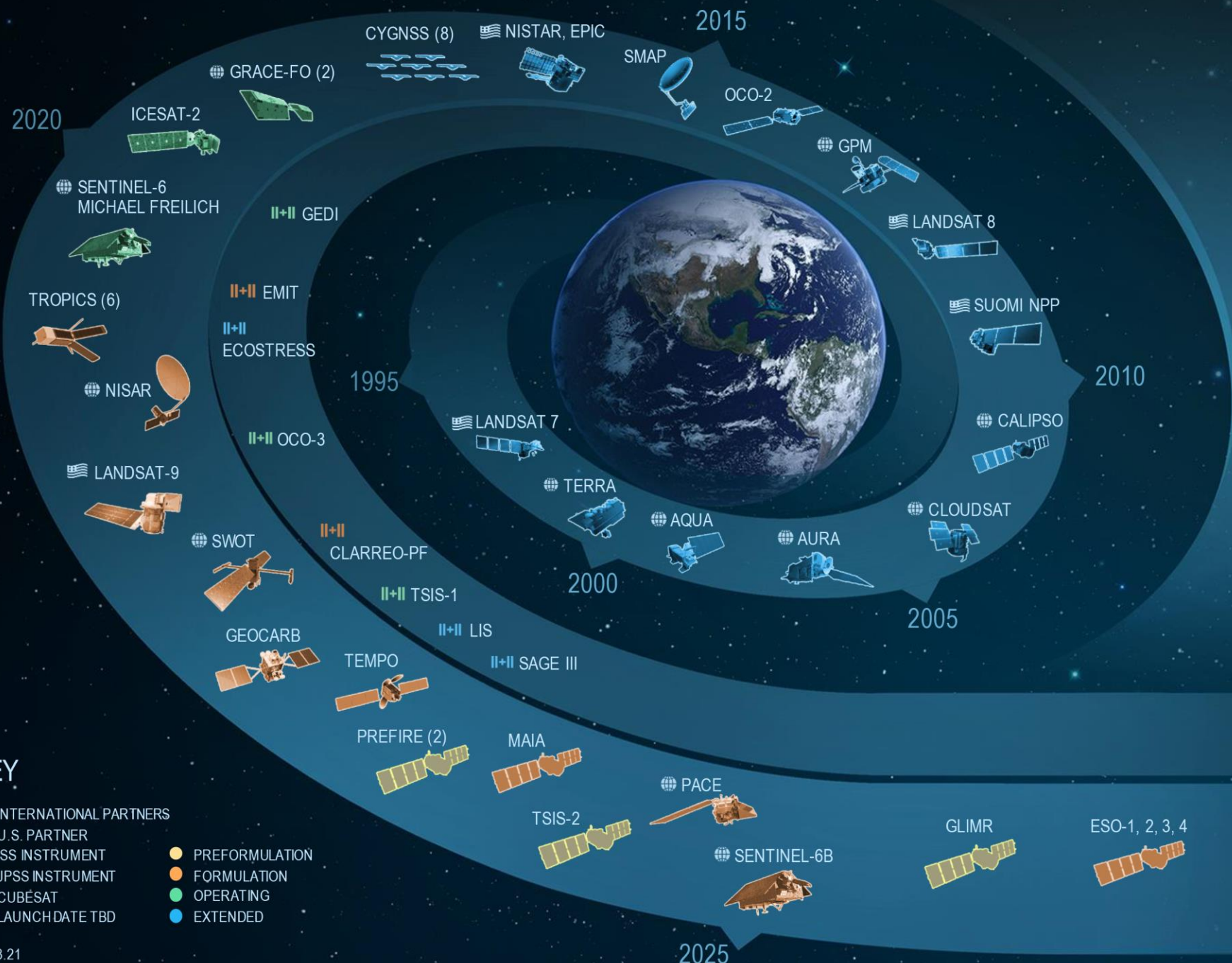
Applications with Earth observations

Resources

Engagement & Feedback!



EARTH FLEET



INVEST/CUBESATS

- CSIM-FD 2023
- HARP 2022
- CIRIS 2023
- CTIM* 2022
- HYT* 2022
- SNOOP* 2022
- NACHOS* 2022
- NACHOS2* 2022

JPSS INSTRUMENTS

- OMPS-LIMB 2022
- LIBERA 2027

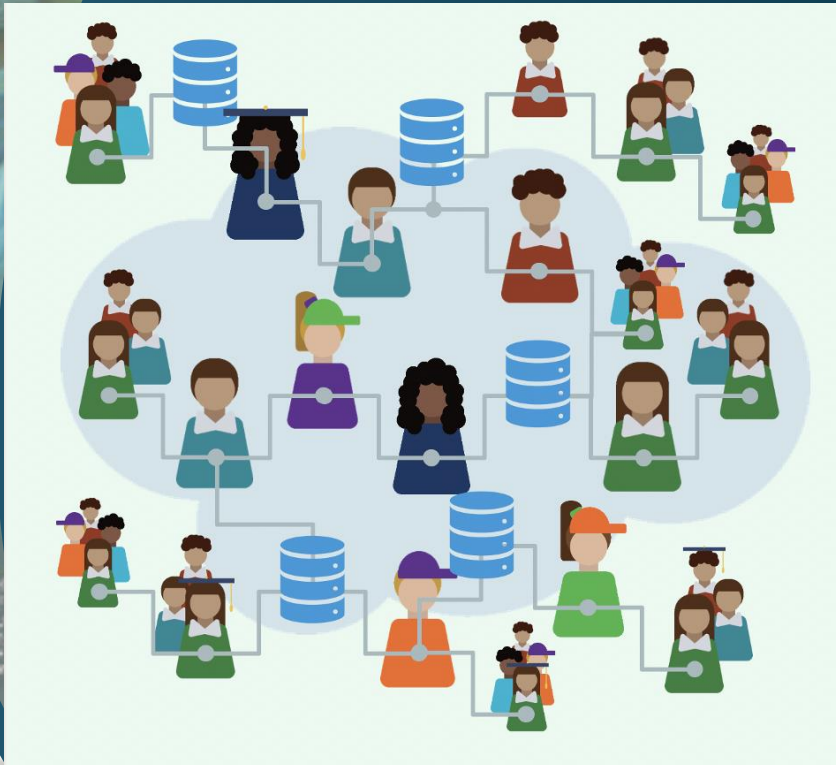
ISS INSTRUMENTS

MISSIONS

KEY

- INTERNATIONAL PARTNERS
- U.S. PARTNER
- ISS INSTRUMENT
- JPSS INSTRUMENT
- CUBESAT
- LAUNCH DATE TBD
- PREFORMULATION
- FORMULATION
- OPERATING
- EXTENDED

Open Data to fuel Open Science



"Information wants to be free."

--Stewart Brand

Building a new ecosystem to...

- ***Shorten the time*** it takes for a new user to find and learn how to use data
- ***Increase community contributions*** with hands-on engagement
- ***Explore and exploit data*** in new ways - share knowledge!
- ***Incentivize and energize*** innovation
- ***Complement efforts and enhance integration*** with uniquely designed, holistic, Earth-focused missions

A satellite view of Earth at night, showing city lights and cloud patterns over the Americas. The text "Accessing and Using NASA Earth Observations" is overlaid in the center in a light blue font.

Accessing and Using NASA Earth Observations

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

NASA Worldview

Interactively browse ~900 global, full-resolution satellite imagery layers (GIBS)

The screenshot displays the NASA Worldview web application interface. The main view is a satellite image of Earth, showing the continents of Africa, Europe, and Asia. The interface includes a sidebar on the left with the following sections:

- OVERLAYS**
 - Place Labels (© OpenStreetMap contributors, Natural Earth)
 - Coastlines / Borders / Roads (© OpenStreetMap contributors, Natural Earth)
 - Coastlines (© OpenStreetMap contributors)
- BASE LAYERS**
 - Corrected Reflectance (True Color) (Suomi NPP / VIIRS)
 - Corrected Reflectance (True Color) (Aqua / MODIS)
 - Corrected Reflectance (True Color)

At the bottom of the sidebar are buttons for "+ Add Layers" and "Start Comparison". The top right of the interface features a notification banner that says "Check out our new geostationary layers!" and a set of navigation icons (share, globe, camera, info). A scale bar in the bottom right indicates 2000 km and 1000 mi. The bottom of the interface shows a timeline with the date "2020 JAN 29" and a "1 DAY" interval, along with a "JAN 2020" label and navigation arrows.

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

More than viewing... Interacting!

The screenshot displays the NASA WorldView web application interface. On the left, a sidebar contains the following sections:

- Layers:** Includes icons for Layers, Events, and Data.
- Time Selection:** Shows two dates: A: 2018-04-21 and B: 2018-04-14.
- OVERLAYS:**
 - Mammal Richness - All Species:** Species: Global Mammal Richness Grids, 2015 Release (2013). Includes a color scale legend with the number 137.
 - Land Cover Type (L3, IGBP, Yearly):** Terra and Aqua / MODIS. Includes a color legend.
 - Place Labels:** © OpenStreetMap contributors, Natural Earth.
 - Coastlines / Borders / Roads:** © OpenStreetMap contributors.
 - Coastlines:** © OpenStreetMap contributors.
- BASE LAYERS:**
 - Corrected Reflectance (True Color) NOAA-20 / VIIRS
 - Corrected Reflectance (True Color) Suomi NPP / VIIRS
 - Corrected Reflectance (True Color)
 - Group Similar Layers
- COMPARE MODE:** Swipe, Opacity, Spy.
- Buttons:** + Add Layers, Exit Comparison.

The main map area shows a comparison of two satellite images of Africa. The left image (A) is a true-color satellite image, and the right image (B) is a false-color image showing mammal richness. A vertical line separates the two images, with a double-headed arrow and labels 'A' and 'B' below it. The right image shows a color scale from blue (low richness) to red (high richness). The interface includes a search bar at the top right, a scale bar (1000 km / 500 mi) at the bottom right, and a timeline at the bottom showing the date 2018 APR 14 and navigation controls.

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

Earthdata Search

Download Data Files

EARTHDATA Find a DAAC - Feedback ?

EARTHDATA SEARCH Earthdata Login

Search for collections or topics

Search Results (1,057 Collections)

MODIS/Terra+Aqua Leaf Area Index/FPAR 8-Day L4 Global 500m SIN Grid V006

Showing 20 of 248,217 matching granules Sort View

MCD15A2H.A2021097.h05v1 3.006.2021107075938.hdf	MCD15A2H.A2021097.h07v0 3.006.2021107075837.hdf
START 2021-04-07 00:00:00 END 2021-04-14 23:59:59	START 2021-04-07 00:00:00 END 2021-04-14 23:59:59
MCD15A2H.A2021097.h09v0 4.006.2021107075728.hdf	MCD15A2H.A2021097.h01v1 1.006.2021107075752.hdf
START 2021-04-07 00:00:00 END 2021-04-14 23:59:59	START 2021-04-07 00:00:00 END 2021-04-14 23:59:59
MCD15A2H.A2021097.h22v1 3.006.2021107080016.hdf	MCD15A2H.A2021097.h06v0 3.006.2021107075516.hdf

248,217 Granules **Download All** 248,217 Granules

Search Time: 0.3s

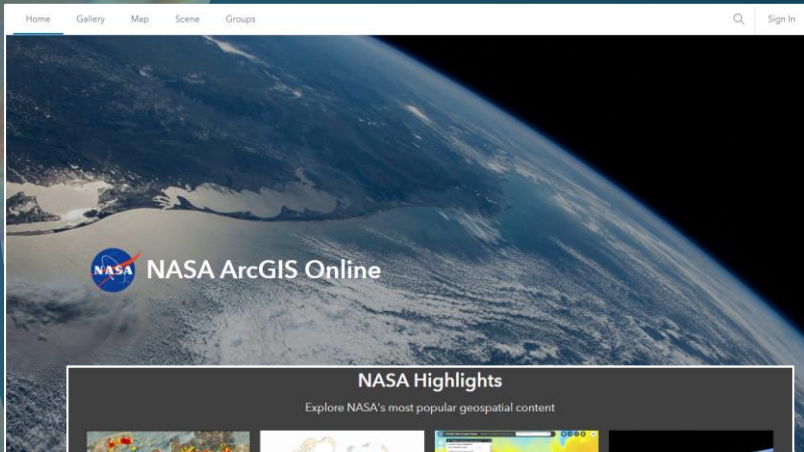
MONTH MODIS/Terra+Aqua Leaf Area Index/FPAR 8-Day L4 Global 500m SIN Grid...

May Jun Jul Aug Sep Oct Nov Dec Jan 2021 Feb Mar Apr

<https://nasa.maps.arcgis.com/home/index.html>

NASA's ArcGIS Online (AGOL)

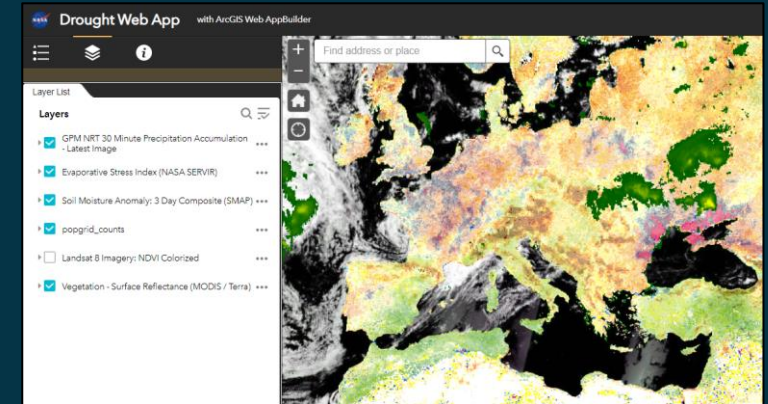
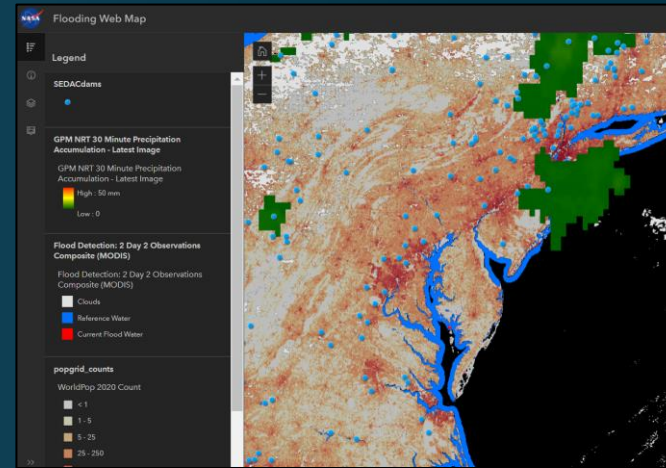
Publicly Available Collaborative Web Maps



NASA Highlights

Explore NASA's most popular geospatial content

- NASA Products for the Explosion in Lebanon August 2020**
- Gridded Population of the World...** GPNv4 is a gridded data product that depicts global population data from the 2010 round of Popu...
- POWER Data Access Viewer** POWER Data Access Viewer (DAV) supports access to community-based to analysis ready
- GIS at NASA** Geographic Information Systems - going beyond mapping! Providing powerful capabilities to visuali...
- Water States - Corrected Reflect...** This visualization represents a 'false color' band combination (M3-I3-M1) of data continuously colle...
- Lake Victoria Rising Water Levels**
- Cyclone Amphan** Cyclone Amphan hit Indian and Bangladesh in May 2020.
- True Color - Corrected Reflecta...** This visualization represents a 'true color' band combination (I1-M4-M3) of data continuously collected...



Publicly Available Story Maps

Shifting the 2019-2020 Australian Bushfire using NASA Data

Global temperatures in 2019 were 2 °F (1.1 °C) warmer than in the late 19th century, according to scientists at NASA's Goddard Institute for Space Studies (GISS) in New York. Temperatures in 2019 were second only to those of 2016 and continued the planet's long-term warming trend. The last six years on the instrumental record have been the warmest.

As seen in the figure below, the average annual temperature in Australia has been steadily increasing. The Australian Bureau of Meteorology has placed 2019 as the hottest year on record so far.

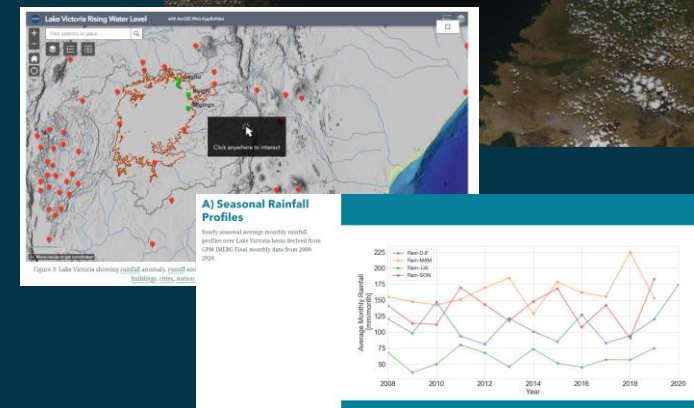
Australia has been getting warmer

Annual mean temperature above or below average (°C)

Image Credit: BOM, 'Australia from a visual point in the'

Lake Victoria Rising Water Levels

December 9, 2020



Living Atlas of the World

By NASA_Earthdata



NASA Earthdata
NASA_Earthdata

Bio

NASA's Earth Science Data Systems (ESDS) program oversees the life cycle of NASA's Earth science data—from acquisition through processing and distribution. The primary goal of ESDS is to maximize the scientific return from NASA's missions and experiments for research and applied scientists, decision makers, and society at large.

Our vision is to make NASA's free and open Earth science data interactive, interoperable, and accessible for research and societal benefit both today and tomorrow.

ESDS falls within the purview of the Earth Science Division (ESD), under the Science Mission Directorate at NASA Headquarters. For more information on ESDS please visit <https://earthdata.nasa.gov/esds>

For information regarding content hosted by

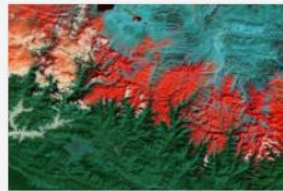
Item gallery

Top items based on relevance.

View all



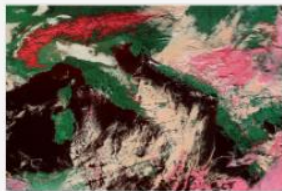
True Color - Corrected Reflectance (...)
Imagery Layer



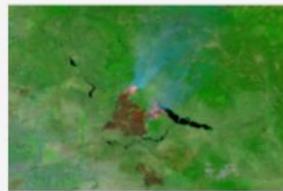
Water States - Corrected Reflectanc...
Imagery Layer



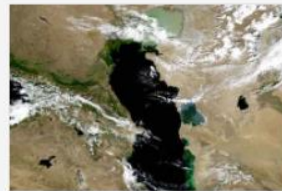
True Color - Corrected Reflectance (...)
Imagery Layer



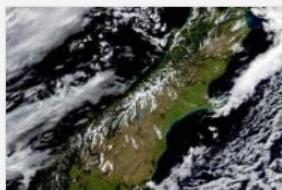
Water States - Corrected Reflectanc...
Imagery Layer



Burn Scar - Corrected Reflectance (...)
Imagery Layer



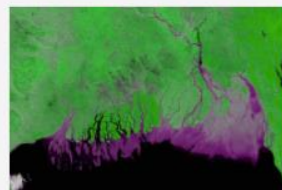
True Color - Surface Reflectance (M...
Imagery Layer



True Color - Surface Reflectance (M...
Imagery Layer

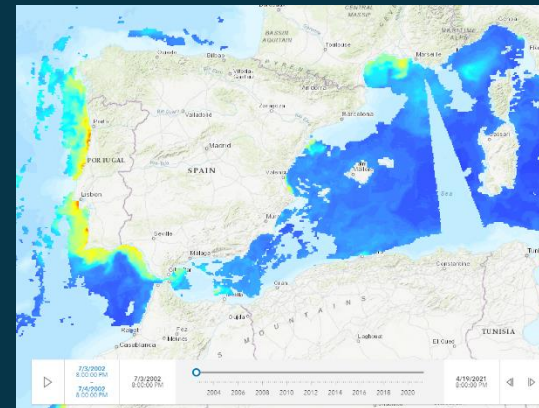


Burn Scar - Corrected Reflectance (...)
Imagery Layer



Vegetation - Surface Reflectance (M...
Imagery Layer

Chlorophyll



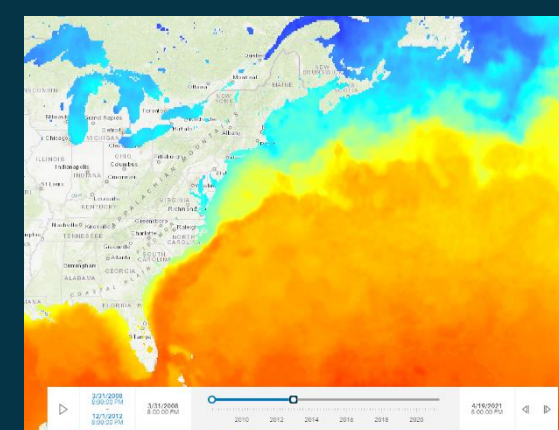
Seasonal Changes



Earth at Night

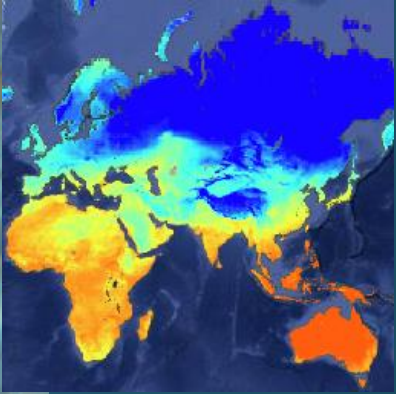


Sea Surface Temp

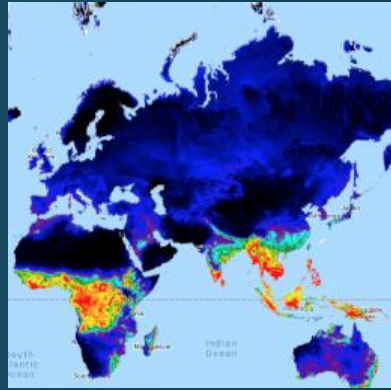


Google Earth Engine

Global Land Data Assimilation System



FEWS NET LDAS



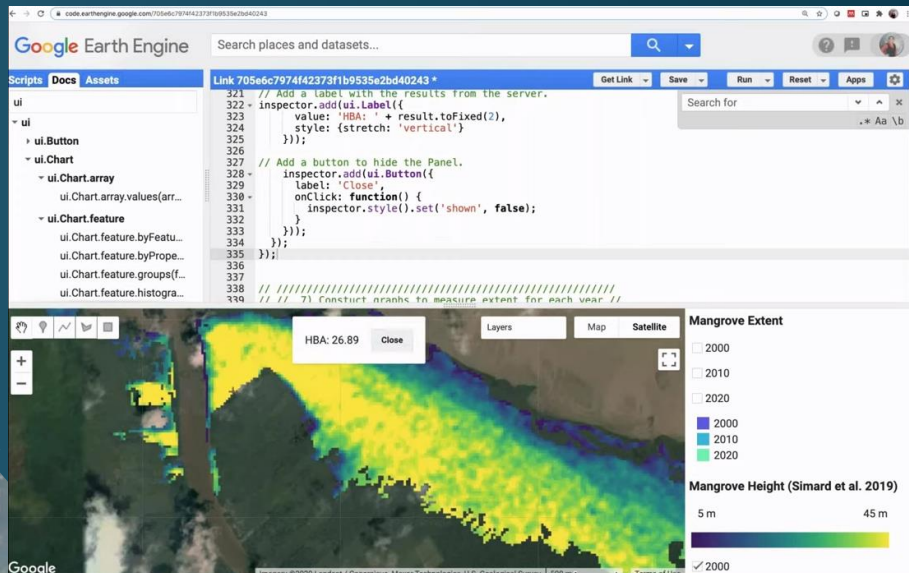
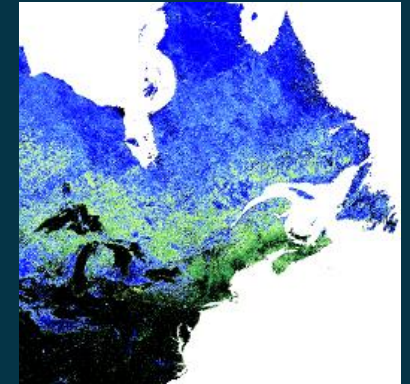
SRTM Digital Elevation Data



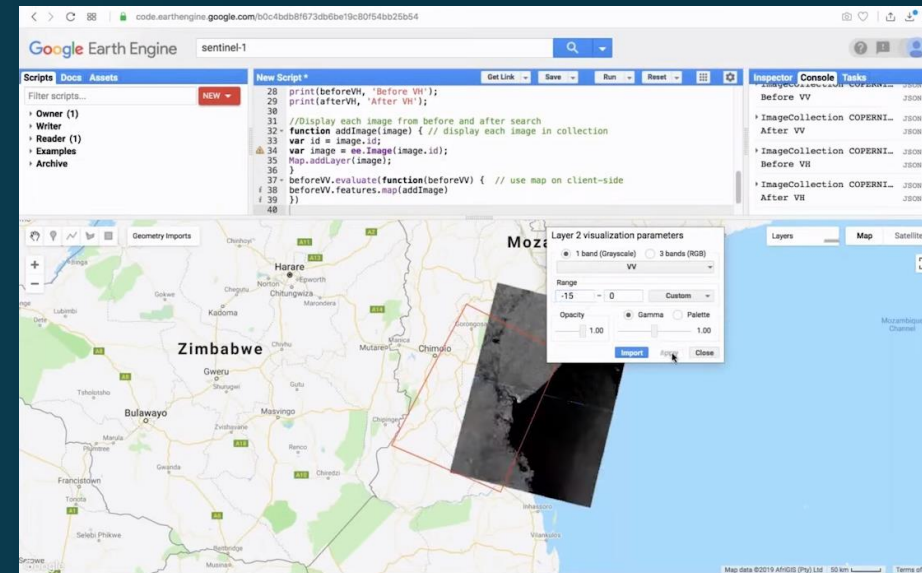
MODIS Leaf Area Index



Terra Snow Cover Daily



```
221 // Add a label with the results from the server.
222 inspector.add(ui.Label({
223   value: 'HBA: ' + result.toFixed(2),
224   style: {stretch: 'vertical'}
225 }));
226
227 // Add a button to hide the Panel.
228 inspector.add(ui.Button({
229   label: 'Close',
230   onClick: function() {
231     inspector.style().set('shown', false);
232   }
233 }));
234
235 ///////////////////////////////////////////////////////////////////
236 // !! !! !! Construct graphs to measure extent for each year !!
237
```



```
28 print(beforeVW, 'Before VW');
29 print(afterVW, 'After VW');
30
31 //Display each image from before and after search
32 function addImage(image) { // display each image in collection
33   var id = image.id;
34   var img = ee.Image(image.id);
35   Map.addLayer(image);
36 }
37 beforeVW.evaluate(function(beforeVW) { // use map on client-side
38   beforeVW.features.map(addImage)
39 });
40
```

NASA Applied Remote Sensing Training (ARSET) Program

Vertex: <https://search.asf.alaska.edu/>

On-Demand RTC:

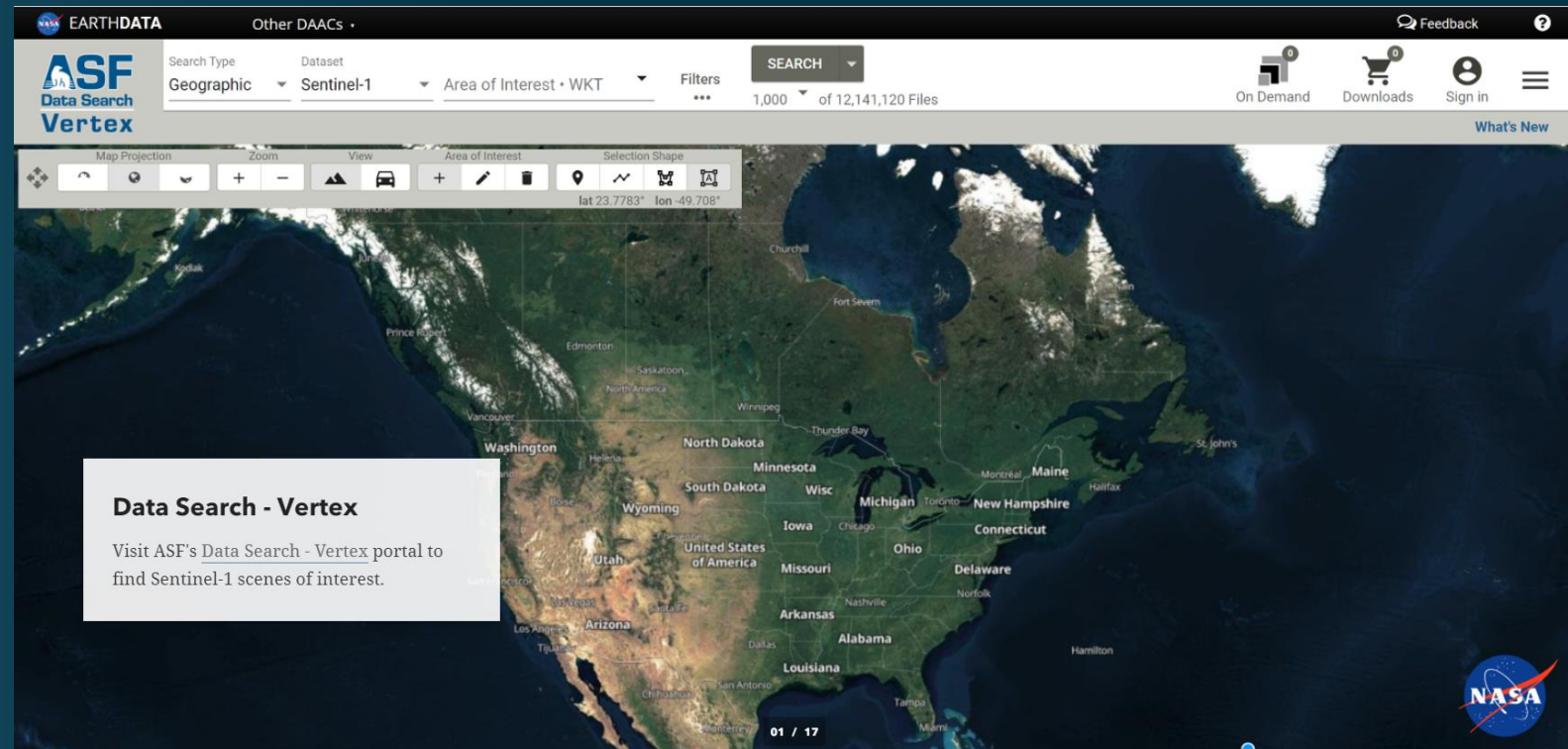
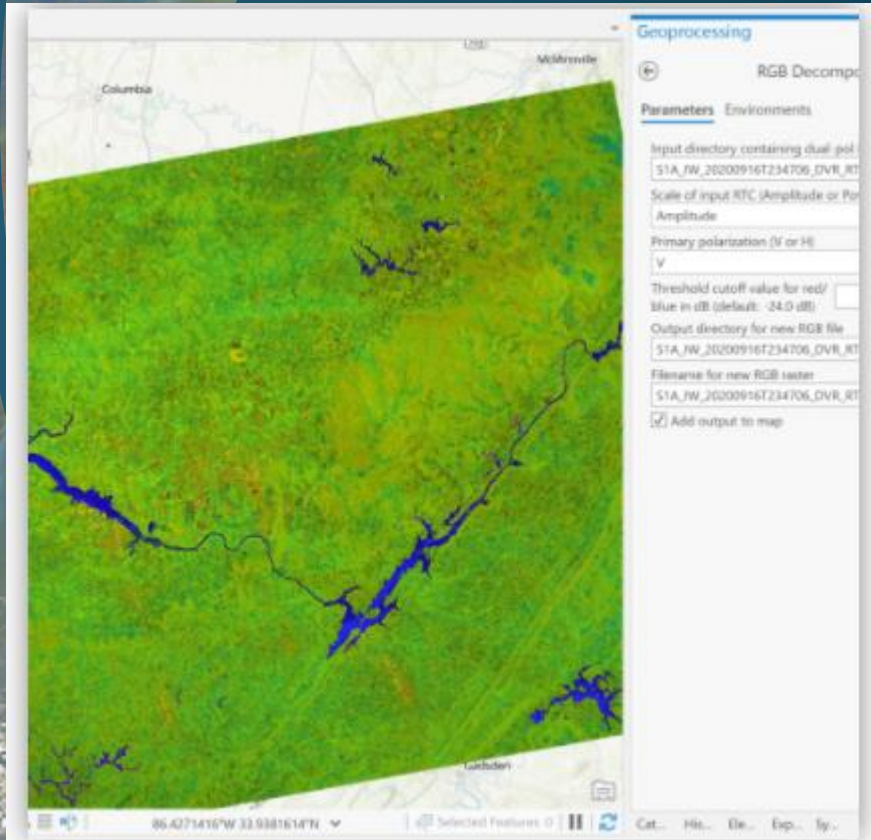
<https://hyp3-docs.asf.alaska.edu/using/vertex/>

ArcGIS Toolbox:

<https://asf.alaska.edu/how-to/data-tools/gis-tools/>

Alaska Satellite Facility - Synthetic Aperture Radar (SAR)

Radiometric Terrain Correction (RTC) Imagery



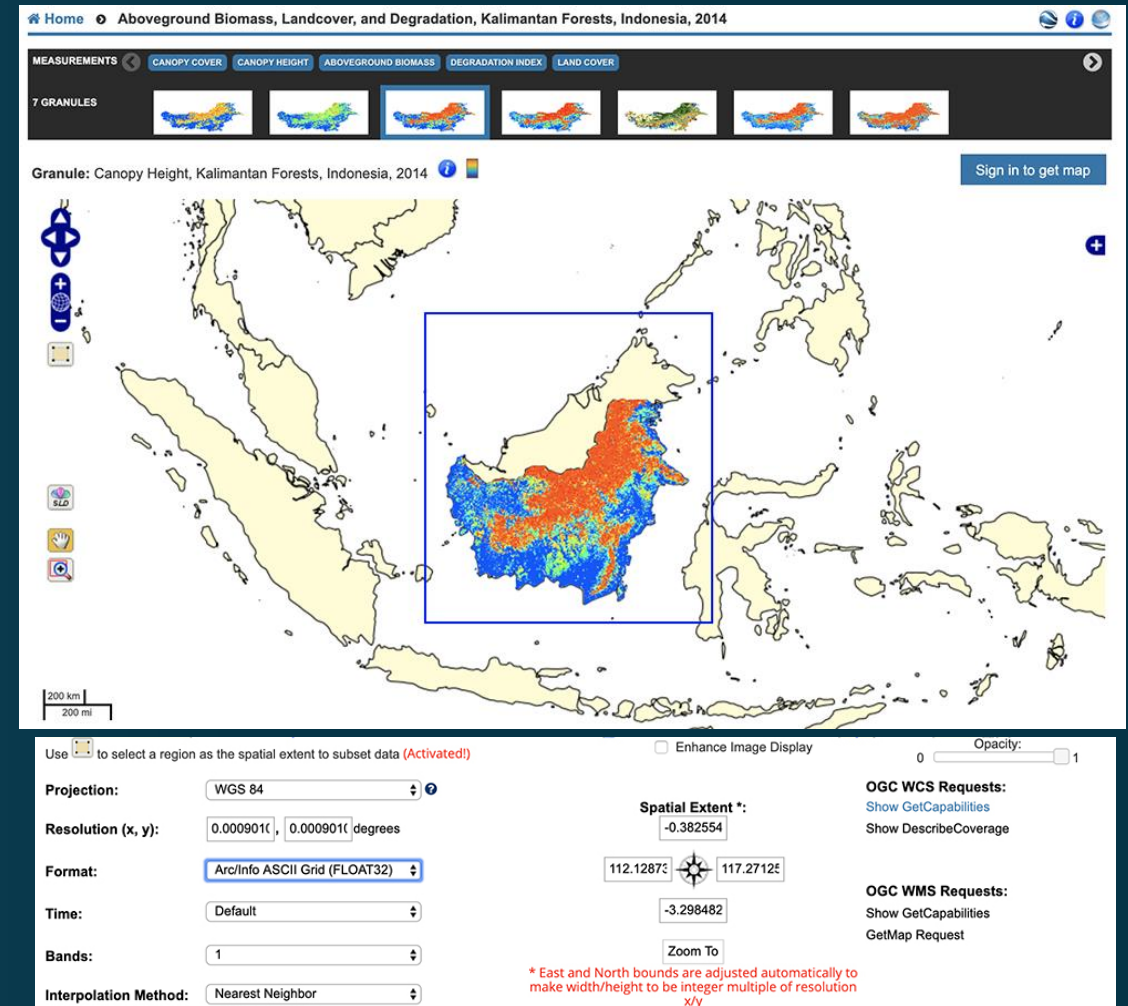
Python Toolbox used with either ArcGIS Desktop or ArcGIS Pro, and contains tools that perform geoprocessing tasks useful for working with SAR data.

Oak Ridge National Laboratory (ORNL) DAAC

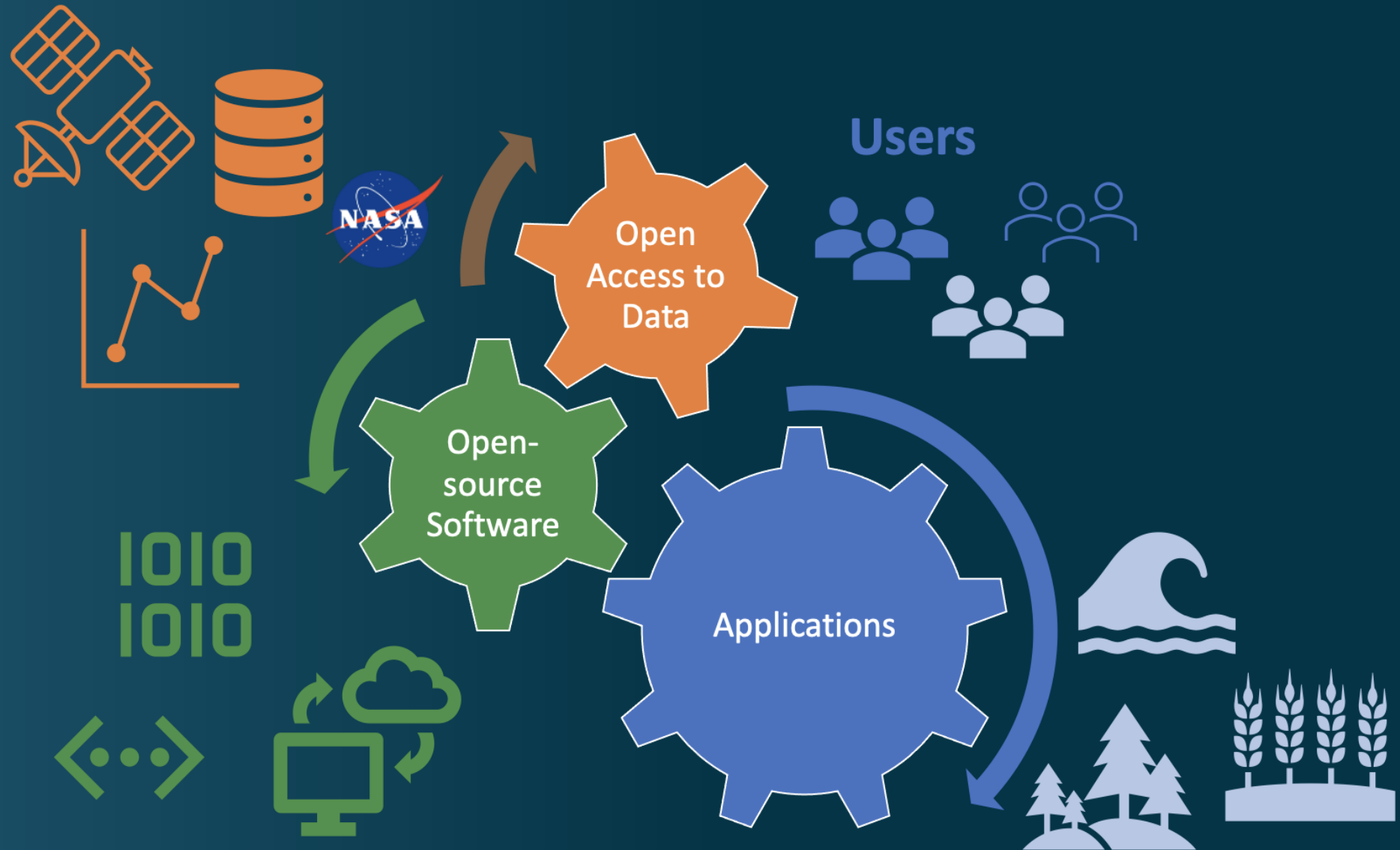
Spatial Data Access Tool (SDAT)

Disciplines:

- Agriculture (7)
- Atmosphere (46)
- Biological Classification (1)
- Biosphere (124)
- Climate Indicators (4)
- Cryosphere (5)
- Field Investigation (6)
- Human Dimensions (28)
- Land Surface (109)
- Oceans (5)
- Spectral/Engineering (5)
- Terrestrial Hydrosphere (21)



Open Science – Applying the Data



Earth Applied Sciences

The Program supports projects that enable innovative uses of NASA Earth science data in organizations' policy, business and management decisions. The project results and enhanced decision making to improve quality of life and strengthen economies.

Program Areas:

- Capacity Building
- Disasters
- Ecological Forecasting
- Health and Air Quality
- Water & Agriculture Resources

NASA Applied Remote Sensing Training (ARSET)

Free, online and in-person remote sensing trainings!



Check us out on YouTube

NASA Video

Search “ARSET”



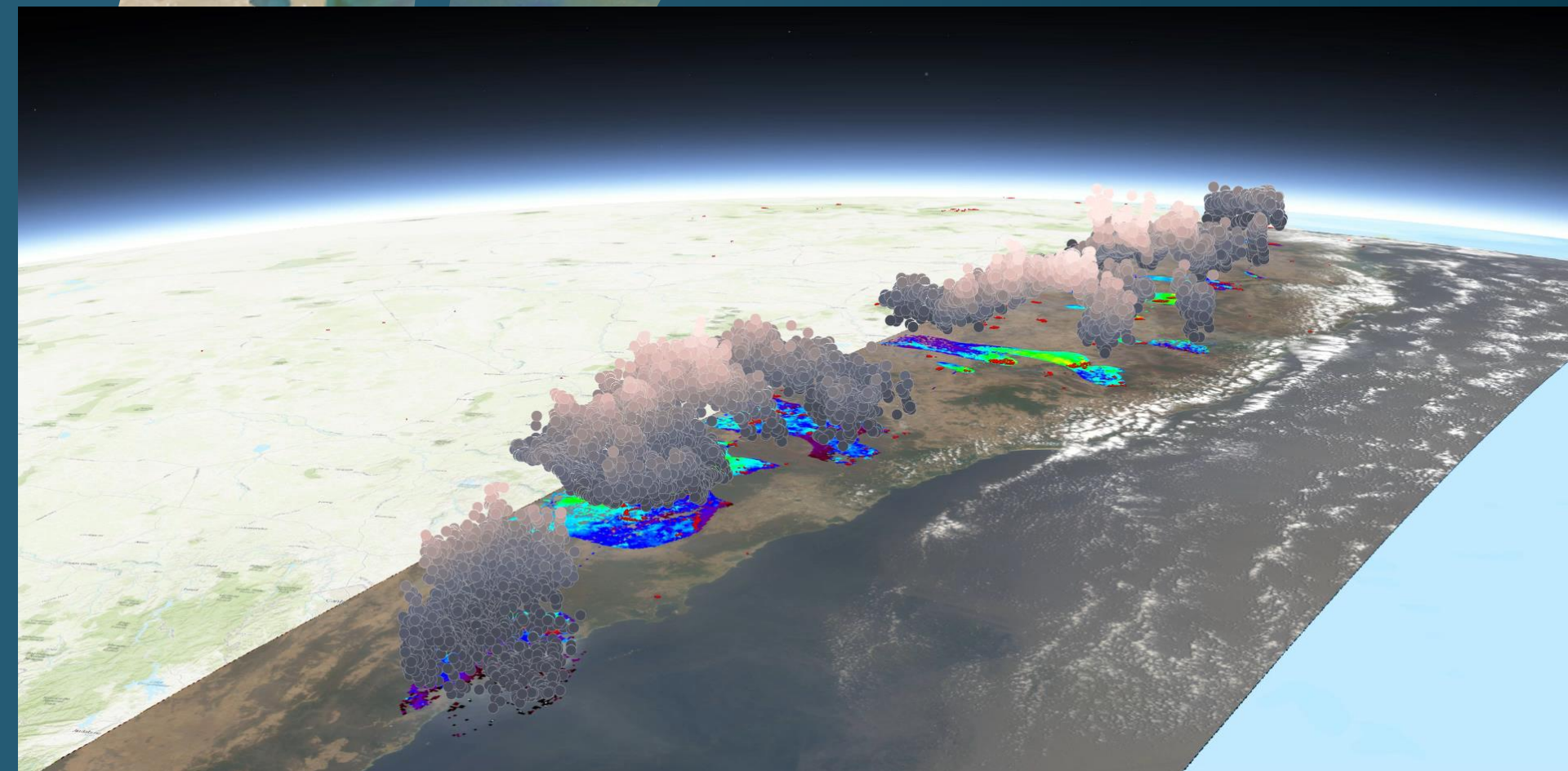
And on Twitter

@nasaarset



Event-Based Products

Exaggerated (20x) Australia Fire Smoke Plume Height (MISR)
12/16/19



GIS Products

- Free and openly available GIS Products
- Esri REST and WMS Endpoints
- Event-based and Near Real-Time Products

Learn More:

<https://disasters.nasa.gov>

GIS Portal:

<https://maps.disasters.nasa.gov>

Contact:

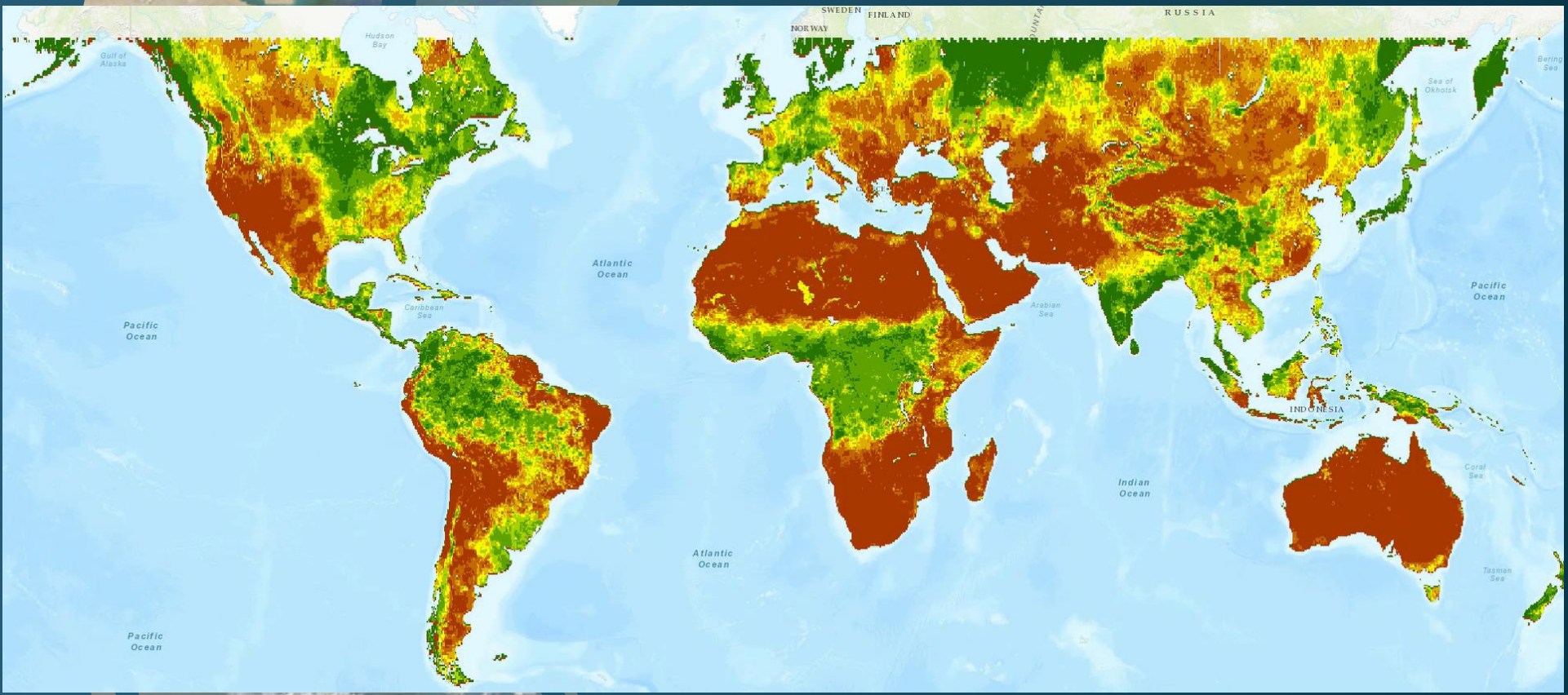
HQ-Disasters-GIS@mail.nasa.gov

View this web app in the Disasters GIS Portal
<https://maps.disasters.nasa.gov>



Near Real-Time Products

SMAP-Based Soil Moisture



Near Real-Time Products

- Soil Moisture
- Flood Extent
- Thermal Hot Spots
- Global Precipitation
- Landslide Nowcast
- Evaporative Stress Index

Learn More:
<https://disasters.nasa.gov>

GIS Portal:
<https://maps.disasters.nasa.gov>

Contact:
HQ-Disasters-GIS@mail.nasa.gov

View this soil moisture product and more
in the Disasters GIS Portal
<https://maps.disasters.nasa.gov>



Interactive Story Maps and Apps

NASA Disasters Program Mapping Portal: Products from Recent Tropical Cyclones

Hurricane Dorian

Scientists in the NASA Disasters Program used Synthetic Aperture Radar (SAR) from Copernicus Sentinel-1 to detect flooding beneath the clouds shown by GOES-16 on September 2, 2019.

Credits: ARIA Team, NASA/JPL-Caltech, NOAA

Use of this product should include:
"Contains modified Copernicus Sentinel data (2019) processed by ESA"

Showing What Is Possible

- Story Maps
- Dashboards
- 3D Web Apps

Learn More:
<https://disasters.nasa.gov>

GIS Portal:
<https://maps.disasters.nasa.gov>

Contact:
HQ-Disasters-GIS@mail.nasa.gov

View the Hurricane Dorian Story Map and more
in the Disasters GIS Portal
<https://maps.disasters.nasa.gov>

Prediction of Worldwide Energy Resources (POWER)

Objective is to integrate environmental data, analysis, and modeling from NASA research to enhance decision support in three user communities 1) Renewable Energy, 2) Sustainable Buildings, and 3) Agroclimatology with community specific geospatially enabled Analysis Ready Data (ARD) for use in decision support tools and in research.

Type: Solar and Meteorological Data

Spatial: Global Availability (0.5° x 0.5° grid)

Temporal: Daily, Interannual, Climatology

Time Series: Up to 38 Years of daily data

Availability: 3-5 Days of Near Real Time (NRT)

Parameters: 275+ Solar and Meteorological

Access: WEB, API, ArcGIS Services, OPeNDAP

Formats: JSON, NetCDF, CSV, ASCII, ICASA

Contact: power-project@lists.nasa.gov





Resources to Get Started

Pathfinders and Toolkits

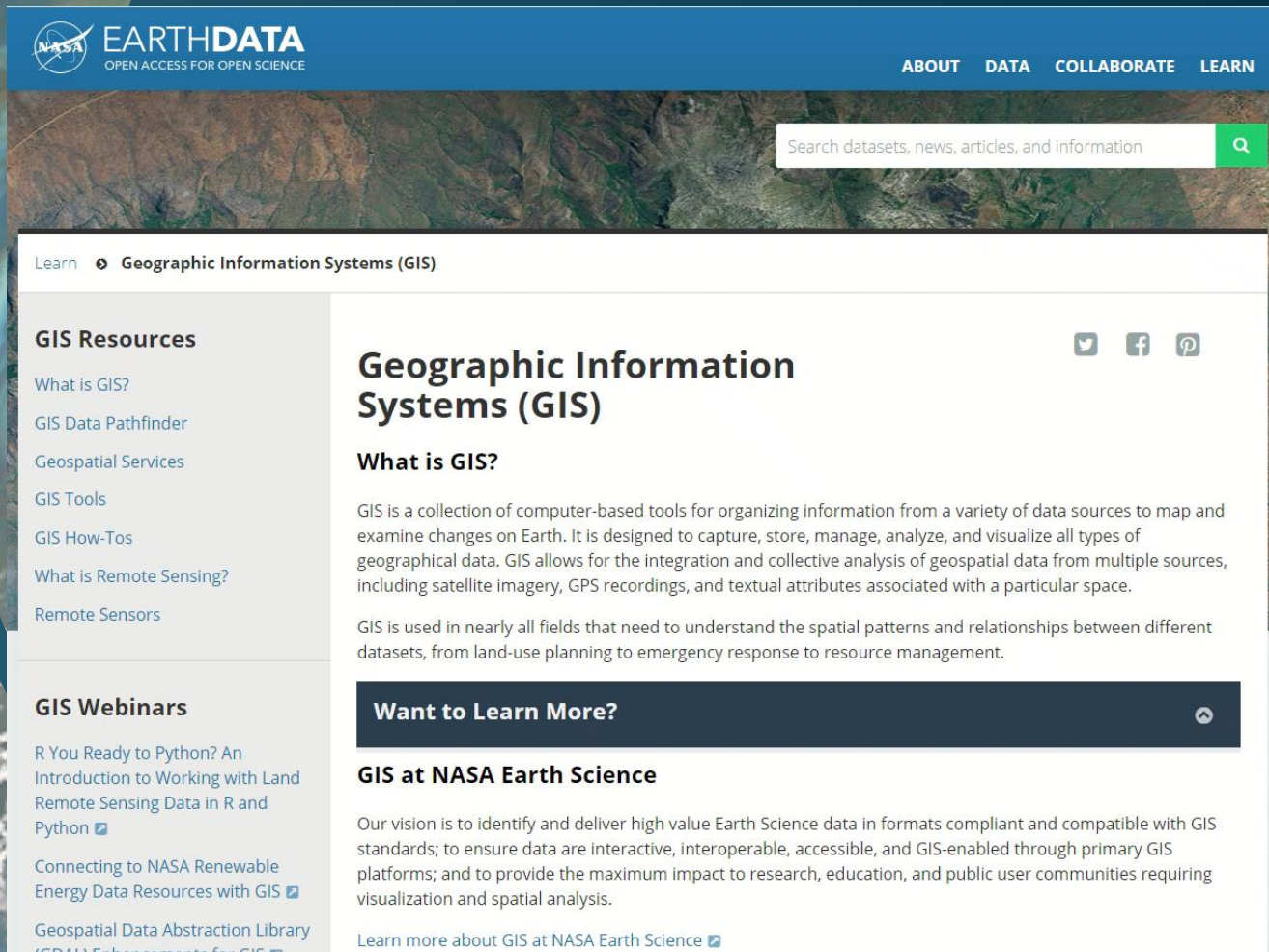


Pathfinders are data product selection guides focused on a science discipline or application areas. They help users find, visualize and use the data.

Data Toolkits provide links to datasets, tutorials and how-tos, feature articles and Data User Profiles, as well as other useful information.

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

Resources for New Users



The screenshot shows the NASA EarthData website's GIS page. The header includes the NASA logo, the text 'EARTHDATA OPEN ACCESS FOR OPEN SCIENCE', and navigation links for 'ABOUT', 'DATA', 'COLLABORATE', and 'LEARN'. A search bar is positioned above a satellite map background. The main content area is titled 'Learn Geographic Information Systems (GIS)'. On the left, there is a sidebar with 'GIS Resources' and 'GIS Webinars' sections. The main content features a 'Geographic Information Systems (GIS)' article with a 'What is GIS?' section, a 'Want to Learn More?' button, and a 'GIS at NASA Earth Science' section.

GIS Resources

- What is GIS?
- GIS Data Pathfinder
- Geospatial Services
- GIS Tools
- GIS How-Tos
- What is Remote Sensing?
- Remote Sensors

GIS Webinars

- R You Ready to Python? An Introduction to Working with Land Remote Sensing Data in R and Python
- Connecting to NASA Renewable Energy Data Resources with GIS
- Geospatial Data Abstraction Library (GDAL) Enhancements for GIS

Geographic Information Systems (GIS)

What is GIS?

GIS is a collection of computer-based tools for organizing information from a variety of data sources to map and examine changes on Earth. It is designed to capture, store, manage, analyze, and visualize all types of geographical data. GIS allows for the integration and collective analysis of geospatial data from multiple sources, including satellite imagery, GPS recordings, and textual attributes associated with a particular space.

GIS is used in nearly all fields that need to understand the spatial patterns and relationships between different datasets, from land-use planning to emergency response to resource management.

Want to Learn More?

GIS at NASA Earth Science

Our vision is to identify and deliver high value Earth Science data in formats compliant and compatible with GIS standards; to ensure data are interactive, interoperable, accessible, and GIS-enabled through primary GIS platforms; and to provide the maximum impact to research, education, and public user communities requiring visualization and spatial analysis.

Learn more about GIS at NASA Earth Science

Earthdata GIS page provides links to EOSDIS GIS resources, from webinars to data recipes to story maps.

<https://earthdata.nasa.gov/learn/user-resources/webinars-and-tutorials>

<https://www.youtube.com/c/NASAEarthdata>

Webinars & Tutorials

EARTHDATA

NASA Earthdata
5.7K subscribers

SUBSCRIBED

HOME VIDEOS PLAYLISTS COMMUNITY CHANNELS ABOUT

Data Recipes & Short Tutorials ▶ PLAY ALL

- GIS at NASA Earth Science**
NASA Earthdata
683 views • 3 months ago
- Discover Earth Science Data Resources at NASA...**
NASA Earthdata
754 views • 6 months ago
- Understanding NASA's Global Ecosystem Dynamics...**
NASA Earthdata
938 views • 11 months ago
- Getting Started with NASA Worldview**
NASA Earthdata
6.1K views • 11 months ago
- Navigating the New LP DAAC Website: Searching for Data**
NASA Earthdata
750 views • 1 year ago

Earthdata Forum

DAAC Data Recipes

Post Reply Search this question...

DAAC Data Recipes

by **asdc_user_services** » Tue Oct 27, 2020 1:42 pm America/New_York

This page provides links to the Data Recipe resources (also called How-To or Tutorials) available from Earthdata Forum member DAACs. The titles below the link for each DAAC are examples of the topics covered. The number in brackets indicate the total number of available resources covering additional topics. For an introduction on how to use the Forum please view our recorded webinar:
YouTube Link: <https://youtu.be/kCKyQscsXWA>

EARTHDATA Forum

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.

Quick links: [FAQ](#) [Data Recipes](#)

Home

It is currently Fri Dec 18, 2020 12:57 pm America/New_York

[Post a New Question](#)

SEARCH

Search for keywords, tags... [Advanced Search](#)

OR

SEARCH BY TAGS

Discipline	DAAC	Major Projects	Services/Usage
Select	Select	Select	Select

Services/Usage

- Select
- Select
- Algorithms
- Cloud
- Data Access
- Data Download
- Data Processing
- Data Recipes
- Data Search
- Data Visualization
- Documentation
- FAQ
- General Science
- Giovanni
- GIS Tools**
- SeaDAS
- SOOT

Engage!

Feedback is **critical** - <https://go.nasa.gov/32sYa1g>



- What data product?
- What format?
- What distribution method (files vs. services)?
- What tool does the data need to 'work' in?

Uncovering Needs to Broaden Outside Use of NASA Data
(UNBOUND)

Research Opportunities

- Citizen Science for Earth Systems Program (CSESP)
- ACCESS, ROSES, AIST



Thank you!

EXPLORE
with us



References

NASA Worldview (Imagery)	https://worldview.earthdata.nasa.gov/
Earthdata Search (Data)	https://search.earthdata.nasa.gov/
GIS Data Pathfinder	https://earthdata.nasa.gov/learn/pathfinders/gis-pathfinder
Data Toolkits	https://earthdata.nasa.gov/learn/toolkits
NASA ArcGIS Online (AGOL)	https://nasa.maps.arcgis.com/
Earthdata Forum	https://forum.earthdata.nasa.gov/
NASA Earth Science GIS - User Feedback	https://go.nasa.gov/32sYa1g