https://ntrs.nasa.gov/search.jsp?R=20190034095 2020-03-11T16:13:28+00:00Z

NASA GIBS and Worldview: Visualizing NASA's Earth Science Data for All to Explore

ED11B-0868

https://worldview.earthdata.nasa.gov https://earthdata.nasa.gov/gibs

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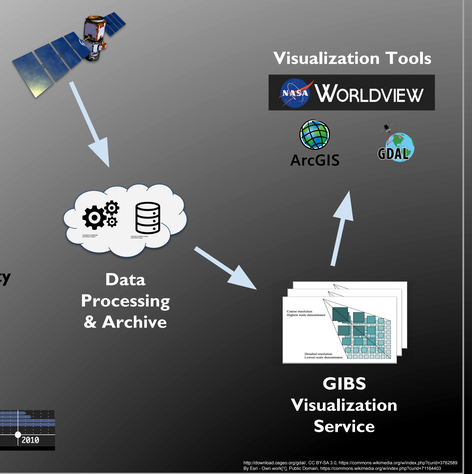
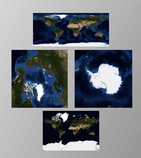
What is GIBS?

The **G**lobal **I**magery **B**rowse **S**ervices (GIBS) provides full resolution visualizations of NASA Earth science data through a free, open, and interoperable application programming interface. Through responsive and highly available web services, it enables interactive exploration of data to support a wide range of applications including scientific research, applied sciences, natural hazard monitoring, education, outreach, and more. The GIBS visualization catalog includes over 900 layers representing hundreds of science parameters. Many visualizations are available within a few hours after satellite overpass, some within minutes, and some span over 18 years.

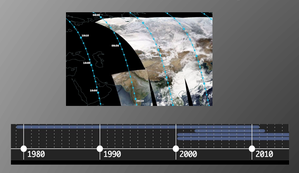


"Native" Sensor Resolution

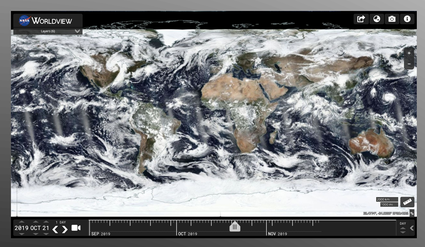
Multiple Map Projections



Near Real-Time and Full-Mission Availability



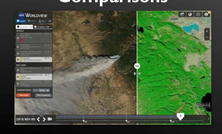
http://download.osgeo.org/gdal, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=27629399
By Eric - Own work(?), Public Domain, https://commons.wikimedia.org/w/index.php?curid=7719403



What is Worldview?

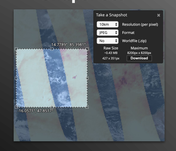
The Worldview tool provides the capability to interactively browse global full-resolution satellite and in-situ visualizations served by the GIBS system. Users may select visualizations based on a curated list of science parameters or current natural events including wildfires, tropical storms, and volcanic eruptions. Visualizations from multiple instruments may be viewed simultaneously to better understand the earth's processes. Users may easily share their individually-selected visualizations with others. Worldview is supported on desktop, tablet, or smartphone devices. Desktop browsing provides a full interactive experience to the following capabilities.

Comparisons



Select from three methods to compare customized visualizations differing by the selected layers and/or date.

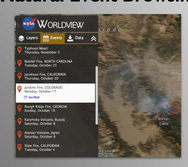
Snapshots



Capture a static snapshot image or animated GIF of your current view to share with others.

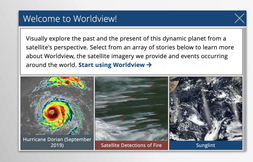
Animations

Natural Event Browsing



Browse visualizations via a curated list of natural events.

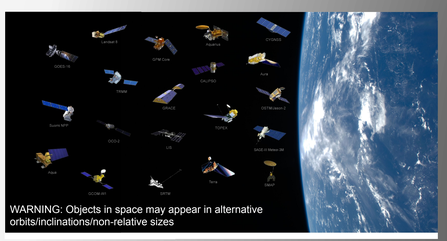
Interactive Tour



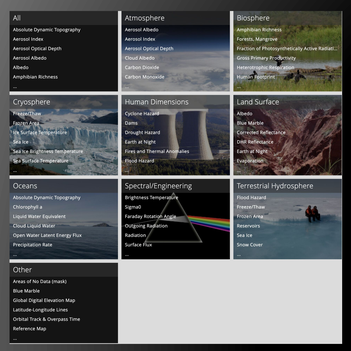
Learn about recent observations, science discoveries, and Worldview features.

Imagery Platforms

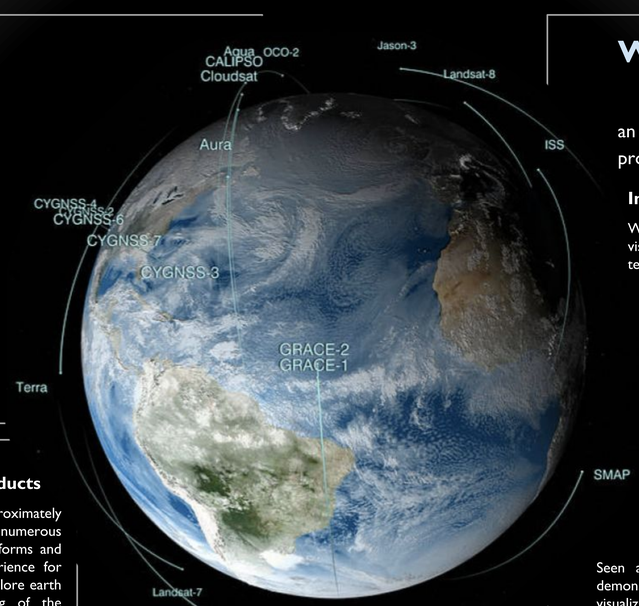
GIBS and Worldview provide visualizations from dozens of remote sensing platforms, instruments, and scientific disciplines.



The image above show the variety of satellites capturing remote sensed earth science data on which GIBS and Worldview visualizations are based.



The image above shows GIBS and Worldview visualizations organized by scientific discipline.

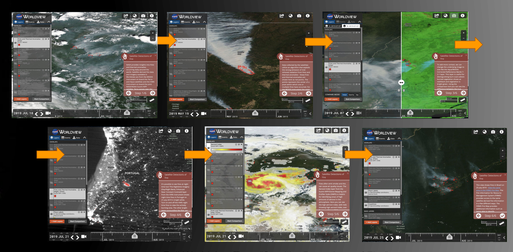


Worldview Highlights

The Worldview team is continually adding new features to benefit an expanding user community. The information in this section provides an overview of major accomplishments over the past year.

Interactive Tours

Worldview users may use an interactive tour to learn about notable natural events, visualization phenomena, and existing or new Worldview features. The Worldview team regularly adds new tour stories curated to meet users' interests and needs.



Full Worldview Tour: "Satellite Detections of Fire"

Seen above are the steps in a tour demonstrating various ways to view visualizations of fire detections.

To the right are individual panels from additional tours teaching users about more imagery and features.

Sunglint

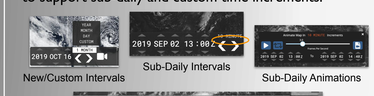
Worldview Animations

Measurement Tool

A new map feature allows users to measure custom distances and areas. This provides users more context to observations and ability to interpret visualizations.

Timeline Enhancements

In order to support the recently added geostationary visualizations, the Worldview team overhauled timelines to support sub-daily and custom time increments.

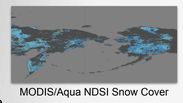


New/Custom Intervals | Sub-Daily Intervals | Sub-Daily Animations

Increased Timeline Detail

Snapshot Improvements

The Worldview snapshot tool now supports images crossing the anti-meridian. Additional behind-the-scenes improvements have also been made to improve performance and support new visualizations.



MODIS/Aqua NDSI Snow Cover

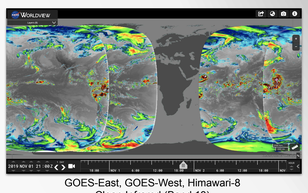
Recent Visualization Activities

The GIBS and Worldview teams are continually working to expand their catalog of visualization products and capabilities. The information in this section provides an overview of major accomplishments over the past year.

Geostationary Imagery Support

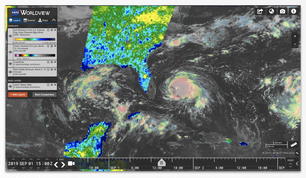
The GIBS team actively worked with the NASA SPoRT[1] team to visualize 10-minute increment geostationary visualizations from the NOAA GOES[2]-East, and GOES[2]-West satellites and the JMA[3] Himawari-8 satellite. These visualizations provide a unique view into the active changes in earth systems not as easily seen through the standard NASA polar orbiting satellite. A rolling 1-month window of imagery is available in addition to selected natural events.

[1] - Short-term Prediction Research and Transition Center
[2] - Geostationary Operational Environmental Satellite
[3] - Japan Meteorological Agency



GOES-East, GOES-West, Himawari-8
Clean Infrared (Band 13)

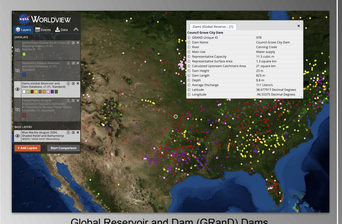
Visualizations from polar-orbiting and geostationary satellites may be combined to provide additional context to natural events and science research, as seen below.



GOES-East Red Visible (Band 2); Clean Infrared (Band 13); SMAP Soil Moisture

Vector-Based Visualizations

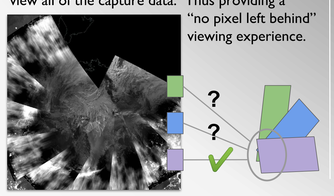
Some earth science data products are best visualized through vector points, lines, or polygons. GIBS and Worldview have added enhanced support for these vector-based visualizations allowing users to access additional information about the underlying data.



Global Reservoir and Dam (GRanD) Dams

Swath-Based Visualizations

When polar-orbiting satellite swaths are overlapped in the higher latitudes, or in polar projections, much of the underlying data ends up hidden. The GIBS and Worldview team are prototyping the ability to unwrap these swaths to allow users to view all of the capture data. Thus providing a "no pixel left behind" viewing experience.

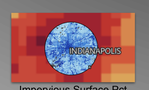


Additional Visualizations Products

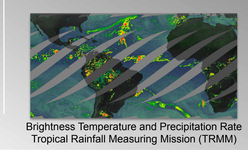
In 2019, GIBS added or updated approximately 150 new visualization products across numerous active and retired remote sensing platforms and instruments. This enriches the experience for GIBS users looking to compare and explore earth science data. Below is a sampling of the visualizations that were added or updated.

- Atmospheric Infrared Sounder (AIRS)
  - Air and surface temp, relative humidity, and more...
- GOES-East, GOES-West, Himawari-8
  - Red Visible, Clean Infrared, Air Mass
- Moderate Resolution Imaging Spectroradiometer (MODIS)
  - Nearly 50 atmosphere, cryosphere, and land products covering 18 years of observations
- MODIS Multi-Angle Implementation of Atmospheric Correction (MAIAC)
  - Water Vapor, AOD, Reflectance, and more..
- Orbiting Carbon Observatory 2 (OCO-2)
  - Carbon Dioxide, Water Vapor, and Solar-induced Chlorophyll Fluorescence
- Socioeconomic Data Center
  - National disaster hotspot, urban extents, impervious surfaces, and more...
- Tropical Rainfall Measuring Mission (TRMM)
  - Brightness Temperature and Precipitation
- Visible Infrared Imaging Radiometer Suite (VIIRS)
  - Aerosol Optical Depth and Clear Sky Confidence
  - Corrected Reflectance and Brightness Temperature
- Web Enabled Landsat Data (WELD)
  - False color band combinations and polar projection

Surface Skin Temperature
AIRS



Impervious Surface Pct and Flood Hazard
Socioeconomic Data Center



Brightness Temperature and Precipitation Rate
Tropical Rainfall Measuring Mission (TRMM)

Future Visualization Activities

The GIBS and Worldview teams are continually working on ways to expand their catalog of visualization products and capabilities. The information in this section provides an overview of major initiatives that are ongoing or are being considered for the next year's work.

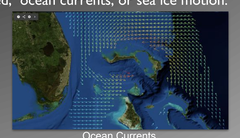
Future Catalog Additions

The GIBS team is working with existing and new providers to expand the GIBS catalog of visualization products in 2020. Products currently in the pipeline include:

- AMSR-E, AMSR-UE, and AMSR-U2
  - Rain, land, ocean, and snow parameters
  - Sea ice motion (vector)
- Deep Space Climate Observatory (DSCOVR)
  - Reflected radiation, ozone, aerosol, and cloud parameters
- Gravity Recovery and Climate Experiment Follow-On (GRACE-FO)
  - Liquid water thickness
- Harmonized Landsat-Sentinel
  - True- and false-color reflectance
- Moderate Resolution Imaging Spectroradiometer (MODIS)
  - Flood mapping
- Multi-angle Imaging SpectroRadiometer (MISR)
  - Wind speed and direction (vector)
- TROPOspheric Monitoring Instrument (TROPOMI)
  - Aerosol, cloud, and ozone parameters
- Visible Infrared Imaging Radiometer Suite (VIIRS)
  - A full suite of atmosphere, land, and cryosphere parameters matching the existing MODIS catalog items
  - New daily and monthly "night lights" products

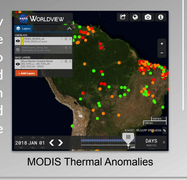
Vector-Based Visualizations

Building upon existing functionality, the GIBS and Worldview teams are investigating enhancements to support visualizing "velocity" vector data that are best represented as arrows. This will allow support for products such as wind speed, ocean currents, or sea ice motion.



Ocean Currents
(Courtesy of the PO.DAAC "State of the Ocean" Tool)

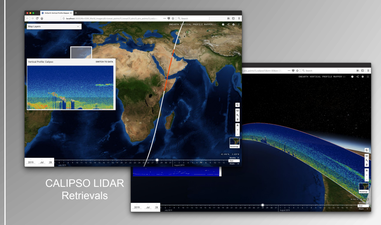
GIBS and Worldview are also adding the capability for users to dynamically filter and style vector data in their browser based on attributes of the data.



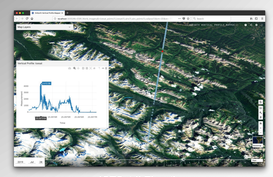
MODIS Thermal Anomalies

Vertical Profile Visualizations

Some instruments capture data in a way that is best visualized as a "vertical profile" or "curtain plot." Representing these data on a map provides unique challenges when visualizing multiple coincident vertical profile instruments and/or with existing 2D lat/lon visualizations. Seen below are prototypes of a future capability in GIBS and Worldview.



CALIPSO LIDAR Retrievals



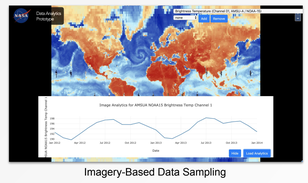
ICESat-II Elevation

Advanced Data Visualization

Many factors such as increased data volumes/rates, new instruments, and improved server-side performance require and provide opportunities for significant improvements in data visualization capabilities. The GIBS and Worldview teams continue to investigate new ways to visualize data to their current and new users.

Current focus areas include the following visualization-based capabilities:

- Client- and Server-side sampling / analytics
  - Analyze data values over a user-specified region and/or date range
- Dynamic Data Visualization
  - Create data visualizations dynamically, using user-defined ranges and color palettes
- Machine Learning
  - Detect data anomalies or natural events



Imagery-Based Data Sampling