



PACE Data: Applications, Access, and Resources

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NOAA Satellite Symposium: Water

*Special thanks to contributors: Erin Urquhart,
Antonio Mannino, Jeremy Werdell, Skye Caplan*

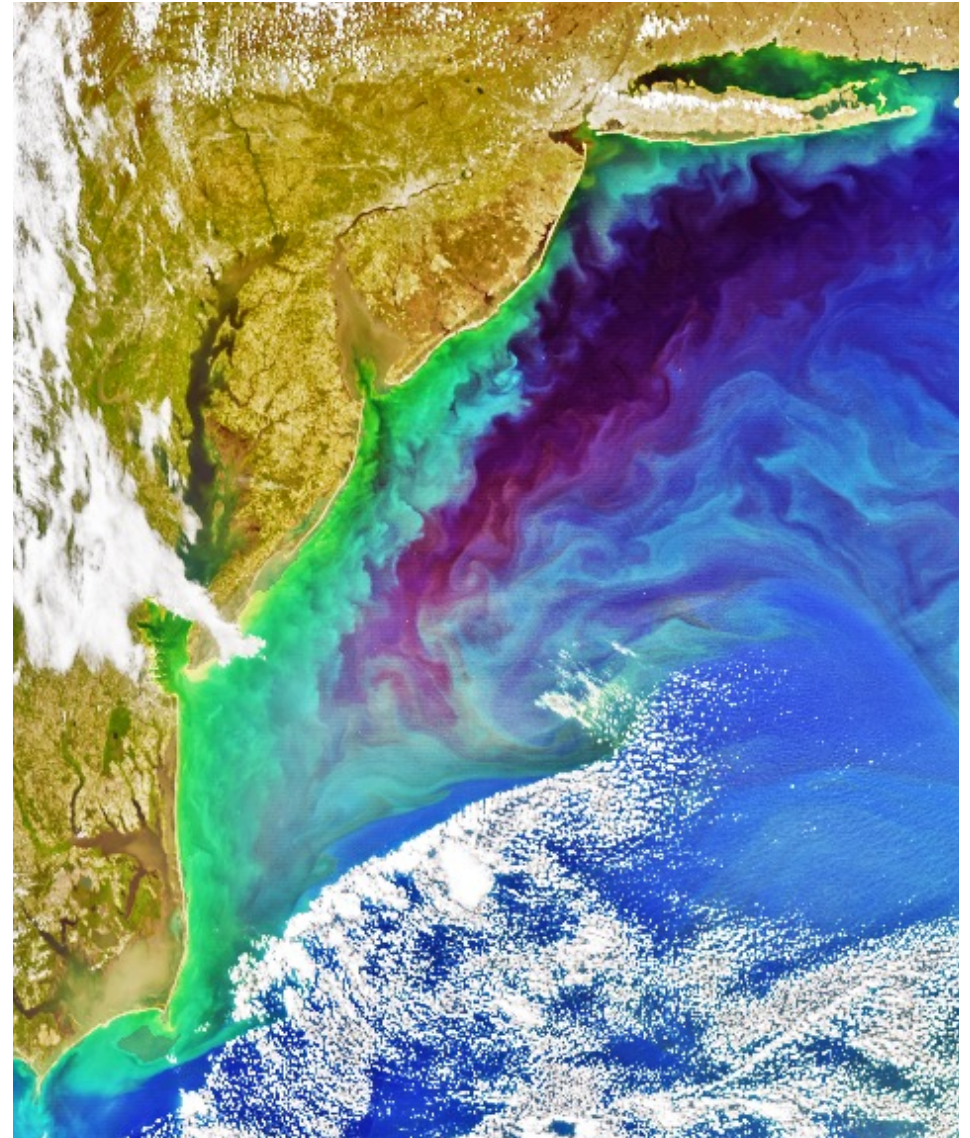
The PACE logo, featuring the word "PACE" in white, bold, sans-serif font with a stylized white starburst graphic above the letter 'A'.

PACE



Today we'll explore...

- PACE Applications Program & use case examples
- Where to access PACE ocean color data products available now
- Resources & support available to work with PACE data



PACE enhanced RGB, US East Coast, April 26, 2024. Credit: Joseph Knuble



Science Goals: PACE is NASA's next great investment to advance and extend ocean biological, ecological, and biogeochemical data records, as well as cloud, aerosol, and terrestrial data records. **PACE is the most advanced global ocean color mission to date.**

- Global, 13:00 local equatorial crossing
- 3yr mission (at least 10yrs of propellant)
- **Data products are free & open to all**

Ocean Color Instrument (OCI)

- Hyperspectral 340-890nm (UV-NIR)
5nm bandwidth, 2.5nm steps;
7 SWIR bands
- 1-2 day global; 1.2 km² at nadir

Two multi-angle polarimeters:

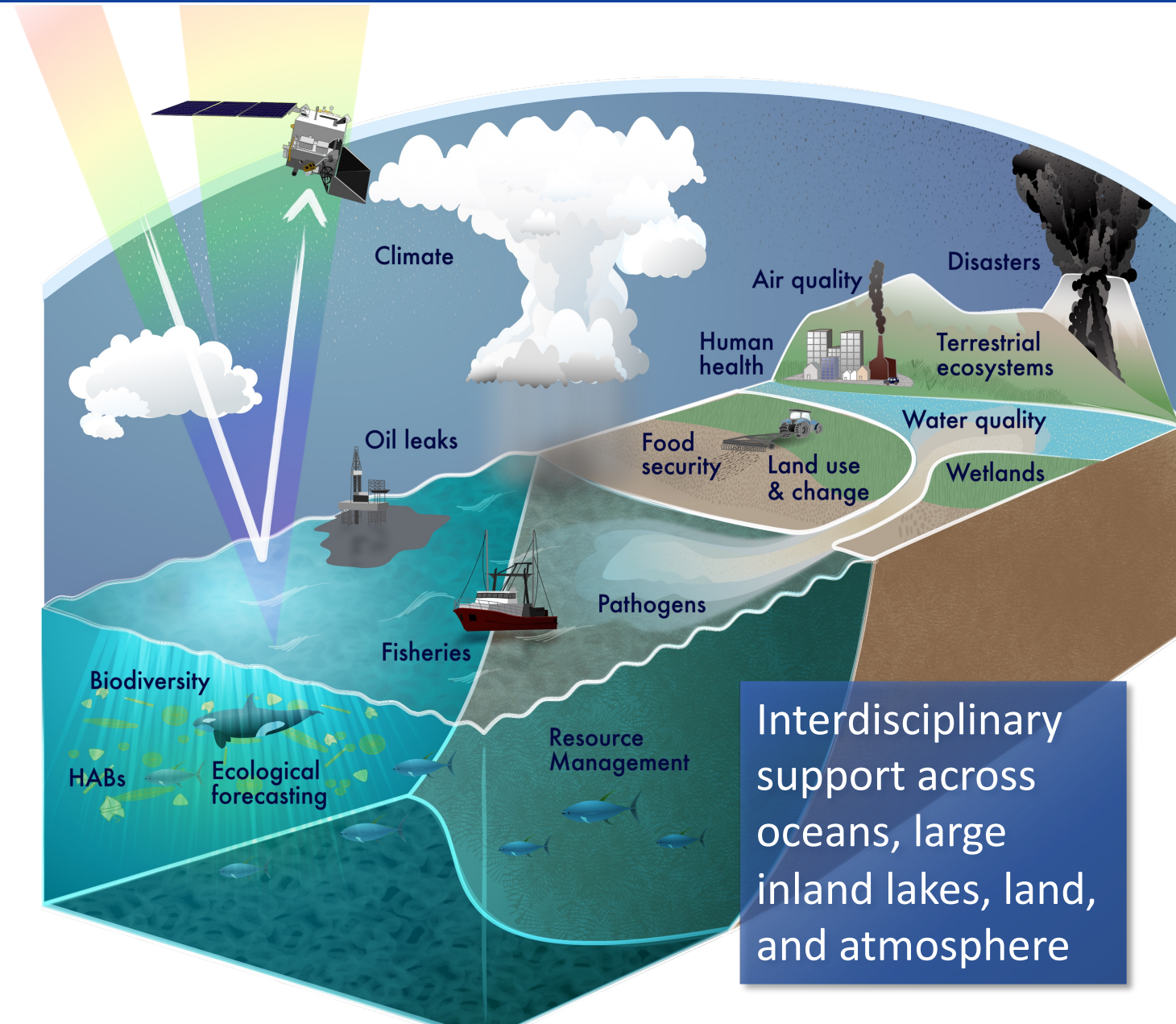
- **HARP-2:** wide-swath, hyper-angular,
4 bands; 2 day global; 3 km² nadir
- **SPEXone:** narrow-swath,
hyperspectral from UV-NIR, 5
viewing angles, >30 day global,
2.5 km² nadir



PACE Applications & Use Cases

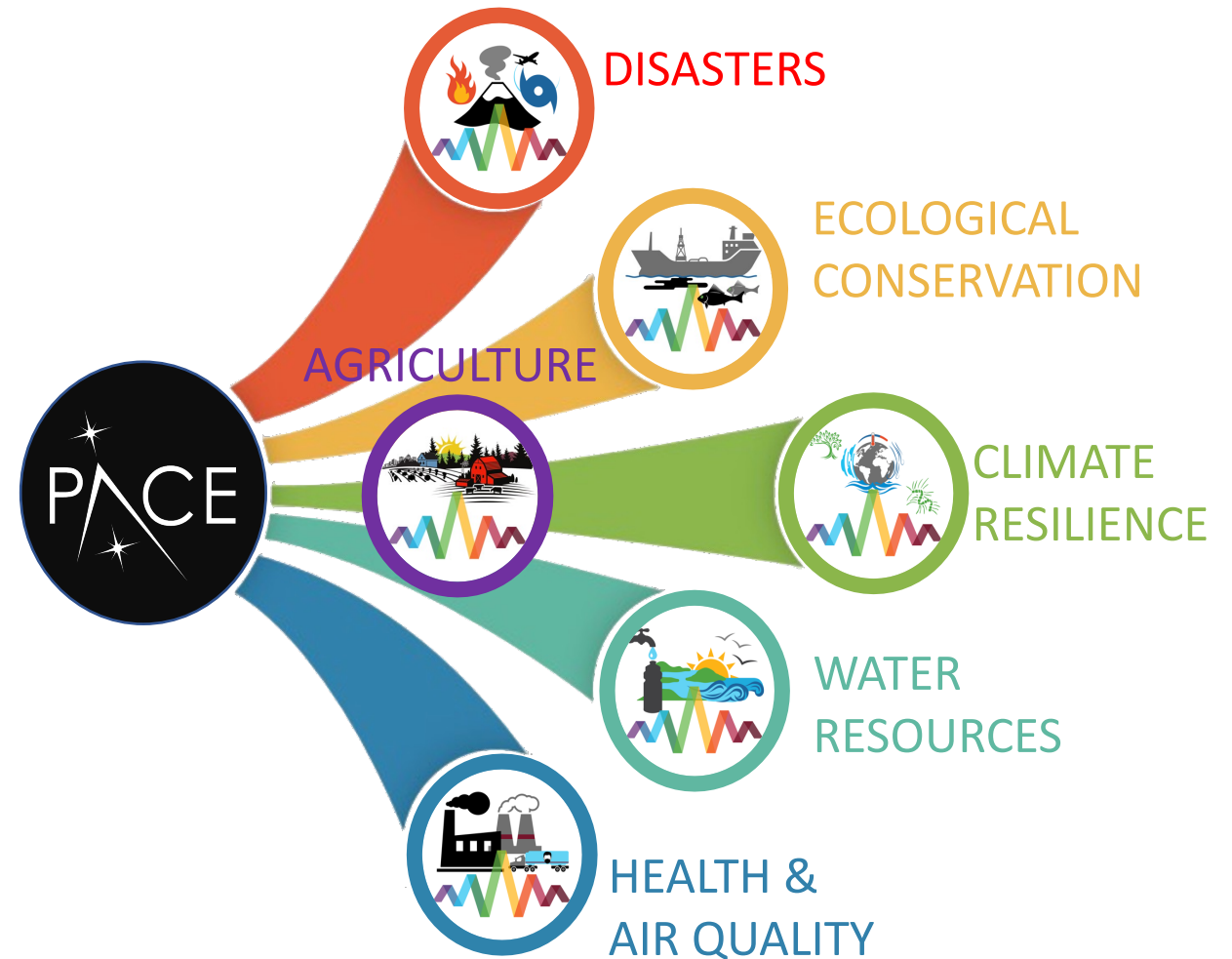


- **Applications** are innovative uses of NASA PACE data products to improve decision-making activities & help provide practical solutions to meet societal needs.
- **Applied Research** bridges PACE data & applications. Provides fundamental knowledge of how to scale & integrate PACE data products into users' policy, business & management activities.
- **End-user communities** include
 - Individuals & groups
 - Public, private, academic sectors
 - National & international orgs
 - Local & global scales



Goal: accelerate & support translation of PACE's advanced data into societal *action*

- Build partnerships between PACE data producers & users
- Increase accessibility & actionability of PACE data
- Demonstrate the societal value & utility of PACE



Community of Practice: Anyone interested in staying up-to-date on the PACE mission, data, and applications. *Join us!!*

1. *Send an email to *with 'join' in the subject line* to pace-community-join@lists.nasa.gov*
2. *Look for confirmation email → confirm!*

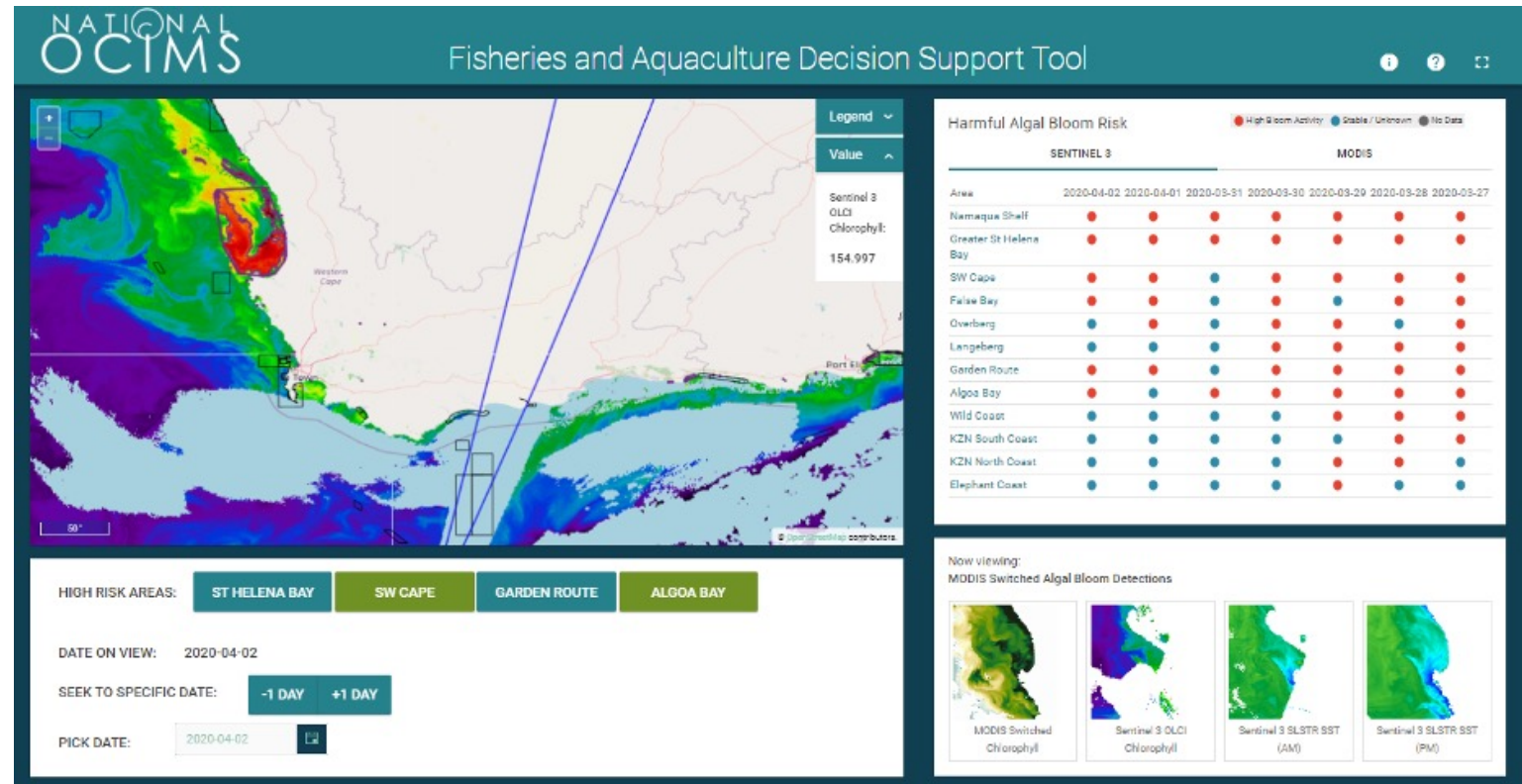
Science & Applications Team: NASA-funded scientists working on algorithm development, applications, validation, etc.

Early Adopters: Researchers and others with applied projects/needs teamed with stakeholders to develop and apply advanced PACE applications



New, hyperspectral-based PACE data products & advanced versions of legacy ocean color products will advance water quality management & understanding of aquatic ecosystems by improving:

- Identification & tracking of harmful algal blooms (HABs)
- Assessment of fisheries & aquaculture health
- Evaluating & maintaining ecosystem health
- Identification of oil spills
- Post-disaster water quality impacts (e.g., floods, fires, hurricanes): particularly regarding suspended solids, HABs, and fish kills/hypoxia



Top: The National Oceans and Coastal Information Management System (OCIMS) Fisheries and Aquaculture Decision Support Tool will incorporate phytoplankton community composition from PACE.



Damian Brady

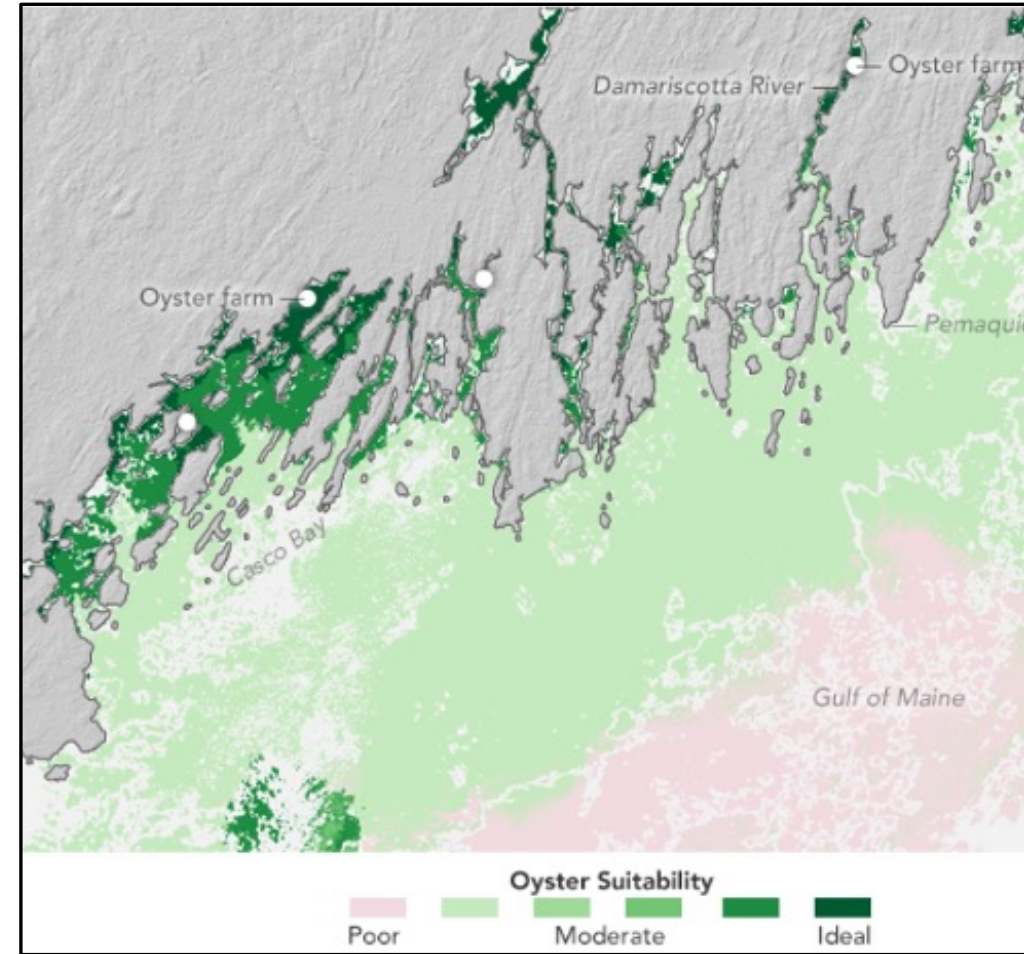
Aquaculture site prospecting:
Applying PACE products to sustainable aquaculture site selection »

Application Aquaculture Site Prospecting:
Applying PACE products to sustainable aquaculture site selection


Significance: Choosing optimal aquaculture sites with the best available information could save prospective oyster, mussel, and scallop growers money and time.

How PACE can help: PACE's spectral resolution could help optimize site selection tools by relating phytoplankton size to oyster feeding rates.

Stakeholders: End-users change each year with over 600 Limited Purpose Aquaculture License holders in the state of Maine.



Example map from oyster farm site selection tool
https://pace.oceansciences.org/people_ea.htm?id=52



Antar Jutla

Predictive assessment of clinically active biotreats in coastal and ocean waters using PACE data

Application: Enhanced cholera risk models through integration of hyperspectral remotely sensed plankton & plankton health data into algorithms for Florida & the Chesapeake Bay.

Significance: Water-borne pathogens pose a significant threat to human and environmental health. Better understanding of the relationship between plankton and *Vibrio cholerae* will improve risk assessment and improve human health advisories. This work can be used to make real-time decisions of when and where to initiate cholera relief and mitigation activities, as well as, for decision-making for safe water and sanitation.

How PACE can help: The hyperspectral capabilities of PACE OCI will enhance existing prediction models (for *Vibrio cholerae*) by integrating phytoplankton type and phytoplankton health metrics into algorithms. It is anticipated that PACE will enhance such activities to support public health, policy analysis, and decision-making.

Stakeholders: United Nations Office for Coordinator of Humanitarian Affairs (UNOCHA); World Health Organization (WHO); UNCEF

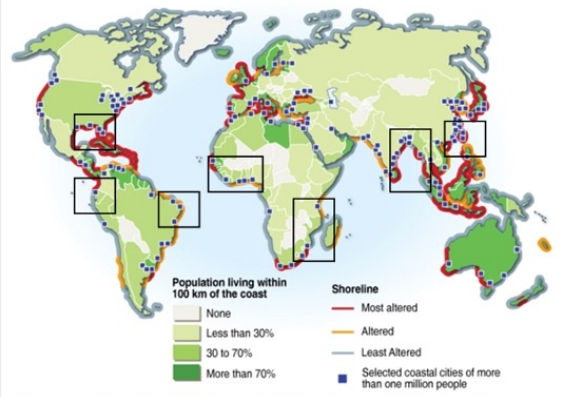


Figure 1: Population distribution and water-borne disease outbreak. Rectangles represent regions with reported disease epidemics.



Bingqing Liu

Assessing the potential impact of a changing climate on the water quality of northern Gulf of Mexico »

Application: Assessing the potential impact of a changing climate on the water quality of northern Gulf of Mexico, including advancing harmful algal bloom identification & forecasting for oyster farms in the Gulf region

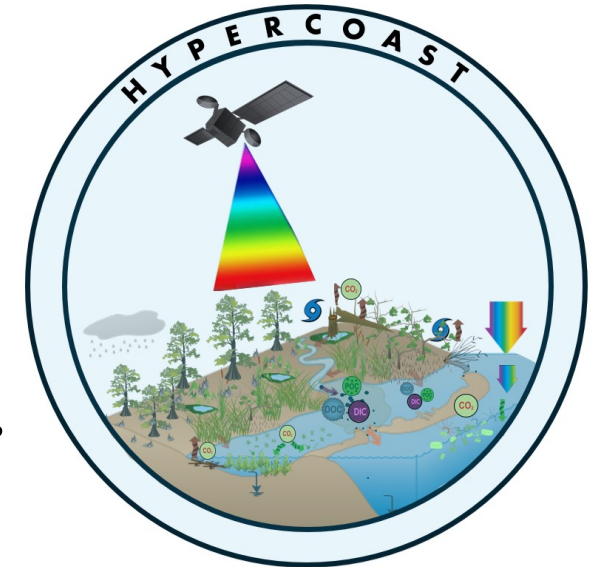
Recently released the HyperCoast Data Visualization Tool:

<https://hypercoast.org/>

PACE Notebook:

https://hypercoast.org/examples/pace_oci_l2/

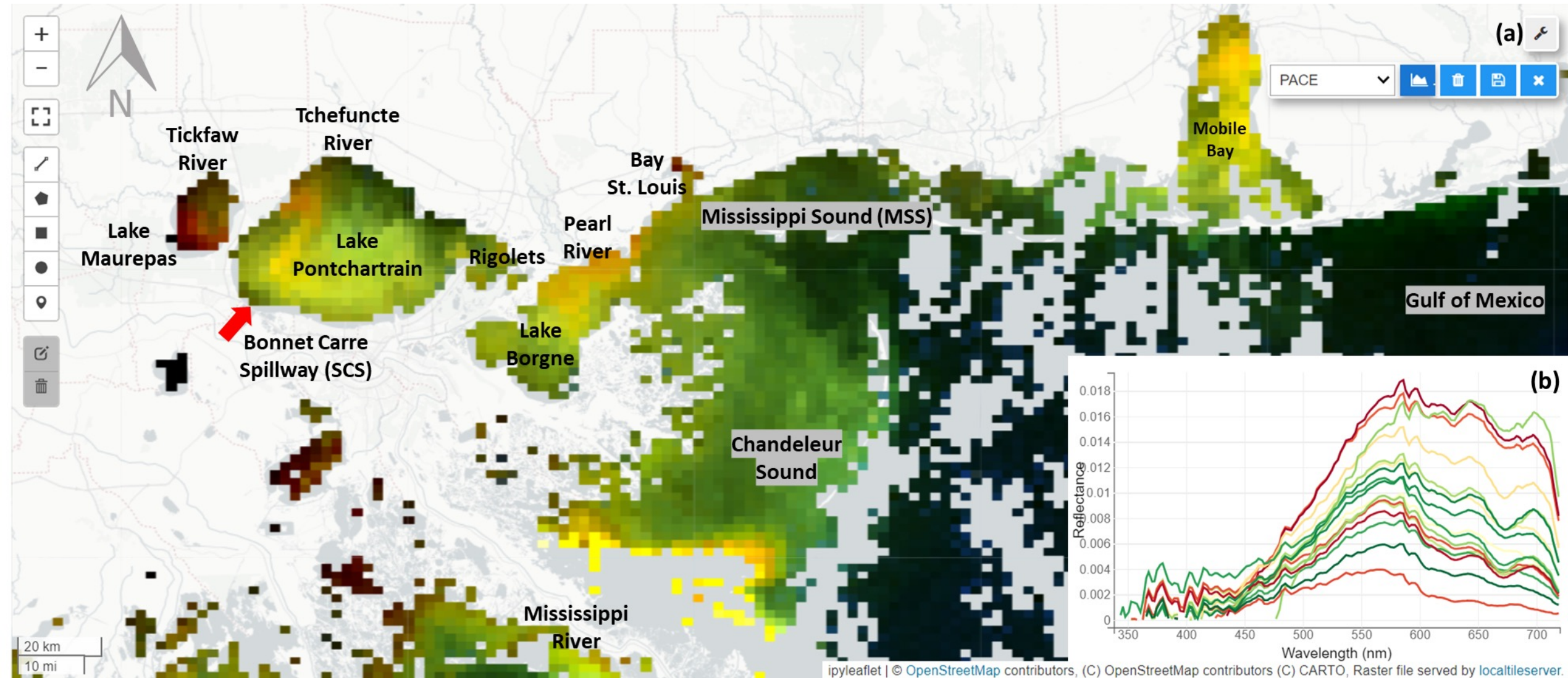
Next step: using these PACE spectra and in situ data in machine learning for characterization of water and phytoplankton types



Stakeholders:

- Barataria-Terrebonne National Estuary Program (BTNEP)
- Oyster Program Manager at Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana Department of Environmental Quality (LDEQ)
- Pontchartrain Conservancy

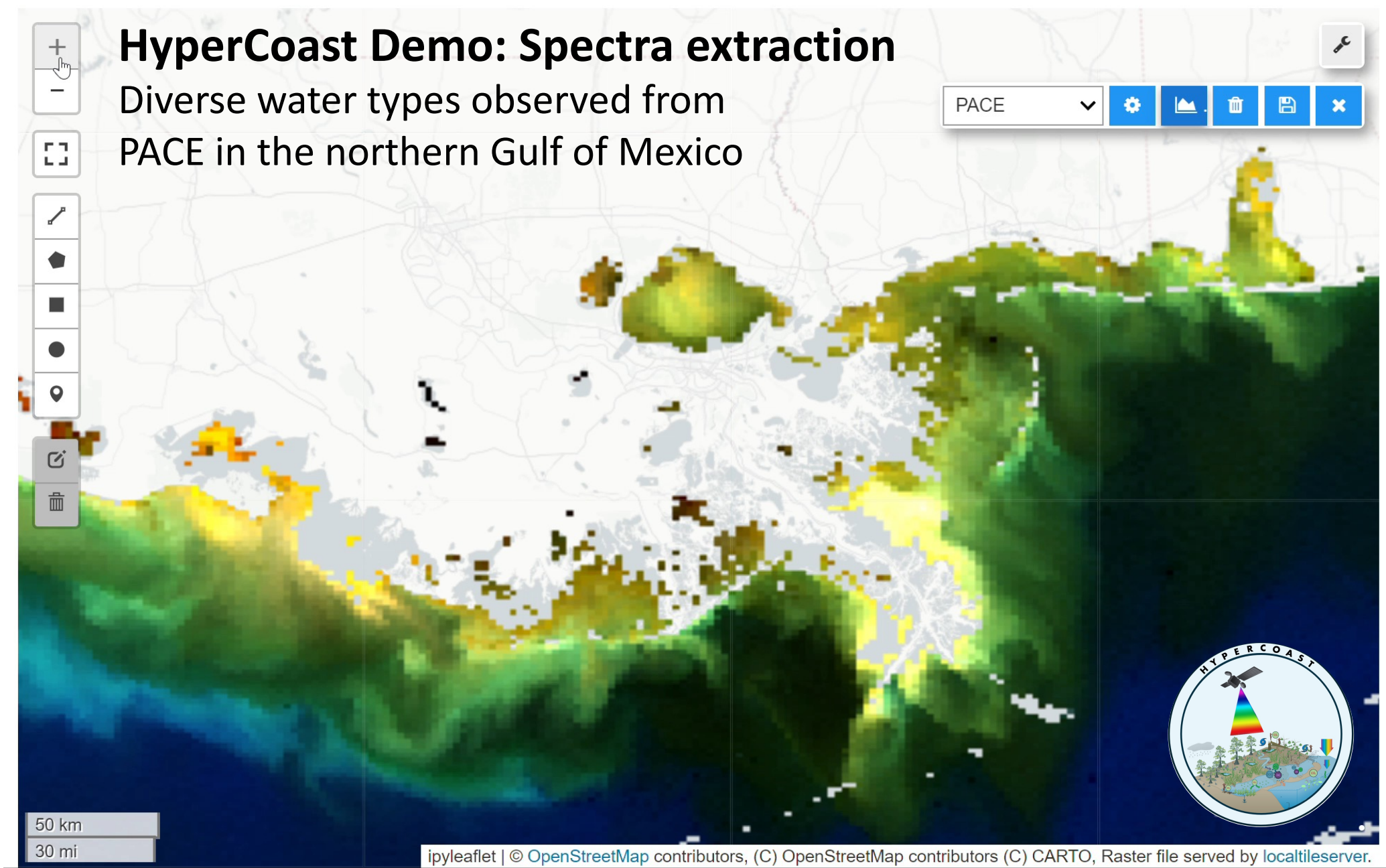
HyperCoast: PACE's Application in Lakes and Estuaries



Diverse water types observed from PACE in the northern Gulf of Mexico

HyperCoast Demo: Spectra extraction

Diverse water types observed from
PACE in the northern Gulf of Mexico



Learn more: [September 5th, 1-2pm \(ET\) during our PACE Community of Practice Quarterly Meeting](#)

Slide contributed by Bingqing Liu



PACE

PACE Data Access: Roadmap for getting started

Accessing PACE Ocean Color Products



Knowledge & experience level of this presentation:

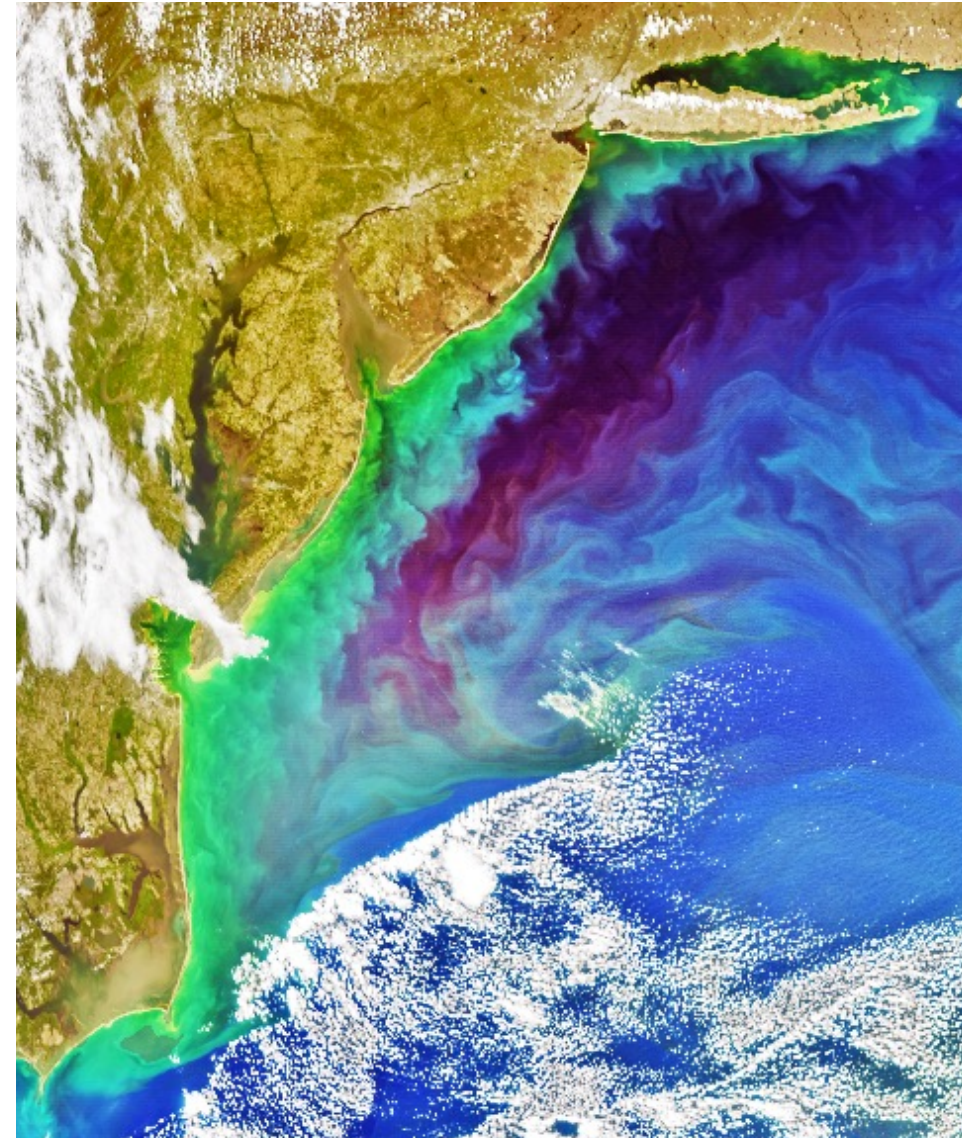
Familiar with downloading, visualizing, and interpreting ocean color satellite data products

Information is current as of July 2024

Data versions, access points, resources will evolve!

By the end of this section you will

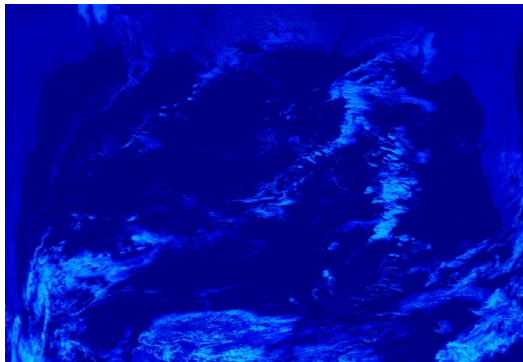
- Know which NASA tools provide access to PACE data
- Know where to find resources available to utilize PACE data (software, Python notebooks, tutorials)



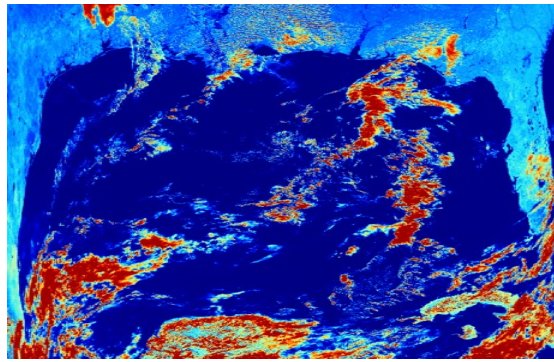
PACE enhanced RGB, US East Coast, April 26, 2024. Credit: Joseph Knuble

Definition of terms: Data Levels

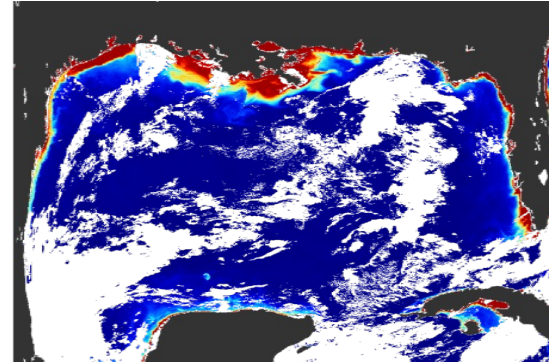
Data Level	Description	Format
Level 1A	Raw instrument data and spacecraft telemetry, reformatted to netCDF4	netCDF4
Level 1B	Calibrated & geolocated instrument data	netCDF4
Level 1C	Calibrated, geolocated, and co-registered to a common grid	netCDF4
Level 2	Derived geophysical science data products	netCDF4
Level 3	Temporally and spatially composited (binned and mapped) products	netCDF4
Level 4	Geophysical products derived from combined Level-3 inputs and/or models	netCDF4



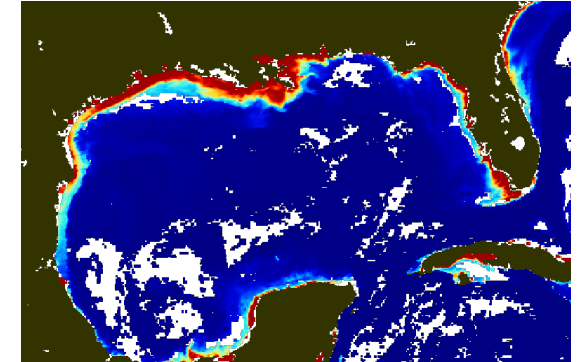
Level 1A – uncalibrated
859 nm band



Level 1B – calibrated
top-of-atmosphere radiance at 859 nm



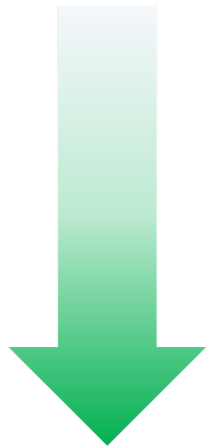
Level 2- Remote Sensing
Reflectance at 645 nm



Level 3
mapped 4km 8-day Chlorophyll-a

Definition of terms: Data Status

Data Status: Descriptor of data maturity. Diagnostic is the least & Standard is the most mature.


Data Status	Description	Maturity
Diagnostic	Products that support analysis of algorithm behavior, but are not intended for science	 <p>Least Mature</p> <p>Most Mature</p>
Test	Have not yet been reviewed by algorithm developers an/or may have known errors under investigation	
Provisional	Results have been reviewed and are within expectations, but have not yet been validated and may still contain significant errors	
Standard (Science Quality)	Products produced by an algorithm that has community consensus and have been validated	

All currently available PACE data products are Diagnostic, Test, or Provisional status

Definition of Terms: Level 2 Ocean Data Product Suites




Data Product Suites: Related data products that are packaged together in one file

 **OC_AOP**


APPARENT OPTICAL PROPERTIES

- Remote Sensing Reflectance
- Rrs uncertainty
- AOT
- Angstrom
- ~~Incident Photosynthesis Available Radiation~~
- ~~Normalized Fluorescence Line Height~~
- Apparent Visible Wavelength

 **OC_IOP**


INHERENT OPTICAL PROPERTIES

- Spectral phytoplankton absorption coefficients
- Spectral non-algal particle plus dissolved organic matter absorption coefficients
- Spectral chromophoric dissolved organic matter absorption coefficients
- Spectral non-algal particle matter absorption
- Spectral particulate matter absorption coefficients
- Spectral slope coefficients of chromophoric dissolved organic matter absorption
- Spectral particle backscattering coefficients
- Total spectral backscattering coefficients
- Total absorption coefficients
- Backscattering Slope
- Non-algal particle matter absorption Slope
- Uncertainties (for some listed above)
- Diffuse attenuation coefficient (Kd_Lee)
- Kd_Lee uncertainties

 **OC_BGC**

BIOGEOCHEMISTRY

- Concentration Of Chlorophyll-a
- Concentration Of Particulate Organic Carbon
- ~~Concentration Of Particulate Inorganic Carbon~~
- Concentration Of Phytoplankton Carbon

 **OC_PAR**

PHOTOSYNTHETICALLY AVAILABLE RADIATION

- Daily PAR scalar 0-
- Daily PAR planar 0+
- Daily PAR planar 0-
- Instantaneous PAR planar 0+
- Instantaneous PAR planar 0-

More to come:

Phytoplankton Community Composition Suite

Net Primary Production Suite

And more...

Adapted from slide by Ivona Cetinic (EGU 2024). Data products that are crossed out are planned for the data suite but not yet available.

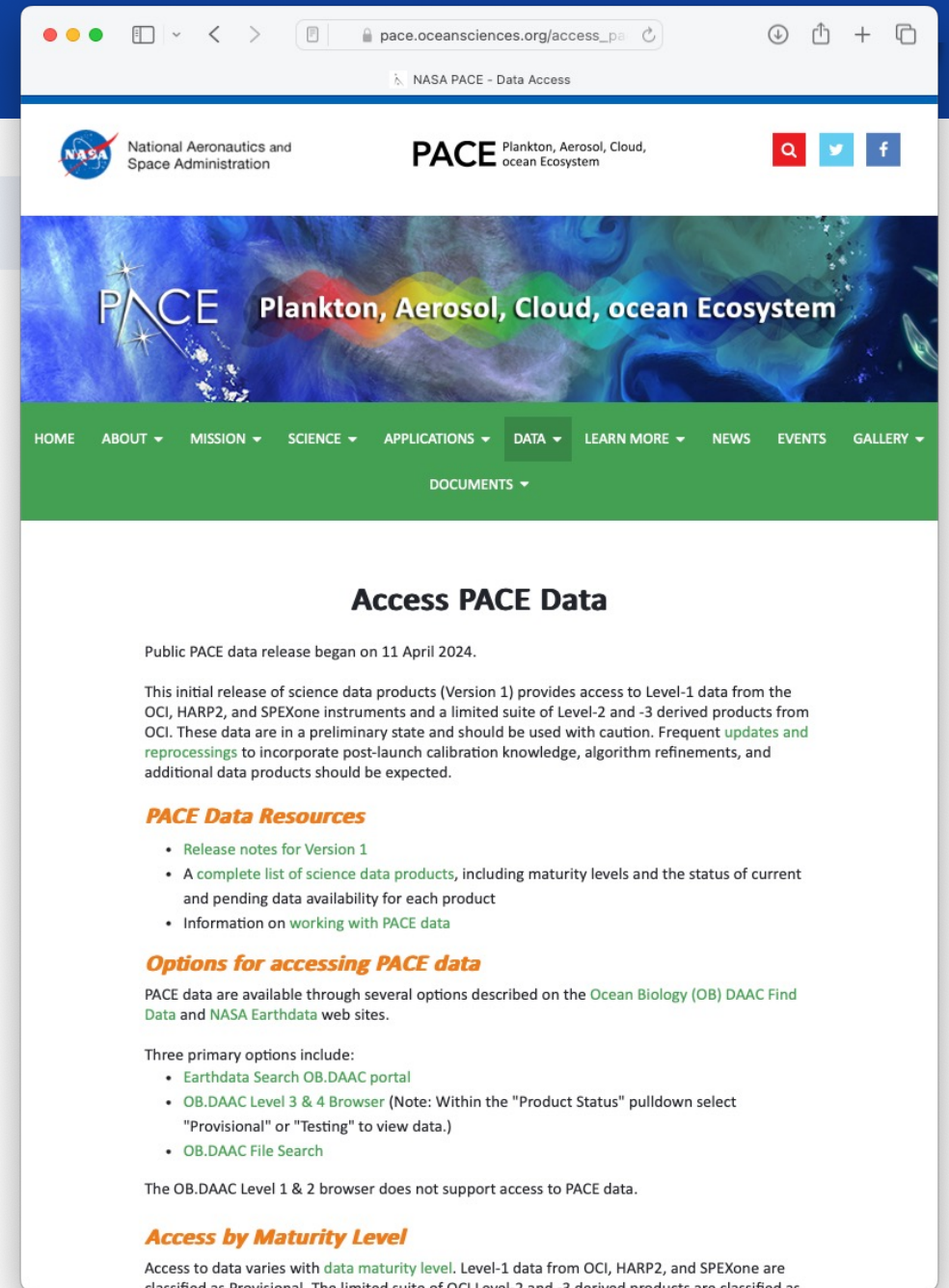
Access PACE Data: Getting Started

PACE Data Access Landing Page

https://pace.oceansciences.org/access_pace_data.htm

→ *Go-to-source for current information*

→ *Bookmark this page!*



The screenshot shows the NASA PACE Data Access landing page. The page features the NASA logo and the PACE mission name (Plankton, Aerosol, Cloud, ocean Ecosystem). A navigation menu includes links for HOME, ABOUT, MISSION, SCIENCE, APPLICATIONS, DATA, LEARN MORE, NEWS, EVENTS, and GALLERY. The main content area is titled "Access PACE Data" and provides information about the public data release starting on April 11, 2024. It includes a section for "PACE Data Resources" with links to release notes, a list of science data products, and information on working with PACE data. There is also a section for "Options for accessing PACE data" which lists three primary options: Earthdata Search OB.DAAC portal, OB.DAAC Level 3 & 4 Browser, and OB.DAAC File Search. The page concludes with a note that the OB.DAAC Level 1 & 2 browser does not support access to PACE data and a section for "Access by Maturity Level" which explains that Level-1 data is provisional and Level-2 and -3 data are also provisional.

NASA National Aeronautics and Space Administration

PACE Plankton, Aerosol, Cloud, ocean Ecosystem

HOME ABOUT MISSION SCIENCE APPLICATIONS DATA LEARN MORE NEWS EVENTS GALLERY

DOCUMENTS

Access PACE Data

Public PACE data release began on 11 April 2024.

This initial release of science data products (Version 1) provides access to Level-1 data from the OCI, HARP2, and SPEXone instruments and a limited suite of Level-2 and -3 derived products from OCI. These data are in a preliminary state and should be used with caution. Frequent updates and reprocessings to incorporate post-launch calibration knowledge, algorithm refinements, and additional data products should be expected.

PACE Data Resources

- [Release notes for Version 1](#)
- [A complete list of science data products](#), including maturity levels and the status of current and pending data availability for each product
- [Information on working with PACE data](#)

Options for accessing PACE data

PACE data are available through several options described on the [Ocean Biology \(OB\) DAAC Find Data](#) and [NASA Earthdata](#) web sites.

Three primary options include:

- [Earthdata Search OB.DAAC portal](#)
- [OB.DAAC Level 3 & 4 Browser](#) (Note: Within the "Product Status" pulldown select "Provisional" or "Testing" to view data.)
- [OB.DAAC File Search](#)

The OB.DAAC Level 1 & 2 browser does not support access to PACE data.

Access by Maturity Level

Access to data varies with [data maturity level](#). Level-1 data from OCI, HARP2, and SPEXone are classified as Provisional. The limited suite of OCI Level-2 and -3 derived products are classified as

What data products are currently available?



Data Products Table Webpage: current & future data products, availability, and status.
https://pace.oceansciences.org/data_table.htm Always up-to-date → **Bookmark this page!** ←

Data Products Table

Calibrated Radiometry and Polarimetry | Ocean Properties to be Produced by OCI | Atmospheric Properties to be Produced by OCI | Land Data Products to be Produced by OCI | Aerosol and Ocean Properties from HARP2 | Aerosol and Land Surface Properties from HARP2 | Cloud Properties from HARP2 | Ocean Surface Properties from HARP2 | Aerosol and Ocean Properties from SPEXone | Aerosol and Land Surface Properties from SPEXone | Aerosol and Ocean Properties from OCI + HARP2 + SPEXone

Access to data varies with its status (data maturity level). Provisional data are available through [Earthdata Search](#), the [OB.DAAC File Search](#) and [Level 3 & 4 Browser](#). Test and Diagnostic data are available through the [OB.DAAC File Search](#) and [Level 3 & 4 Browser](#). See also “[Access PACE Data](#)”.

What do colors in the “Availability” column mean?

Available

Coming soon!

Currently implementing and evaluating

No approach currently identified

Calibrated Radiometry and Polarimetry

Calibrated and geolocated radiometry and polarimetry as observed at sensor.

Product	Description and Use	Units	Availability	Status	Additional Info
Spectral top-of-atmosphere radiances from OCI	Spectral radiance observed at the top of the atmosphere.	$W\ m^{-2}\ \mu m^{-1}\ sr^{-1}$	Level-1B 1-km at nadir; daily - Level-1C ; daily	Provisional	Level-1C draft data format and examples
Spectral top-of-atmosphere radiances and polarimetry from SPEXone	Spectral radiance and polarimetry observed at the top of the atmosphere, for all sensor viewing angles.	Various	Level-1B TBD; daily - Level-1C ; daily	Provisional	Level-1C draft data format and examples
Spectral top-of-atmosphere radiances and polarimetry from HARP2	Spectral radiance and polarimetry observed at the top of the atmosphere, for all sensor viewing angles.	Various	Level-1B TBD; daily - Level-1C ; daily	Provisional	Level-1C draft data format and examples

Access PACE Data: Getting started



I am accustomed to getting ocean color data from OB.DAAC (Ocean Biology Distributed Active Archive Center) via the Level 1,2 and Level 3,4 browsers on the Ocean Color Website.

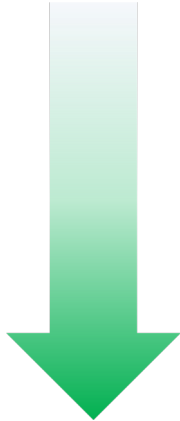
Is accessing PACE data different?

Yes!

- Access varies with data level & data status (data maturity).
For example:
 - Provisional Level-1 &2 data available through Earthdata Search
 - Provisional, Test, and Diagnostic data available from the OB.DAAC File Search and the OB.DAAC Level 3 & 4 Browser

What is available today?

- **Level 1 Provisional** data from **OCI, HARP2, and SPEXone**
- Limited suite of **OCI Level 2 & Level 3** derived products
- **Version 2 release**. Preliminary data, use with caution. Frequent updates & reprocessing should be expected.

Data Status	Maturity
Diagnostic	Least Mature  Most Mature
Test	
Provisional	
Standard (Science Quality)	

Access PACE Data: Where to find data products



NASA Worldview

Visualization. Quickly outputs images & videos.

← Currently OCI Level 2, Chl-a & True Color

WORLDVIEW

<https://worldview.nasa.gov>



NASA Earthdata

*Comprehensive: data from *all* NASA Distributed Active Archive Centers (DAACs). Cloud-based.*

← Level 1 & 2, Provisional: OCI, SPEXone, HARP2 data

EARTHDATA
OPEN ACCESS FOR OPEN SCIENCE

<https://earthdata.nasa.gov>

NASA OB.DAAC (Ocean Biology DAAC) Website

“File Search” & “Level 3 & 4 Browser” Search Tools

- Provisional, Test, and Diagnostic data
- Level/maturity available varies by instrument/product

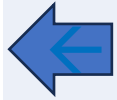


<https://oceancolor.gsfc.nasa.gov>



NASA Worldview

Visualization. Quickly outputs images & videos.



← Currently OCI Level 2, Chl-a & True Color

WORLDVIEW

<https://worldview.nasa.gov>

NASA WORLDVIEW

Layers Events Data

OVERLAYS

Place Labels
© OpenStreetMap contributors, Natural Earth

Coastlines / Borders / Roads
© OpenStreetMap contributors

Coastlines
© OpenStreetMap contributors

Chlorophyll a (L2)
PACE / OCI **v1 NRT**

< 0.0100 mg/m³ >= 20.000 mg/m³

BASE LAYERS

Corrected Reflectance (True Color)
PACE / OCI **v1 NRT**

Group Similar Layers

+ Add Layers

Start Comparison

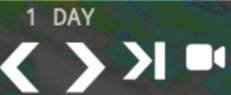
Search for places or enter coordinates

Zoom out view

2000 km
1000 mi

77.7890°, -139.3775° EPSG:4326

2024 APR 20



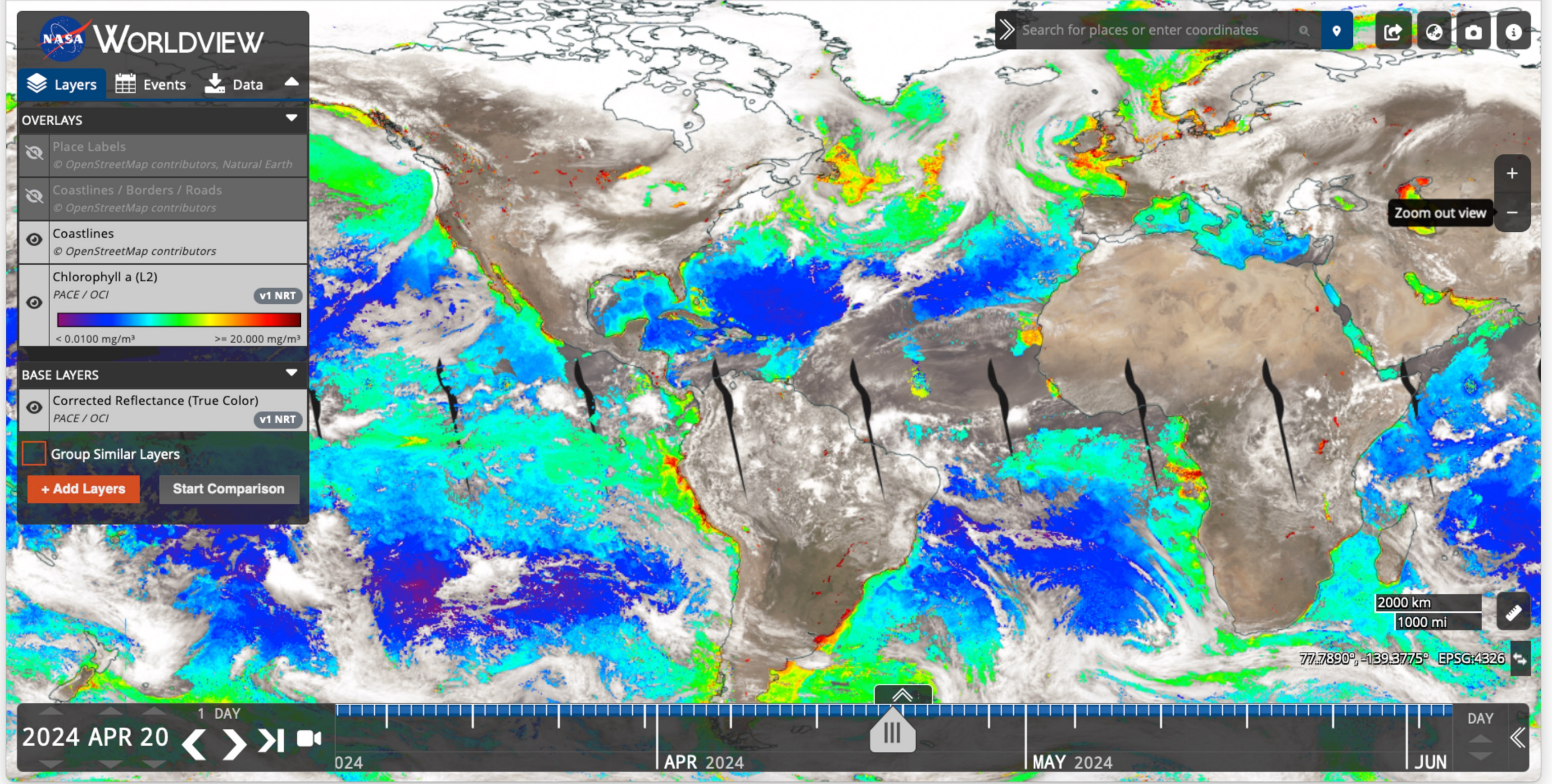
024

APR 2024

MAY 2024

JUN

DAY





NASA Worldview

Visualization. Quickly outputs images & videos.

← Currently OCI Level 2, Chl-a & True Color



<https://worldview.nasa.gov>



NASA Earthdata

*Comprehensive: data from *all* NASA Distributed Active Archive Centers (DAACs). Cloud-based.*

← Level 1 & 2, Provisional: OCI, SPEXone, HARP2 data



<https://earthdata.nasa.gov>

EARTHDATA SEARCH

OBDAAC (Ocean Biology Distributed ... Leave Portal

Search for collections or topics

Filter icons

PACE x Clear Filters

Filter Granules

Granule Search

Granule ID(s) Search Single or Multiple Granule IDs...

Temporal Start YYYY-MM-DD HH:mm:ss

End YYYY-MM-DD HH:mm:ss

Recurring? checkbox

Day/Night

Find granules captured during the day, night or anytime.

Anytime dropdown

Data Access

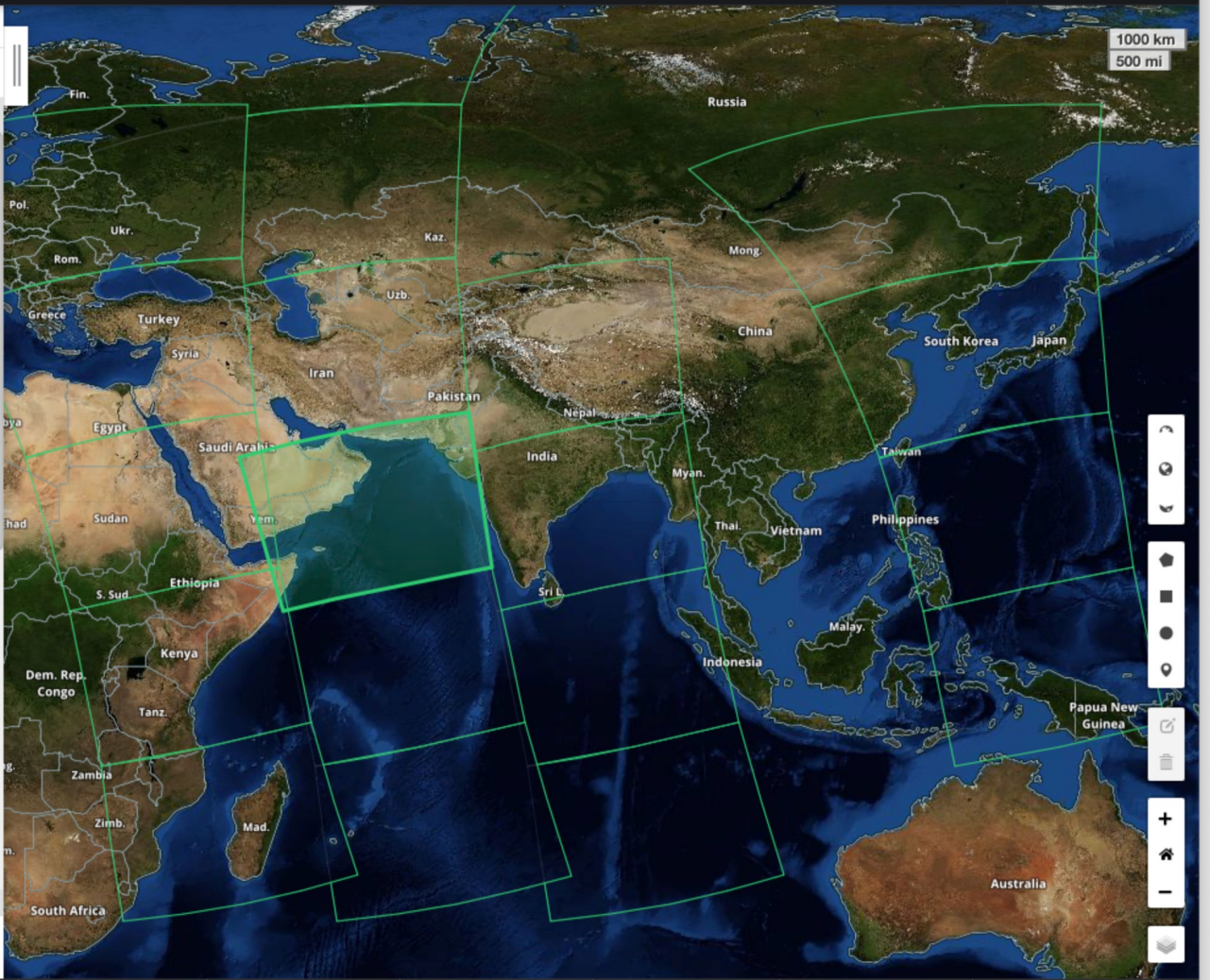
Find only granules that have browse images checkbox
Find only granules that are available online checkbox

Search Results (32 Collections)

PACE OCI Level-1C Science Data, V1.0

Showing 20 of 7,096 matching granules Sort View

Table with 2 columns of granule information including ID, START, and END times. Includes a 'Download All 7,096' button at the bottom.



Access PACE Data: NASA Earthdata

ALL downloads require an Earthdata account

Register:

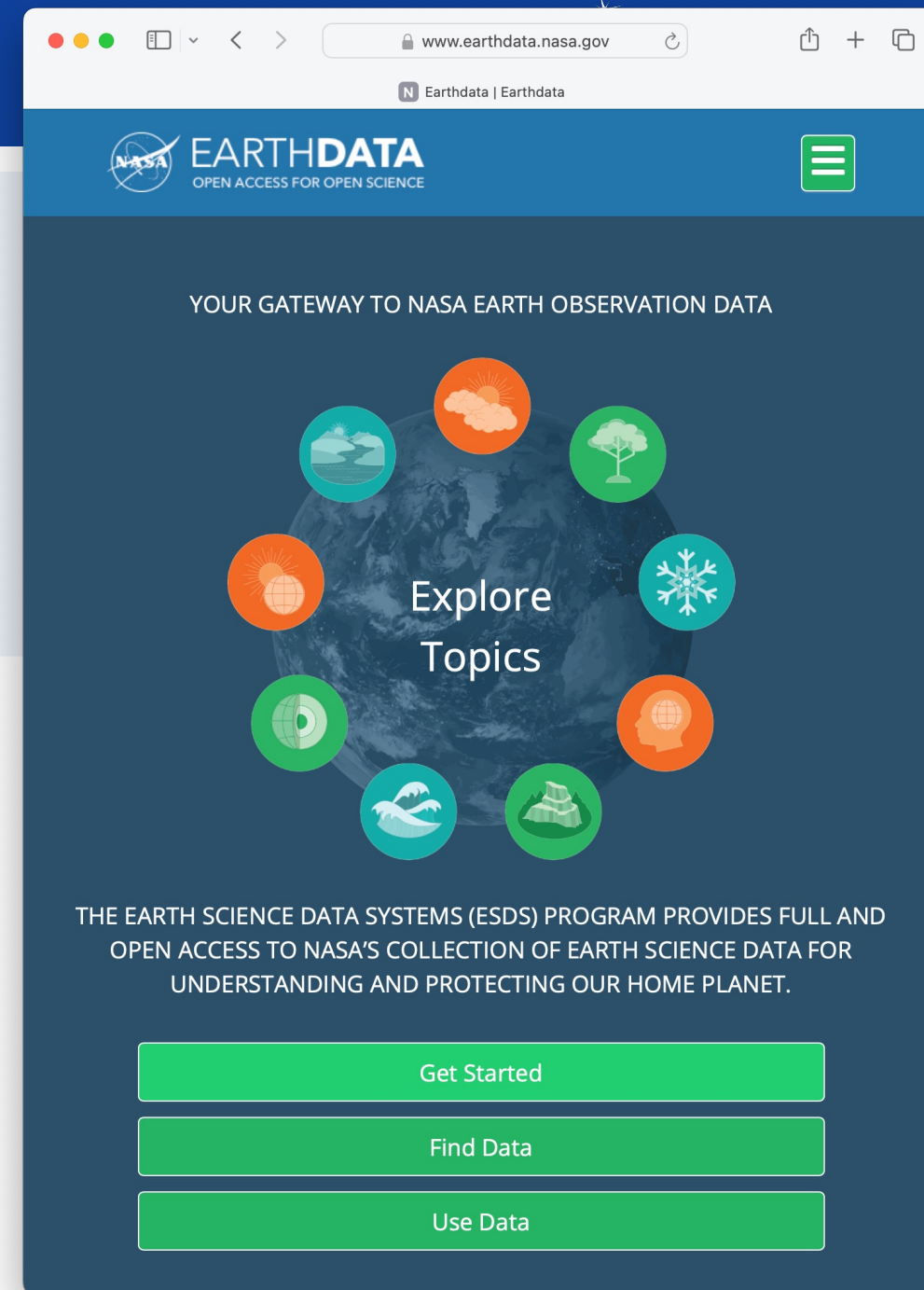
<https://www.earthdata.nasa.gov/eosdis/science-system-description/eosdis-components/earthdata-login>

Getting started with Earthdata:

<https://www.earthdata.nasa.gov/learn/get-started>

Recent PACE OB.DAAC Tutorial, includes Earthdata (& OB.DAAC) data search details:

<https://www.earthdata.nasa.gov/learn/webinars-and-tutorials/pace-mission-products-data-discovery-webinar>



The screenshot shows the NASA Earthdata website homepage. At the top, the URL is www.earthdata.nasa.gov. The header features the NASA logo and the text "EARTHDATA OPEN ACCESS FOR OPEN SCIENCE". Below the header, the main content area has a dark blue background with a central image of Earth. Overlaid on the Earth image is the text "Explore Topics" surrounded by several circular icons representing different Earth science topics: a sun, a tree, a snowflake, a globe, a mountain, a wave, a globe with a play button, and a sun with clouds. Below this central graphic, there is a paragraph of text: "THE EARTH SCIENCE DATA SYSTEMS (ESDS) PROGRAM PROVIDES FULL AND OPEN ACCESS TO NASA'S COLLECTION OF EARTH SCIENCE DATA FOR UNDERSTANDING AND PROTECTING OUR HOME PLANET." At the bottom of the page, there are three prominent green buttons: "Get Started", "Find Data", and "Use Data".



NASA Worldview

Visualization. Quickly outputs images & videos.

← Currently OCI Level 2, Chl-a & True Color

The Worldview logo consists of the word "WORLDVIEW" in white, bold, uppercase letters on a black rectangular background.

<https://worldview.nasa.gov>



NASA Earthdata

*Comprehensive: data from *all* NASA Distributed Active Archive Centers (DAACs). Cloud-based.*

← Level 1 & 2, Provisional: OCI, SPEXone, HARP2 data

The Earthdata logo features the word "EARTHDATA" in white, bold, uppercase letters on a blue rectangular background. Below it, the tagline "OPEN ACCESS FOR OPEN SCIENCE" is written in smaller white uppercase letters.

<https://earthdata.nasa.gov>

NASA OB.DAAC (Ocean Biology DAAC) Website

"File Search" & "Level 3 & 4 Browser" Search Tools

- Provisional, Test, and Diagnostic data
- Level/maturity available varies by instrument/product

The Ocean Color logo features a stylized blue wave icon on the left. To its right, the text "OCEAN COLOR" is written in large, bold, black uppercase letters, with "OB.DAAC | OBPG" in smaller black uppercase letters below it.

<https://oceancolor.gsfc.nasa.gov>

Access PACE Data: NASA OB.DAAC Tools

Level 3 & 4 Browser

<https://oceancolor.gsfc.nasa.gov/l3/>

Visualize, extract, and download select Level 3 PACE data products

User Note:

- (1) First, in the “Product Status” menu, select “Provisional” or “Test”; (2) *then* select PACE instrument options in the “Instrument” menu; and (3) select your product, period & resolution
- Includes useful help feature (red button to right)
- *Downloads require NASA Earthdata account*
<https://urs.earthdata.nasa.gov>

Level 3 & 4 Browser

Extract or Download Data Help

Product Status	Instrument	Product	Period	Resolution
Provisional	PACE-OCI	Chlorophyll concentration	Daily	0.1-deg

Start Date: 2024-02-25 End Date: 2024-06-07

Previous

PACE-OCI
Chlorophyll concentration

Tue, 30 Apr 2024 (L3) Wed, 1 May 2024 (L3) Thu, 2 May 2024 (L3) Fri, 3 May 2024 (L3)

Sat, 4 May 2024 (L3) Sun, 5 May 2024 (L3) Mon, 6 May 2024 (L3) Tue, 7 May 2024 (L3)

Wed, 8 May 2024 Thu, 9 May 2024 Fri, 10 May 2024 Sat, 11 May 2024

Access PACE Data: NASA OB.DAAC Tools

File Search

https://oceandata.sci.gsfc.nasa.gov/api/file_search

Search currently available Provisional, Diagnostic, and Test data

User Notes:

- Has a useful help feature (red button on left) that details useful search features, e.g. wget & curl text generation for data of interest, advanced search, etc.
- *Downloads require NASA Earthdata account*
<https://urs.earthdata.nasa.gov>

The screenshot shows a web browser window with the URL `oceandata.sci.gsfc.nasa.gov/api`. The page title is "NASA Ocean Color". At the top left, there is a "LOGIN" button with an external link icon. Below it is the "File Search" heading and a red "Help" button. A navigation bar contains four tabs: "Basic" (selected), "Advanced", "Search Ancillary", and "Search by Subscription". The "Instrument:" field is a dropdown menu set to "PACE-OCI". The "Data Class:" section has three radio buttons: "Show All" (selected), "Level-0", and "Level-1C". The "Data Type:" section has a dropdown menu set to "PACE-OCI level-1C at SPEXone width" and three radio buttons: "All" (selected), "Refined Only", and "Quicklook Only". Under "Additional Options", there are three unchecked checkboxes: "Display results as text, one file name per line", "Prepend URL prefix to file name", and "Include checksum with file name". A code block contains the following commands:

```
wget -q --post-data="results_as_file=1&sensor_id=42&dtid=1355&sdate=2024-02-25 00:00:00&edate=2024-06-07 03:34:54&subType=1" -O - https://oceandata.sci.gsfc.nasa.gov/api/file_search
curl -d "results_as_file=1&sensor_id=42&dtid=1355&sdate=2024-02-25 00:00:00&edate=2024-06-07 03:34:54&subType=1" https://oceandata.sci.gsfc.nasa.gov/api/file_search
```

A "Submit" button is located at the bottom of the form.

PACE Jupyter Notebook Tutorials

<https://oceancolor.gsfc.nasa.gov/resources/docs/tutorials/>

Learn with OCI Tutorial Notebooks

- Data Access
- File Structure at Three Processing Levels
- OCSSW: Installing & Running Command-line Tools
- OCSSW: Processing with Command-line Tools
- (also Learn with HARP2: Data Visualization)
- More to come...



NASA Cloud Support

earthaccess, a Python API to search for and download or stream data from the Earthdata cloud.

- **Information:** <https://earthaccess.readthedocs.io/en/latest/>
- **Download:** <https://github.com/nsidc/earthaccess>

NASA Openscapes Earthdata Cloud Cookbook

- **Vital resource to understanding Earthdata & the Cloud**
<https://nasa-openscapes.github.io/earthdata-cloud-cookbook/>



Github

nasa-pace

Want to share your PACE-relevant code on Github repository with the Community? Tag it with “nasa-pace”



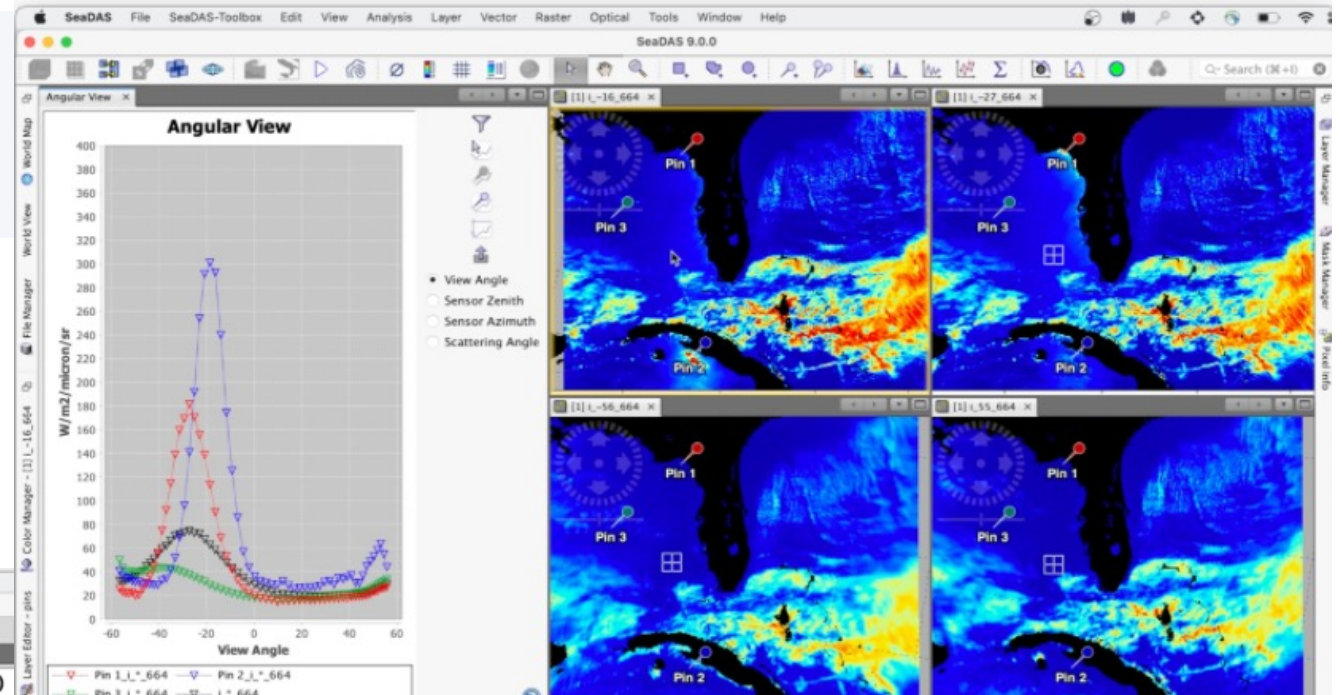
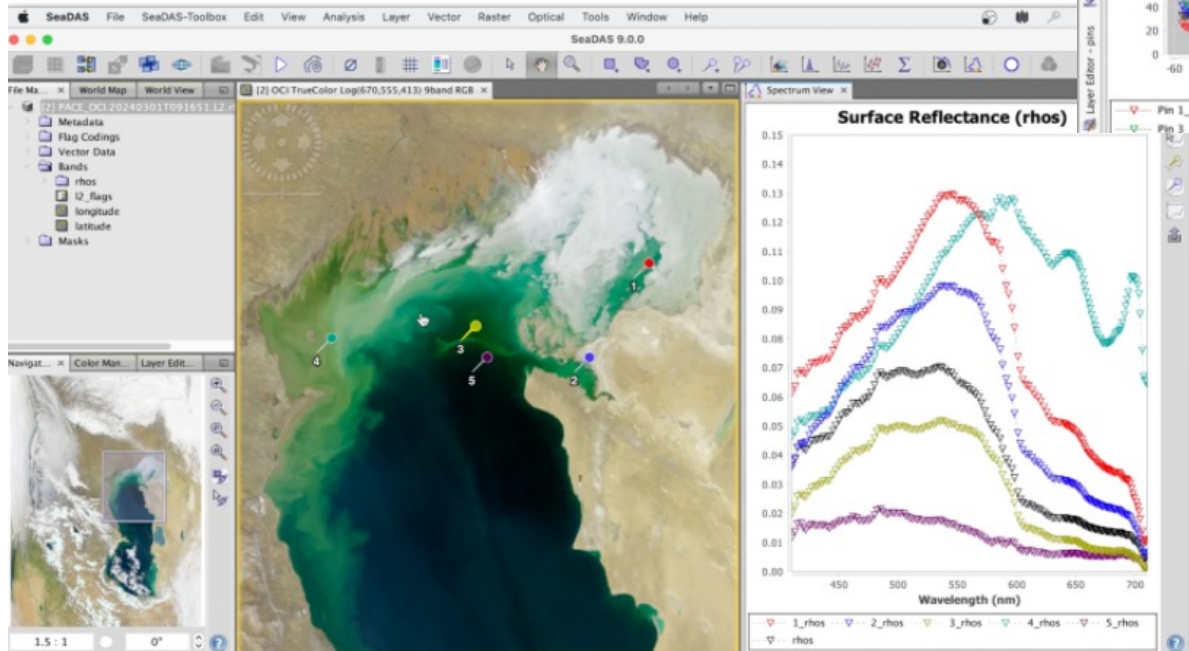
Resources to work with PACE Data: SeaDAS



NASA/OB.DAAC Data Analysis and Visualization Software

Download: <https://seadas.gsfc.nasa.gov>

- Newest version: 9.0.1, May 2024
- Version 9.x supports PACE data
- Operating Systems: Mac, Linux, Windows
- Exports to formats including **GeoTIFF** (readable by GIS), **KML** (readable by Google Earth) & others



Tutorial Video on SeaDAS 9.0
includes OCI hyperspectral (left) and
polarimeter (above) data examples

<https://www.youtube.com/watch?v=GZG2saE9ecc>

Resources: Questions

Data Questions:

Earthdata Forum

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

(all EO missions)

<https://forum.earthdata.nasa.gov/viewforum.php?f=7&&Projects=102>

(links to PACE-tagged questions)

The screenshot shows the Earthdata Forum website interface. At the top, there is a navigation bar with "Quick links", "Help", "Guided Tour", and "Login". Below this is a search bar with the text "Search this forum, filters...". The search filters are set to "PACE" and include "Answered", "Discipline", "DAAC", "Projects", "Services/Usage", and "Dates". There is also an "Author" filter and a "Reset all filters" button. The main content area is titled "Announcements" and lists four items: "NASA ARSET: Invasive Species Monitoring with Remote Sensing", "NASA ARSET: NASA Atmospheric Composition Ground Networks Supporting Air Quality & Climate Applications", "NASA ARSET: Drought Monitoring, Prediction, and Projection using NASA Earth System Data", and "Announcing POWER DAVE's Official Release from Beta". Below the announcements is a "Post New Question" button and a "Share these results" button. The bottom section is titled "Questions and Comments" and shows a list of questions with columns for "Replies" and "Last post". The first question is "Navigating PACE imagery" with 3 replies, last posted by daurin on Thu Jul 25, 2024 2:35 pm. The second question is "Kd for PACE" with 1 reply, last posted by lmckinna on Tue Jul 23, 2024 8:55 am.

forum.earthdata.nasa.gov/viewfor

Home - Earthdata Forum

Welcome to the Earthdata Forum! Here, the scientific user community and subject matter experts from NASA Distributed Active Archive Centers (DAACs), and other contributors, discuss research needs, data, and data applications.

Quick links | Help | Guided Tour | Login

Home

Search this forum, filters...

PACE

Answered | Discipline | DAAC | Projects | Services/Usage | Dates

Author | Reset all filters | Match Any

Announcements

- NASA ARSET: Invasive Species Monitoring with Remote Sensing
- NASA ARSET: NASA Atmospheric Composition Ground Networks Supporting Air Quality & Climate Applications
- NASA ARSET: Drought Monitoring, Prediction, and Projection using NASA Earth System Data
- Announcing POWER DAVE's Official Release from Beta

Post New Question | Share these results

26 questions 1 2

Questions and Comments	Replies	Last post
Navigating PACE imagery OBDAAC PACE	3	by daurin Thu Jul 25, 2024 2:35 pm America/New_York
Kd for PACE Algorithms OBDAAC Ocean	1	by lmckinna Tue Jul 23, 2024 8:55 am America/New_York

Resources: NASA Applied Remote Sensing Training (ARSET)



<https://appliedsciences.nasa.gov/arset>

Cost-free training on the use of Earth Observations for decision making

- Our trainings are:
 - Online and in-person
 - Live and instructor-led, or self-guided
 - Provided at no cost, with materials and recordings available from our website
 - Often **multi-lingual**
 - Range in level from **introductory** to **advanced**

PACE PACE-Relevant Trainings

- Water quality (WQ) monitoring
- How to use SeaDAS software for WQ
- Remote sensing of coastal ecosystem
- Using hyperspectral data
- Air quality monitoring and modeling



Online Resource Guide listing all ARSET trainings

Coming Late 2024 – “Introduction to Hyperspectral (PACE) Data for Water Quality Monitoring”



[Disasters](#)



[Agriculture](#)



[Land](#)



[Water Resources](#)



[Climate](#)



[Health & Air Quality](#)

PACE Data Resources: Summary of links from Webinar



- *How do I prepare to work w/PACE data?* https://pace.oceansciences.org/work_with_pace_data.htm
- *Release notes for version 2?* *Version 2, Release notes:* <https://oceancolor.gsfc.nasa.gov/data/reprocessing/v1/pace/>
- *Which data products are available?* https://pace.oceansciences.org/data_table.htm
- *How do I access PACE Data?* https://pace.oceansciences.org/access_pace_data.htm
- *Where to register an Earthdata account?* To download data, register at <https://urs.earthdata.nasa.gov>
- *Where do I ask PACE questions?* <https://forum.earthdata.nasa.gov/viewforum.php?f=7&&Projects=102> *(links to PACE-tagged questions)*

Which NASA tools provide access to PACE data?

- [Earthdata portal](#) (this link is only PACE instruments) <https://search.earthdata.nasa.gov/search?portal=obdaac&fps0=PACE> *(links only to PACE data)*
- [OB.DAAC Search](#) https://oceandata.sci.gsfc.nasa.gov/api/file_search/
- [OB.DAAC Level 3 & 4 Browser](#) <https://oceancolor.gsfc.nasa.gov/l3/>
- [Worldview](#) [Click here for PACE in Worldview](#) *(only OCI Chlorophyll-a & True Color products at this time)*

What software and Python resources are available for using PACE data?

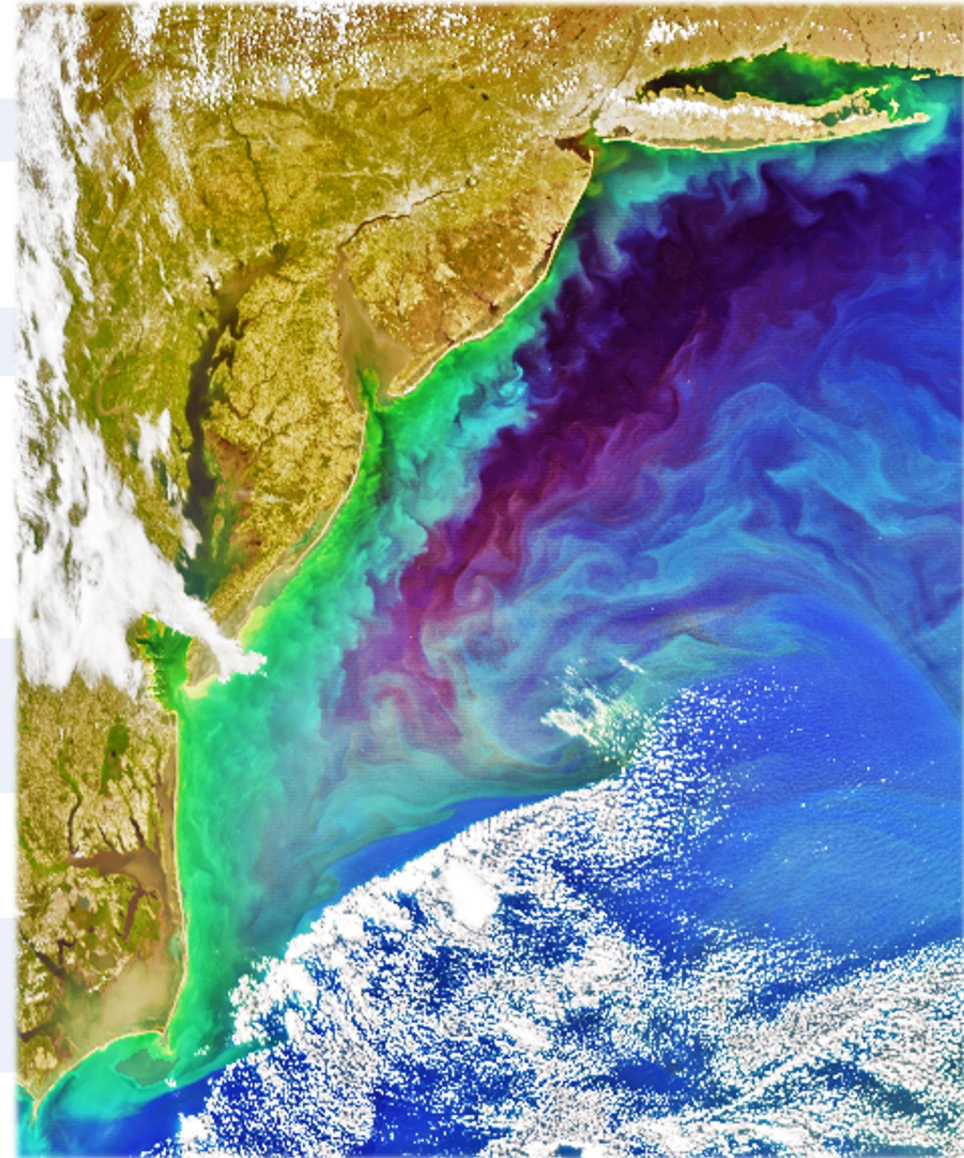
- Jupyter Notebook Tutorials <https://oceancolor.gsfc.nasa.gov/resources/docs/tutorials/>
- SeaDAS 9.0.1, NASA-developed software <https://seadas.gsfc.nasa.gov>
 - SeaDAS 9 Tutorial Video <https://www.youtube.com/watch?v=GZG2saE9ecc>

Stay updated!! Join the PACE Community of Practice <https://forms.gle/cAe4cSLGt3GhmmPc6>

Wrap Up: Upcoming PACE Events

*Updates for below via [PACE-community email list](#), [PACE website](#)

- **August 4-8th: Hackweek: a social coding event**
 - *Recordings and coding material posted online afterward*
- **Sept. 5, 1-2pm ET: PACE Comm. of Practice Quarterly Meeting**
 - *Bingqing Liu, Asst. Professor, U of Louisiana*
 - *Topic: Hypercoast, open source PACE data visualization tool & advancing HAB monitoring for oyster farms in LA Gulf region*
- **October 2024 (Date TBD soon): ARSET Introduction to (PACE) Hyperspectral Observations for Water Quality Monitoring**
 - *Online course from NASA ARSET, registration opens in coming weeks.*
- **December 8th 2024: 4th Annual PACE Applications Workshop Washington DC, 9am-5pm, free, in person**
 - *Cross-disciplinary. Sunday before the AGU Fall Meeting.*
 - *****Going to AGU? In the area? JOIN US!!!**



PACE Enhanced RGB, US East Coast, April 26, 2024 Credit: Joseph Knuble



PACE

<https://pace.gsfc.nasa.gov>

Follow us: @NASAOcean



Speaker email:
morgaine.mckibben@nasa.gov

- Next generation of ocean color science and applications is here with PACE
- On ramp to future hyperspectral missions, e.g. NOAA GeoXO, NASA GLIMR & SBG

Stay up-to-date with all things PACE:

- PACE-community email list
- PACE Website <https://pace.gsfc.nasa.gov>
 - Data Access & Data Product Table webpages
 - News & Events Sections