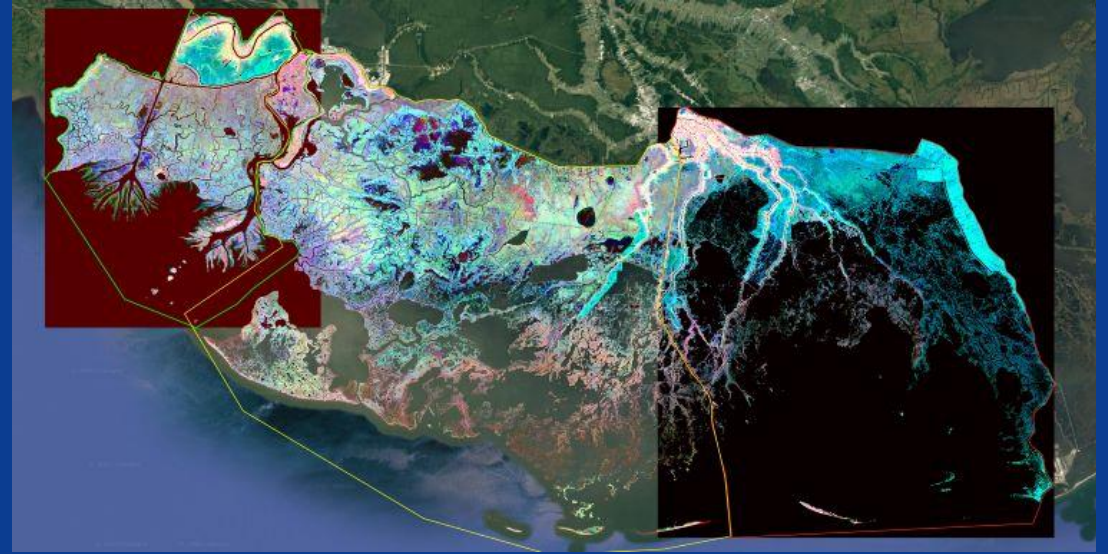


# Delta-X Data Discovery and Access: NASA's ORNL DAAC and Earthdata Cloud

Yaxing Wei

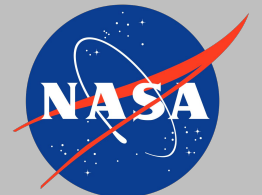
Lead Scientist, ORNL DAAC



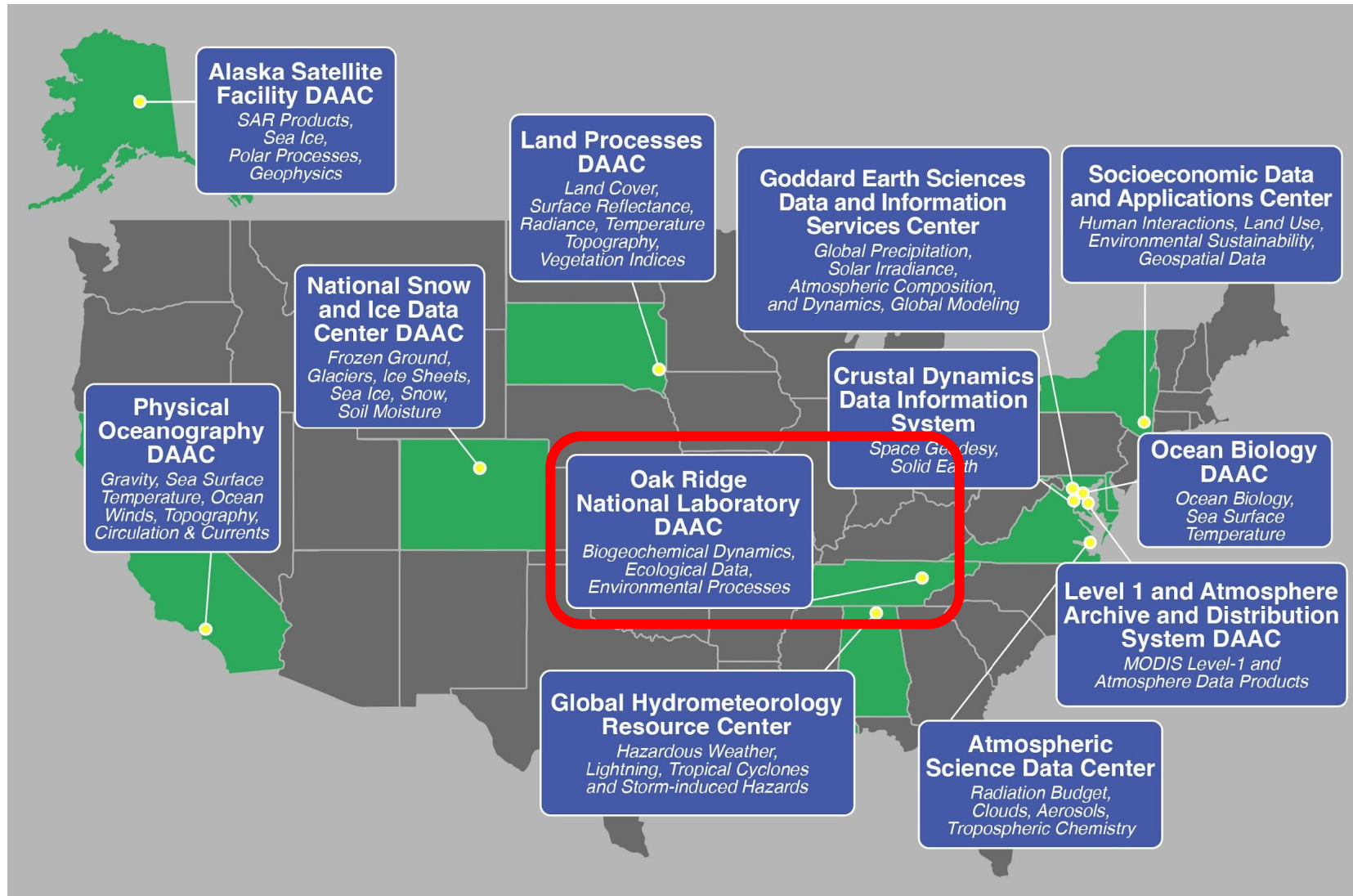
The Oak Ridge National Laboratory Distributed Active Archive Center for Biogeochemical Dynamics operates under an interagency agreement between NASA and the U.S. Department of Energy



U.S. DEPARTMENT OF  
**ENERGY**



# NASA Earth Observing System Data and Information System (EOSDIS) Distributed Active Archive Centers (DAACs)



# Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC)

- **Established in 1993**
- **Mission:** Assemble, distribute, and provide data services for a comprehensive archive of terrestrial biogeochemistry and ecological dynamics observations and models to facilitate research, education, and decision-making in support of NASA's Earth Science.

<https://daac.ornl.gov>

The screenshot shows the ORNL DAAC website homepage. At the top, there is a navigation bar with the NASA logo, 'EARTHDATA', and 'Other DAACs'. Below this is a large banner with the ORNL DAAC logo and a search bar. The main content area features a large image of a river delta with the text 'Ecogeomorphic Cell Products across the MRD, LA, USA, 2021'. Below the image are four categories: 'Field Campaigns' (1342 Datasets in 22 Projects), 'Land Validation' (32 Datasets in 6 Projects), 'Regional/Global' (461 Datasets in 12 Projects), and 'Model Archive' (15 Models in 1 Project). At the bottom, there is a 'News' section with two articles: 'ABOVE: Soil Matric Potential, Dielectric, & Physical Properties 2018' and 'Webinar: Explore the Openscapes Earthdata Cloud Cookbook'.

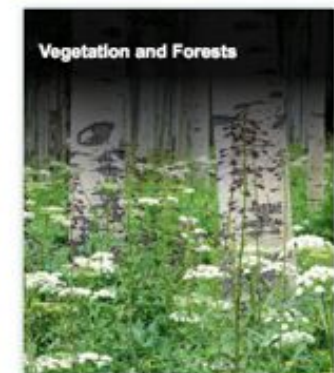
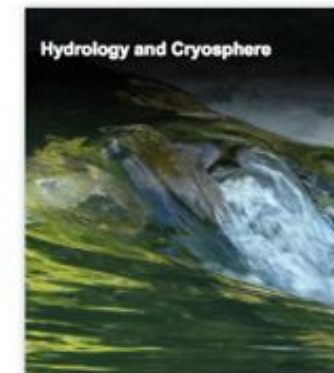
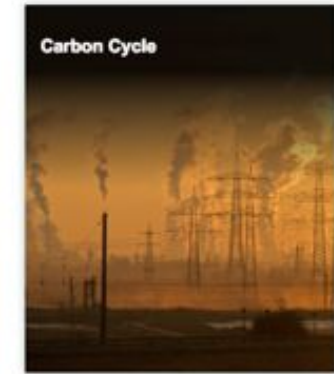
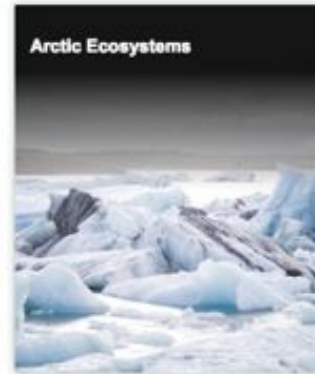




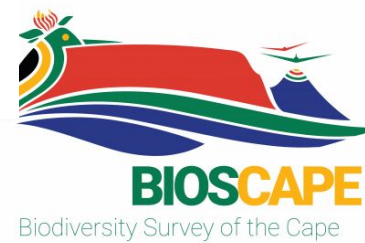
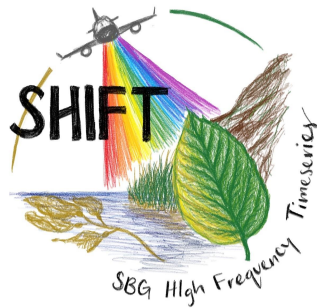
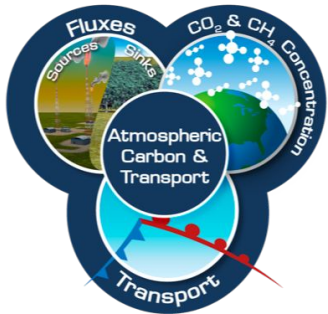
# ORNL DAAC Data Products

- 1800+ datasets
- 9 Science Themes
- 41 Missions/Projects
- 30,000+ users\*
- 1.5+ PB data distributed\*

*\* Metrics based on a 6-month period (2023-10 to 2024-03)*

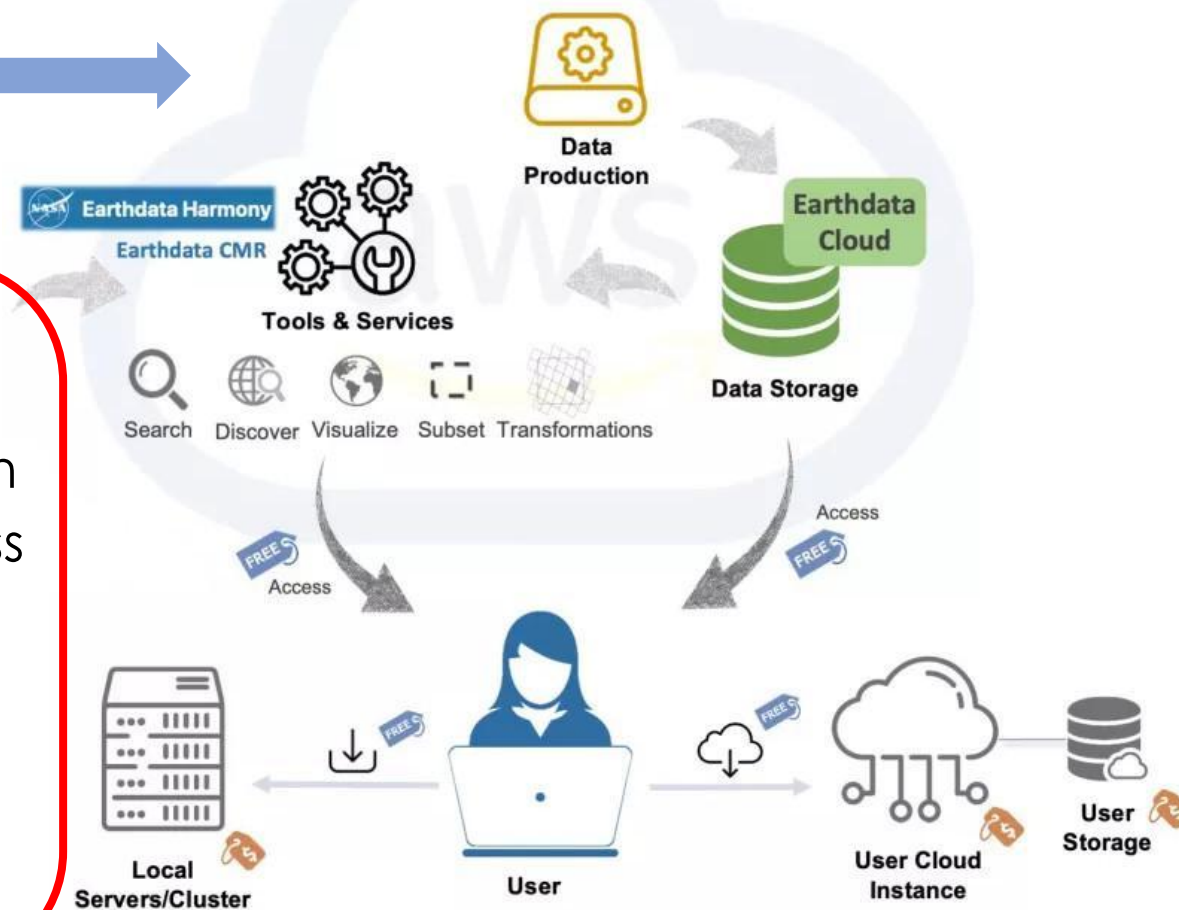


# ORNL DAAC Data Products: Projects





# ORNL DAAC Supports Delta-X

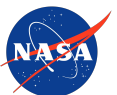


- QA/QC
- Documentation
- Data publication
- Digital Object Identifier (DOI)
- Data citation
- Project/Data Landing Pages
- Metadata
- Preprints
- Data preservation
- Enable data search
- Enable data access
- Usage metrics
- Tutorials
- User support
- ...

Image credit: National Snow and Ice Data Center (<https://insidc.org>)

# Demo

- Find and access Delta-X data from the ORNL DAAC website
  - Live demo at <https://daac.ornl.gov>
- Find and access Delta-X data from NASA Earthdata Cloud
  - [Earthdata Search Client](#) user interface
  - [OPeNDAP](#) subsetting service
  - [Common Metadata Repository](#) (CMR) API
  - CMR [SpatioTemporal Asset Catalog](#) (STAC) API
  - [earthaccess](#) Python library



# Search through the Earthdata Search Client (1)

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

The screenshot displays the Earthdata Search Client interface. The browser address bar shows the search URL: `search.earthdata.nasa.gov/search?fpj=Delta-X&lat=29.44369521412288&long=-92.443359375&zoom=7`. The page header includes the NASA logo, "EARTHDATA SEARCH", and a search bar. The main content area shows "60 Matching Collections" with a list of datasets. The "Delta-X" project is selected in the left sidebar. The first dataset, "Delta-X: AVIRIS-NG L3-derived Water Quality, TSS, and Turbidity, MRD, V3", is highlighted with a red box. Other datasets include "Delta-X: AirSWOT L3 Water Surface Elevations, MRD, Louisiana, 2021" and "Delta-X: UAVSAR L3 Water Level Changes, MRD, Louisiana, 2021". A map of the Atchafalaya River basin is visible on the right side of the interface.

**Delta-X: AVIRIS-NG L3-derived Water Quality, TSS, and Turbidity, MRD, V3**  
50 Granules 2021-03-27 to 2021-09-24 Earthdata Cloud  
This dataset includes estimates of total suspended solids (TSS) concentration and turbidity for waters of the Atchafalaya River and...  
GEOSS · DeltaX\_L3\_AVIRIS-NG\_Water\_V3\_2152 v3 - ORNL\_DAAC

**Delta-X: AirSWOT L3 Water Surface Elevations, MRD, Louisiana, 2021**  
21 Granules 2021-03-26 to 2021-09-12 Earthdata Cloud  
This dataset contains water surface elevations at selected point locations generated from the AirSWOT data collected during the Spring and Fall 2021...  
GEOSS · DeltaX\_L3\_AirSWOT\_WaterElev\_2133 v1 - ORNL\_DAAC

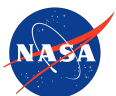
**Delta-X: UAVSAR L3 Water Level Changes, MRD, Louisiana, 2021**  
293 Granules 2021-03-27 to 2021-09-13 Earthdata Cloud  
This dataset contains georeferenced InSAR-derived water level change maps for Delta-X flight lines acquired during the spring (2021-03-27 to 2021-04-...  
GEOSS · DeltaX\_L3\_UAVSAR\_WaterLevels\_2058 v1.1 - ORNL\_DAAC

**Delta-X: Modeled Land Accretion Rate Maps, Wax Lake Delta, MRD, LA, USA, 2021**  
1 Granule 2021-03-20 to 2021-08-27 Earthdata Cloud  
This dataset provides sediment transport and land accretion model results at Wax Lake Delta (WLD), Atchafalaya Basin, in coastal Louisiana, USA. Data...

Subscriptions

v24.2.4-0 · Search Time: 3.2s · NASA Official: Stephen Berrick · FOIA · NASA Privacy Policy · USA.gov

Earthdata Access: A Section 508 accessible alternative





# Search through the Earthdata Search Client (2)

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

The screenshot displays the Earthdata Search Client interface. The search results are for "Delta-X: AVIRIS-NG L3-derived Water Quality, TSS, and Turbidity, MRD, V3". The results table shows 50 matching granules, with two granules highlighted in red boxes. The map on the right shows the region around New Orleans and Baton Rouge, with several green boxes indicating the spatial extent of the granules.

Granule ID	Start	End	Action
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210825t134206_rfl_brdf_WQ.nc4	2021-08-25 13:42:06	2021-08-25 13:52:06	+ (highlighted)
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t165914_rfl_brdf_WQ.nc4	2021-08-24 16:59:14	2021-08-24 17:09:14	+ (highlighted)
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t164809_rfl_brdf_WQ.nc4	2021-08-24 16:48:09	2021-08-24 16:58:09	+ (highlighted)
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t153756_rfl_brdf_WQ.nc4	2021-08-24 15:37:56	2021-08-24 15:47:56	+ (highlighted)



# Download through the Earthdata Search Client (1)

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

The screenshot displays the Earthdata Search Client interface. The search results are for "Delta-X: AVIRIS-NG L3-derived Water Quality, TSS, and Turbidity, MRD, V3". The results table shows 50 matching granules. The interface includes a sidebar for filtering granules, a map of the region around New Orleans, and a "Download" button highlighted with a red box.

Granule ID(s)	START	END	Actions
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210825t134206_rfl_brdf_WQ.nc4	2021-08-25 13:42:06	2021-08-25 13:52:06	+ -
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t165914_rfl_brdf_WQ.nc4	2021-08-24 16:59:14	2021-08-24 17:09:14	+ -
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t164809_rfl_brdf_WQ.nc4	2021-08-24 16:48:09	2021-08-24 16:58:09	+ -
DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t153756_rfl_brdf_WQ.nc4	2021-08-24 15:37:56	2021-08-24 15:47:56	+ -



# Download through the Earthdata Search Client (2)

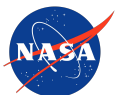
<https://search.earthdata.nasa.gov>

The screenshot shows the Earthdata Search Client interface. The browser address bar displays the URL: [search.earthdata.nasa.gov/projects?p=C2797469962-ORNL\\_CLOUD!C2797469962-ORNL\\_CLOUD&pg\[1\]\[a\]=2798097293!2798097280!ORNL...](https://search.earthdata.nasa.gov/projects?p=C2797469962-ORNL_CLOUD!C2797469962-ORNL_CLOUD&pg[1][a]=2798097293!2798097280!ORNL...)

The interface includes a header with the NASA logo, "EARTHDATA SEARCH", and a search bar. Below the header, there is a sidebar on the left with a project titled "Untitled Project" containing 2 granules and 1 collection, totaling 300.0 MB. The main content area displays the project details: "Delta-X: AVIRIS-NG L3-derived Water Quality, TSS, and Turbidity, MRD, V3". It shows two granules, with the first one highlighted. A red circle highlights the information icon (i) next to the first granule's filename: "DeltaX\_L3\_AVIRIS-NG\_Water\_V3.ang20210824t165914\_rfl\_brd\_f\_WQ.nc4". A red box highlights the "Download Data" button at the bottom left of the granule list.

The right side of the interface features a satellite map of the region around New Orleans and Baton Rouge, Louisiana. The map includes a scale bar (30 km / 20 mi) and navigation controls (zoom in, zoom out, home, and layers).

At the bottom of the interface, there is a monthly navigation bar and a footer with the following text: "v24.2.4-0 · Search Time: 2.5s · NASA Official: Stephen Berrick · FOIA · NASA Privacy Policy · USA.gov" and "Earthdata Access: A Section 508 accessible alternative".





# Detailed Metadata in Earthdata Search Client (1)

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

The screenshot shows the Earthdata Search Client interface. The main content area displays the metadata for a granule: `DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t165914_rfl_brdf_WQ.nc4`. The metadata is presented in a JSON format, with a red box highlighting a specific link for direct download access via S3:

```
{
  "rel": "http://esipfed.org/ns/fedsearch/1.1/s3#",
  "title": "This link provides direct download access via S3 to the granule",
  "hreflang": "en-US",
  "href": "s3://ornl-cumulus-prod-protected/deltax/DeltaX_L3_AVIRIS-NG_Water_V3/data/ang20210824t165914_rfl_brdf_WQ.nc4"
},
```

The interface also includes a sidebar with collection details, a search bar, and a map view on the right showing the location of the data (New Orleans, Louisiana).

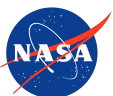
**Collection Details**

- Version: 3
- DOI: 10.3334/ORNLDAAC/2152
- Related URLs: View All Related URLs
- Temporal Extent: 2021-03-27 to 2021-09-24
- Description: This dataset includes estimates of total suspended solids (TSS) concentration and turbidity for waters of the Atchafalaya River and Terrebonne Basins of the Mississippi River Delta (MRD) in coastal Louisiana. Estimates were...

[View More Collection Details](#)

v24.2.4-0 · NASA Official: Stephen Berrick · FOIA · NASA Privacy Policy · USA.gov

Earthdata Access: A Section 508 accessible alternative



# Detailed Metadata in Earthdata Search Client (2)

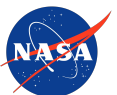
<https://opendap.earthdata.nasa.gov>

The screenshot displays the Earthdata Search Client interface. The top navigation bar includes the NASA logo, 'EARTHDATA SEARCH', and a search bar. The main content area is divided into three sections:

- Collection Details (Left Sidebar):**
  - Version:** 3
  - DOI:** 10.3334/ORNLDAAC/2152
  - Related URLs:** View All Related URLs
  - Temporal Extent:** 2021-03-27 to 2021-09-24
  - Description:** This dataset includes estimates of total suspended solids (TSS) concentration and turbidity for waters of the Atchafalaya River and Terrebonne Basins of the Mississippi River Delta (MRD) in coastal Louisiana. Estimates were...
- Search Results (Center):**
  - Title:** DeltaX\_L3\_AVIRIS-NG\_Water\_V3.ang20210824t165914\_rfl\_brdf\_WQ.nc4
  - Metadata (JSON):**

```
{
  "rel": "http://esipfed.org/ns/fedsearch/1.1/service#",
  "title": "OPeNDAP request URL (GET DATA : OPENDAP DATA)",
  "hreflang": "en-US",
  "href": "https://opendap.earthdata.nasa.gov/collections/C2797469962-ORNL_CLOUD/granules/DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t165914_rfl_brdf_WQ.nc4"
},
{
  "rel": "http://esipfed.org/ns/fedsearch/1.1/data#",
  "hreflang": "en-US",
  "href": "https://daac.ornl.gov/daacdata/deltax/DeltaX_L3_AVIRIS-NG_Water_V3/"
},
{
  "rel": "http://esipfed.org/ns/fedsearch/1.1/documentation#",
  "hreflang": "en-US",
  "href": "https://daac.ornl.gov/DELTA/guides/DeltaX_L3_AVIRIS-NG_Water_V3.html"
},
{
  "rel": "http://esipfed.org/ns/fedsearch/1.1/metadata#",
  "hreflang": "en-US"
}
```
- Map (Right):** A satellite map of the New Orleans area with a green bounding box and a blue location pin. The map includes a scale bar (30 km / 20 mi) and a vertical toolbar with various navigation and interaction icons.

At the bottom of the interface, there is a footer with the text: "v24.2.4-0 · NASA Official: Stephen Berrick · FOIA · NASA Privacy Policy · USA.gov" and "Earthdata Access: A Section 508 accessible alternative".



# Subset through the OPeNDAP service (2)

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

The screenshot shows the OPeNDAP DAP4 Data Request Form interface. The browser address bar displays the URL: `opendap.earthdata.nasa.gov/collections/C2797469962-ORNL_CLOUD/granules/DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t165914_r...`. The page title is "OPeNDAP" and the subtitle is "OPeNDAP DAP4 Data Request Form".

The dataset is identified as `ang20210824t165914_rfl_brdf_WQ.nc4`. The "Actions" section includes a "Download Encoding:" dropdown menu, which is currently open and shows the following options: "Choose One...", "NetCDF-4" (selected), "NetCDF-3", "CSV", and "DAP4 Binary". A "Get Data" button is also present.

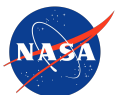
The "Data URL" section contains the URL: `https://opendap.earthdata.nasa.gov/collections/C2797469962-ORNL_CLOUD/granules/DeltaX_L3_AVIRIS-NG_Water_V3.ang20210824t165914_rfl...`. There are buttons for "Copy encoded Data" and "Data URL".

The "Global Attributes" and "Global Dimensions" sections each have a "+ View/Hide" button.

The "Variables" section lists several variables with checkboxes and input fields for range selection:

- Cloud\_Mask[ /c= 0..730 ] [ /r= 0..10128 ] (Type is Float64)
- TSS\_loglog\_PLSR7\_380\_900\_nm[ /c= 0..730 ] [ /r= 0..10128 ] (Type is Float64)
- Turbidity\_loglog\_PLSR7\_380\_900\_nm[ /c= 0..730 ] [ /r= 0..10128 ] (Type is Float64)
- Water\_Mask[ /c= 0..730 ] [ /r= 0..10128 ] (Type is Float64)

Each variable has a "+ attributes" button and two input fields for range selection (e.g., "0:1:730" and "0:1:10128").

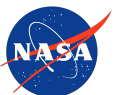




# Search through the Common Metadata Repository (CMR) API

- Search Delta-X datasets
  - <https://cmr.earthdata.nasa.gov/search/collections?project=Delta-X>
- Search granules
  - [https://cmr.earthdata.nasa.gov/search/granules?collection\\_concept\\_id=C2797469962-ORNL\\_CLOUD&bounding\\_box=-91.1,29,-90.6,29.5&temporal=2021-01-01/2021-06-30](https://cmr.earthdata.nasa.gov/search/granules?collection_concept_id=C2797469962-ORNL_CLOUD&bounding_box=-91.1,29,-90.6,29.5&temporal=2021-01-01/2021-06-30)

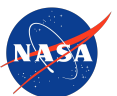
Find out more at the [CMR API Documentation](#)



# Search through the CMR SpatioTemporal Asset Catalog (STAC) API

- Explore ORNL DAAC datasets
  - <https://cmr.earthdata.nasa.gov/stac/ORNLCLOUD/collections>
- Search granules
  - <https://cmr.earthdata.nasa.gov/stac/ORNLCLOUD/search?collections=DeltaXL3AVIRIS-NGWaterV32152&bbox=-91.1,29,-90.6,29.5&datetime=2021-01-01/2021-06-30>

Find out more at the [CMR STAC API Documentation](#)



# Find and access data through earthaccess

- The earthaccess Python library provides an easy way to search, download NASA Earth science data using a few lines of code.

```
import earthaccess

earthaccess.login(strategy="netrc")

results = earthaccess.search_data(
    short_name="DeltaX_L3_AVIRIS-NG_Water_V3_2152",
    bounding_box=(-91.1,29,-90.6,29.5),
    temporal = ("2021-01-01", "2021-06-30"),
    count=60)

earthaccess.download(results, "./data/") # download to local computer

data = earthaccess.open(results) # access data directly from the Cloud
```

Find out more at  
<https://github.com/nsidc/earthaccess>





# Additional Resources

- ORNL DAAC learning resources
  - <https://daac.ornl.gov/resources/learning/>
- NASA Earth science data learning center
  - <https://www.earthdata.nasa.gov/learn>
- Contact us via Earthdata Forum
  - <https://forum.earthdata.nasa.gov>

