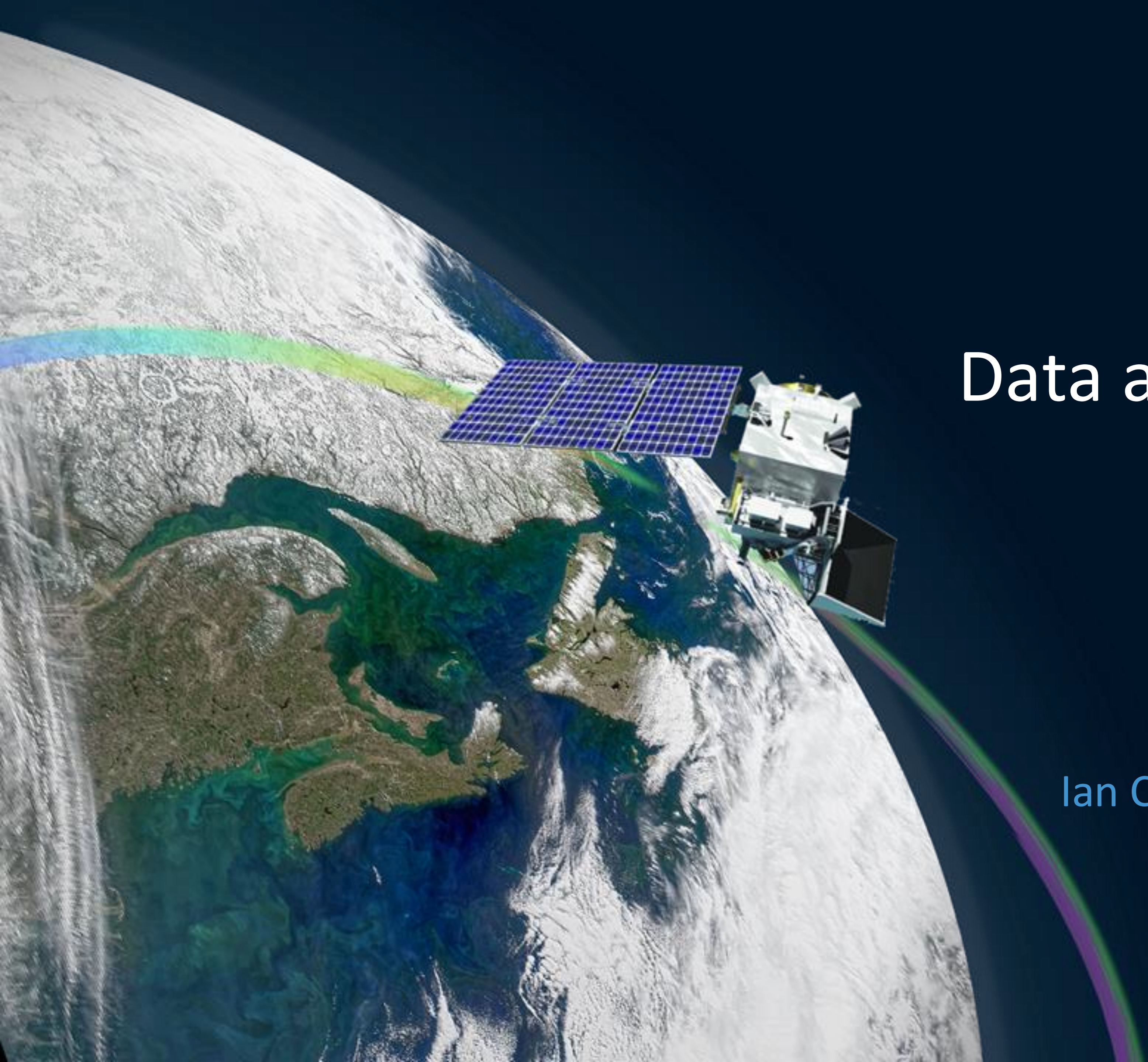


National Aeronautics and
Space Administration

FICE 2025 - PACE
Data access and processing

Tutorial lead
Carina Poulin, Ph.D.
NASA OEL | SSAI

Content collaborators
Ian Carroll, Ph.D. & Anna Windle, Ph.D.
NASA OEL | UMBC | SSAI

Carina Poulin

Scientific Designer
SSAI - NASA Ocean Ecology Laboratory

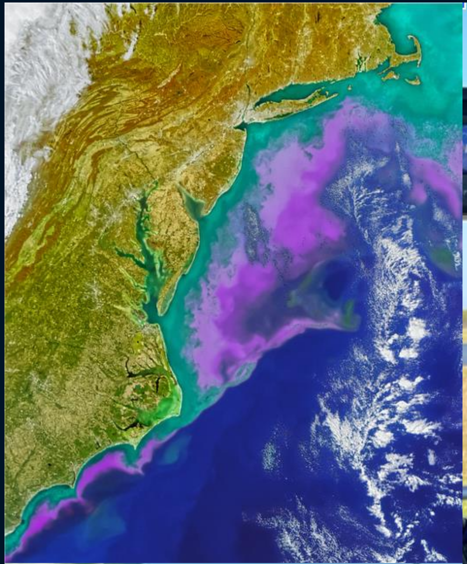
Developing tutorials, educational content, creating visualizations, image processing and designing swag!

Background:

Universite de Sherbrooke
-B.Sc. - Ecology
-M.Env. - Impact of light pollution on cyanobacteria
-Ph.D. Remote Sensing - Optical properties of phytoplankton cultures (Yannick Huot and David Antoine)

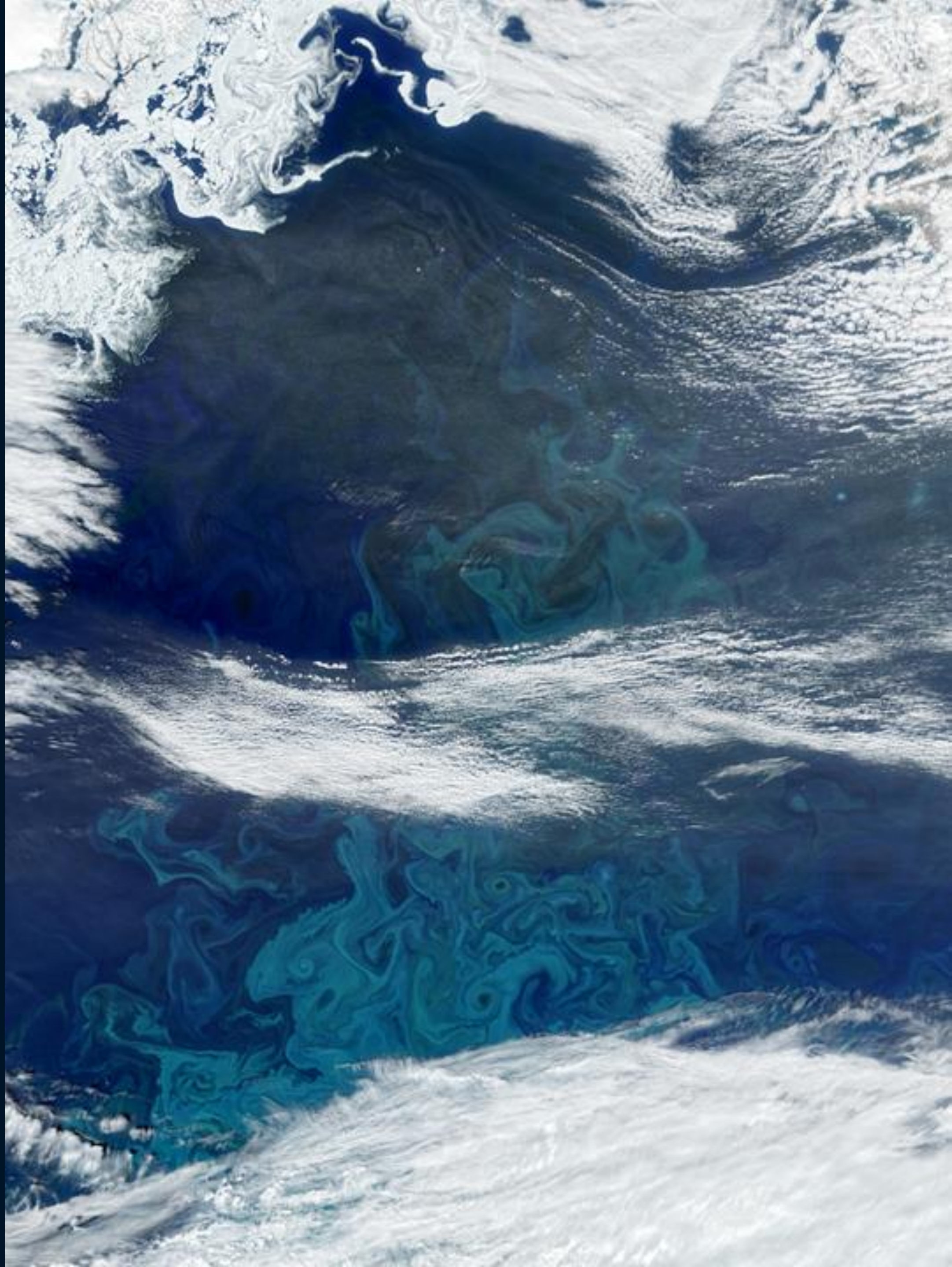
Postdoc University of Southern Mississippi – Stennis Space Center (Xiaodong Zhang) – Plankton optics, refractive index

Postdoc Florida Atlantic University (Mike Twardowski) - Bioluminescence



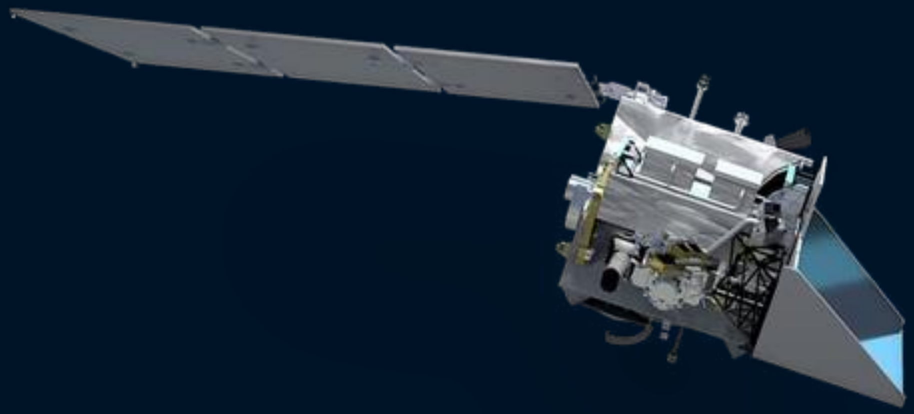
IN A NUTSHELL

- Basic PACE data information
- Earthdata Cloud Access and PACE file structure
- Visualizing PACE data
- PACE data processing with OCSSW/SeaDAS
- Help Hub

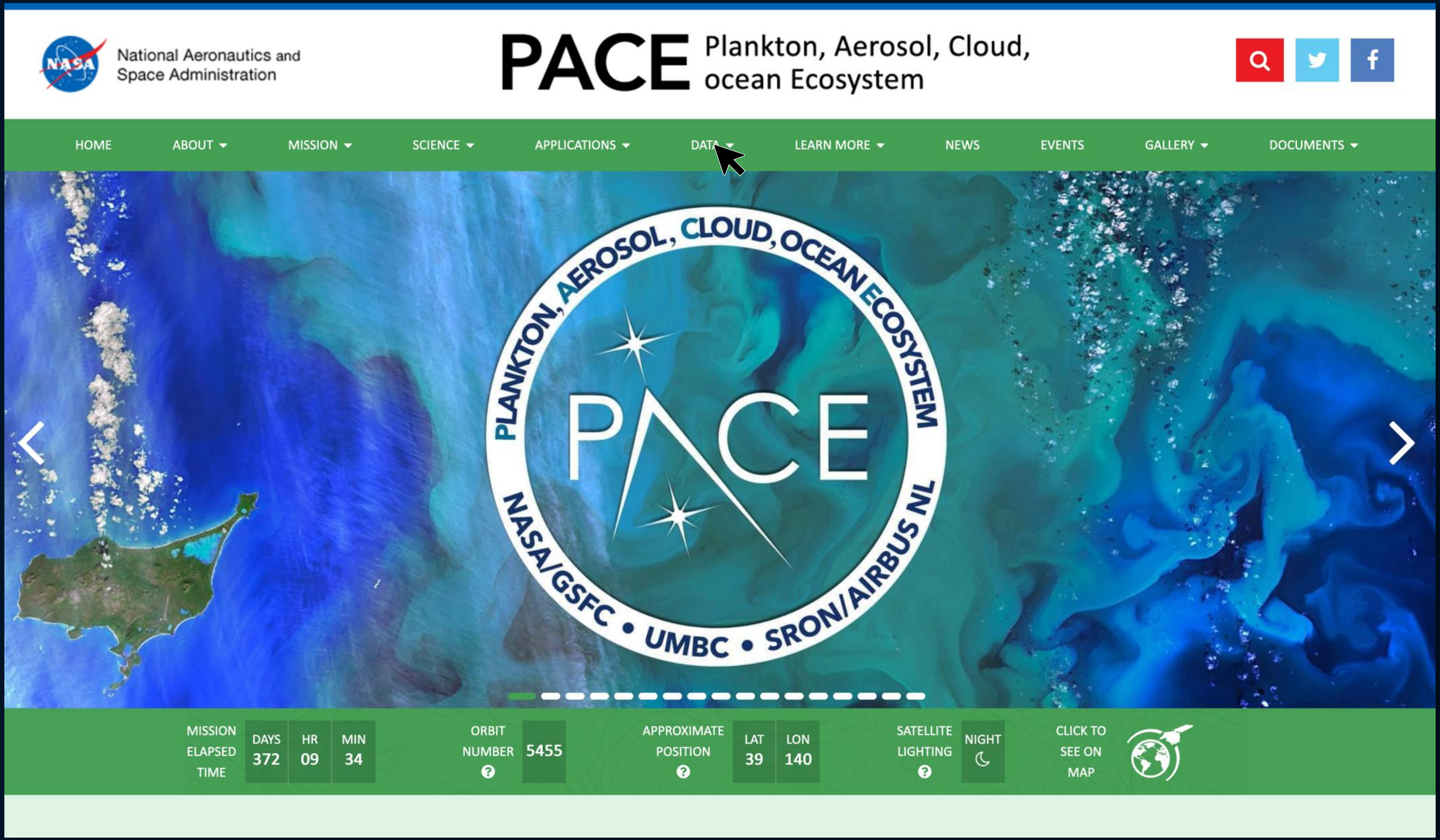


PACE FACTS

- Launched Feb 8, 2023
- Launch site: Kennedy Space Center, Cape Canaveral, FL
- 676.5 km (420 mi) orbital altitude with 98° inclination
- Sun synchronous, polar orbit with 13:00 local crossing time - 3 to 24 hr data latency from collection to distribution
- 3 year design life; 10+ years of propellant
- Managed by NASA’s Goddard Space Flight Center, Greenbelt, Maryland, USA



Overview of the PACE website and the various resources available to you



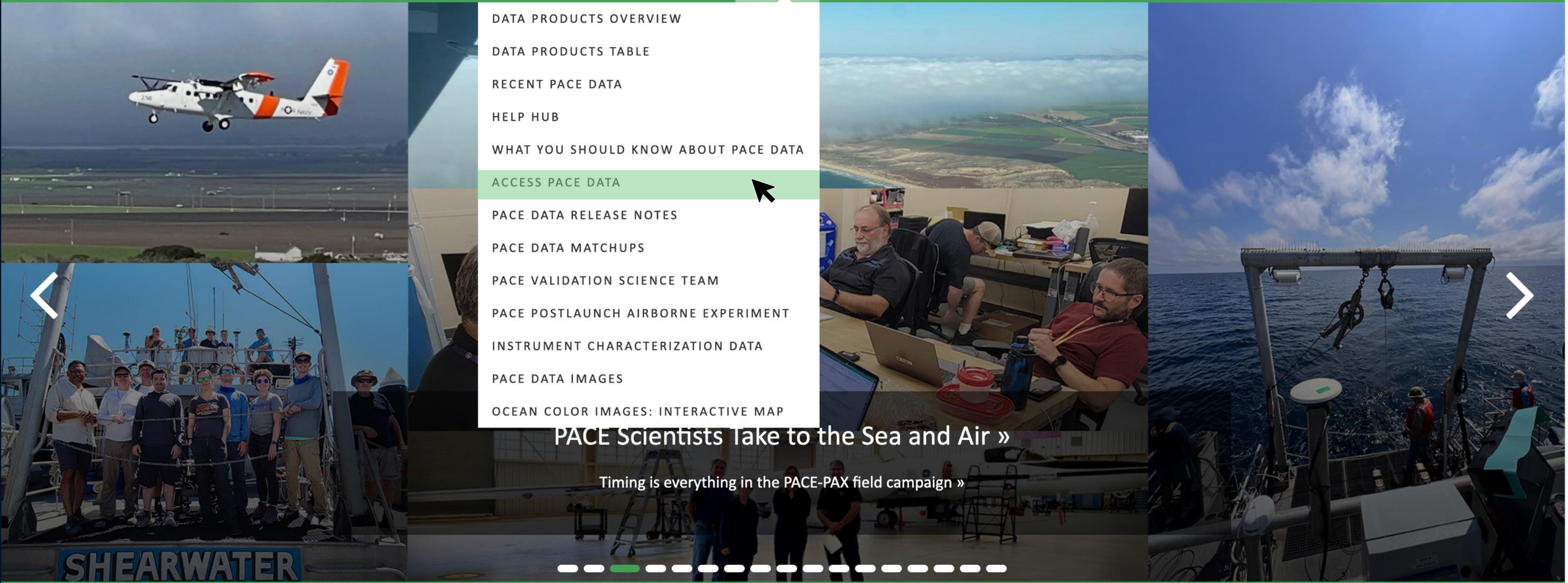
https://pace.oceansciences.org/

National Aeronautics and Space Administration

PACE Plankton, Aerosol, Cloud, ocean Ecosystem

HOME | ABOUT | MISSION | SCIENCE | APPLICATIONS | DATA | LEARN MORE | NEWS | EVENTS | GALLERY | DOCUMENTS

- DATA PRODUCTS OVERVIEW
- DATA PRODUCTS TABLE
- RECENT PACE DATA
- HELP HUB
- WHAT YOU SHOULD KNOW ABOUT PACE DATA
- ACCESS PACE DATA
- PACE DATA RELEASE NOTES
- PACE DATA MATCHUPS
- PACE VALIDATION SCIENCE TEAM
- PACE POSTLAUNCH AIRBORNE EXPERIMENT
- INSTRUMENT CHARACTERIZATION DATA
- PACE DATA IMAGES
- OCEAN COLOR IMAGES: INTERACTIVE MAP



PACE Scientists Take to the Sea and Air »

Timing is everything in the PACE-PAX field campaign »

MISSION ELAPSED TIME	DAYS 371	HR 12	MIN 59	ORBIT NUMBER	5442	APPROXIMATE POSITION	LAT -63	LON -82	SATELLITE LIGHTING	DAY	CLICK TO SEE ON MAP

Access PACE Data

Public PACE data release began on 11 April 2024. **Reprocessing Version 3 is now available.**

Reprocessing Version 3 is the second full mission reprocessing, and primarily serves to incorporate improved refinement of the calibration for the three PACE instrume data format improvements, and expanded product suites. The reprocessing includes all standard science mode data collected during the PACE commissioning period, s February 2024. As for previous reprocessings, we welcome your input and discoveries, but also request your continued patience while we continue to improve the dat 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 3
- Release notes for Version 2
- 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
- Learn what you should know about PACE data

Options for accessing PACE data

PACE data are accessible 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.

PACE orbit lines, true color, and chlorophyll data are also viewable on Worldview.

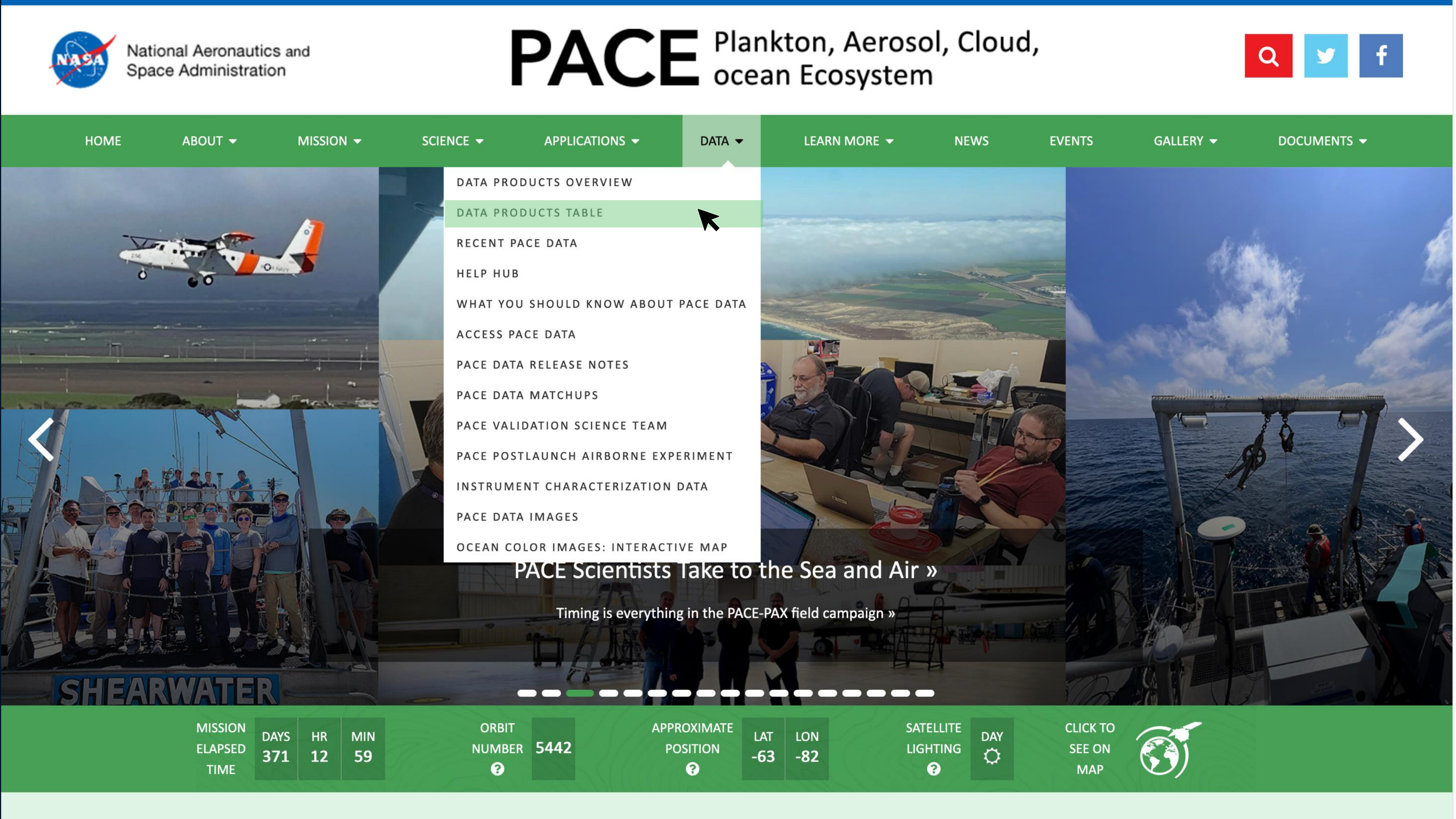
Access by Maturity Level

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 Test.

- Provisional Level-1 and -2 data are available through Earthdata Search and the OB.DAAC File Search. Provisional Level-3 data are available via all three options.

ACCESS PACE DATA

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


National Aeronautics and Space Administration
PACE Plankton, Aerosol, Cloud, ocean Ecosystem
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SHEARWATER
MISSION ELAPSED TIME
DAYS 371
HR 12
MIN 59
ORBIT NUMBER 5442
APPROXIMATE POSITION
LAT -63
LON -82
SATELLITE LIGHTING
DAY
CLICK TO SEE ON MAP

PACE DATA PRODUCTS

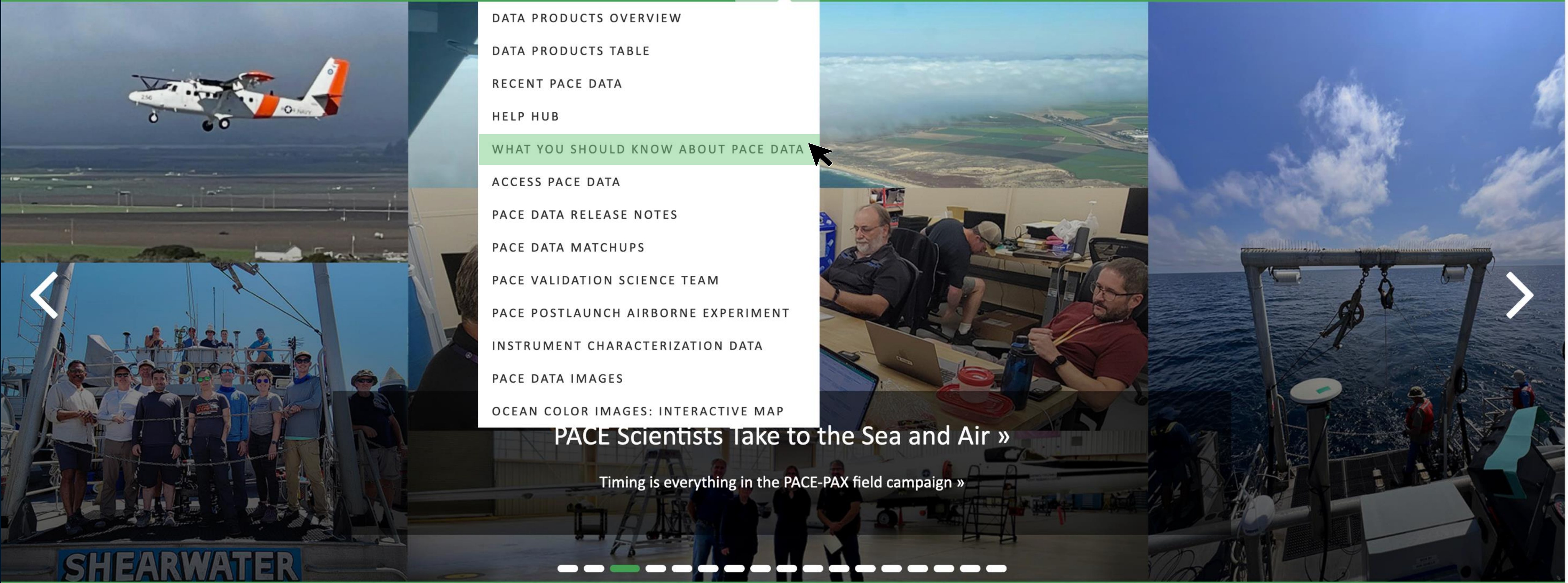
What do colors in the “Availability” column mean?

	Coming soon!	Currently implementing and evaluating	No approach currently identified

Calibrated Radiometry and Polarimetry Calibrated and geolocated radiometry and polarimetry as observed at sensor.					
	Description and Use	Units	Availability	Status	Additional Info
	Spectral radiance observed at the top of the atmosphere.	W m^{-2} um^{-1} sr^{-1}	Level-1B 1-km at nadir; daily - Level-1C; daily	Provisional	Level-1C draft data format and examples
ry 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
ry 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

Ocean Properties to be Produced by OCI Bio-optical and biogeochemical properties of seawater constituents in the sunlit upper ocean.					
	Description and Use	Units	Availability	Status	Additional Info
	Spectral color of the ocean in the ultraviolet-to-near infrared spectral range. Used as input into algorithms to retrieve information about colored dissolved organic matter, phytoplankton, non-algal particles, and other aquatic constituents. Provided in continuous 2.5-nm steps from 350 to 717.5-nm with a resolution (bandwidth) of 5-nm.	sr^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Provisional	ATBD SAT members: Boss, Zhai, Krotkov, Chowdhary, Stam In situ measurement protocols
	Effective reflectance of the Earth's surface as observed by OCI. Used as an input to downstream ocean data products. Includes inland waters as well as ocean surface reflectance.	unitless	Level-2 1-km (at nadir), daily - Level-3 spatial resolution TBD; daily, 8-day, monthly	Test	Current product: L2gen; investigating MAIAC (Lyapus
	An optical water classification index reported as the weighted harmonic mean of visible-range Rrs wavelengths (400-700 nm)	nm	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Test	ATBD
	Spectral diffuse attenuation of downwelling irradiance at multiple wavelengths between 350 and 700 nm. Provides indices of water clarity and light penetration.	m^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Test	ATBD SAT members: Boss, Stramski, Odermatt In situ measurement protocols
	Spectral absorption coefficients for total phytoplankton absorption at multiple wavelengths between 350 and 700-nm. Provides information on phytoplankton physiology, abundance, and community composition.	m^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Provisional	ATBD SAT members: Twardowski, Stramski, Shuchman, Pal Barnes, Stamnes, Chowdhary In situ measurement protocols
tter absorption	Spectral absorption coefficients for non-algal particulates and dissolved organic matter at multiple wavelengths between 350 and 700-nm. Provides information on the concentrations of the dissolved component of organic carbon and the detrital (non-algal) component of the particulate assembly.	m^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Provisional	ATBD SAT members: Twardowski, Stramski, Barnes, Stamn In situ measurement protocols
orption coefficients	Spectral absorption coefficients for dissolved organic matter at multiple wavelengths between 350 and 700-nm. Provides information on the concentration of the dissolved component of organic carbon.	m^{-1}	TBD	Test	SAT member: Stramski In situ measurement protocols
d organic matter	Absorption spectral slope coefficients of chromophoric dissolved organic matter for multiple wavelength ranges: 275-295, 350-400, 380-600 nm. Provides information on the contribution of land-derived dissolved organic matter, relative contribution of land- versus marine-derived dissolved organic matter, and as a relative measure of solar photobleaching.	nm^{-1}	TBD	Test	SAT member: Stramski In situ measurement protocols
ents	Spectral absorption coefficients for non-algal particulate matter at multiple wavelengths between 350 and 700 nm. Provides information on the concentration of non-phytoplankton particulate components.	nm^{-1}	TBD	Test	SAT member: Stramski In situ measurement protocols
	Spectral absorption coefficients for particulate matter at multiple wavelengths between 350 and 700 nm. Provides information on the concentration of particulate matter in the water column.	nm^{-1}	TBD	Test	SAT member: Stramski In situ measurement protocols
	Spectral backscattering of the light associated with particulate material, at multiple wavelengths between 350-700 nm. Provides an indicator of the concentration of particules in the ocean and a proxy indicator of particulate carbon concentrations.	m^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Provisional	ATBD SAT members: Twardowski, Stramski, Shuchman, Pal Stamnes, Chowdhary, Zhang, Odermatt
	Light leaving the surface ocean due to the sun induced chlorophyll fluorescence. Provides an indicator of phytoplankton physiology (health?).	W m^{-2} um^{-1} sr^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Test	ATBD SAT member: Westberry
	The amount of sunlight that is useful for photosynthesis, defined here as the 400-700 nm spectral range, that reaches the surface of the ocean over a day. As phytoplankton require light to convert inorganic carbon to organic carbon, PAR provides a critical parameter for understanding the oceanic carbon cycle.	Einsteins m^{-1} d^{-1}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Provisional	ATBD SAT member: Boss
	Near surface concentration of the photosynthetic pigment chlorophyll-a. Provides proxies	mg m^{-3}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-	Provisional	ATBD

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



MISSION ELAPSED TIME	DAYS	HR	MIN	ORBIT NUMBER		APPROXIMATE POSITION	LAT	LON	SATELLITE LIGHTING		CLICK TO SEE ON MAP
	371	12	59		5442		-63	-82		DAY	

PACE DATA PRODUCTS – WHAT TO KNOW

What you should know about PACE data

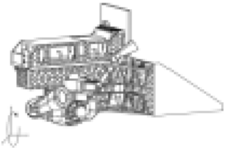
This is a summary of the general information one needs to use PACE data. See the complete release notes for the most current PACE data on the OB.DAAC website.
(Updated Feb 06 2025)

Orbit

The PACE satellite is in a Sun-synchronous polar orbit, with a local Equatorial solar crossing time of 1 pm for the ascending (daytime) note. The descending orbital node happens during local nighttime, and none of PACE's sensors collect science data at night.

PACE Instruments

OCI
Ocean Color Instrument



HARP-2
Hyper Angular Rainbow Polarimeter

SPEXone
Spectro-Polarimeter for Planetary EXploration

OB.DAAC data processing levels

Level 1A
Raw instrument data and spacecraft telemetry in netCDF4

Level-1B
Calibrated & geolocated instrument data

Level-1C
Calibrated, geolocated, and co-registered to a common grid

Level-2
Derived geophysical science data products

Level-3
Temporally and spatially composited (binned and mapped) global products

Level-4
Geophysical products derived from combined Level-3 inputs and/or models

Currently available product maturity levels..

PACE Science Data Reprocessing: Version 3

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

PACE DATA PRODUCTS – WHAT TO KNOW

OB.DAAC data processing levels

Level 1A

Raw instrument data and spacecraft telemetry in netCDF4

Level-1B

Calibrated & geolocated instrument data

Level-1C

Calibrated, geolocated, and co-registered to a common grid

Level-2

Derived geophysical science data products

Level-3

Temporally and spatially composited (binned and mapped) global products

Level-4

Geophysical products derived from combined Level-3 inputs and/or models

Currently available product maturity levels..

Provisional

Results have been reviewed and are in family with heritage data products or other basis of expectation, but which have not yet been validated and may still contain significant errors...

Test

Results have not yet been reviewed by algorithm developers and or may be known to have substantial errors in implementation that are under investigation.

Diagnostic

Products that are produced to support analysis of algorithm behavior, but that are not intended for science.

Known data issues

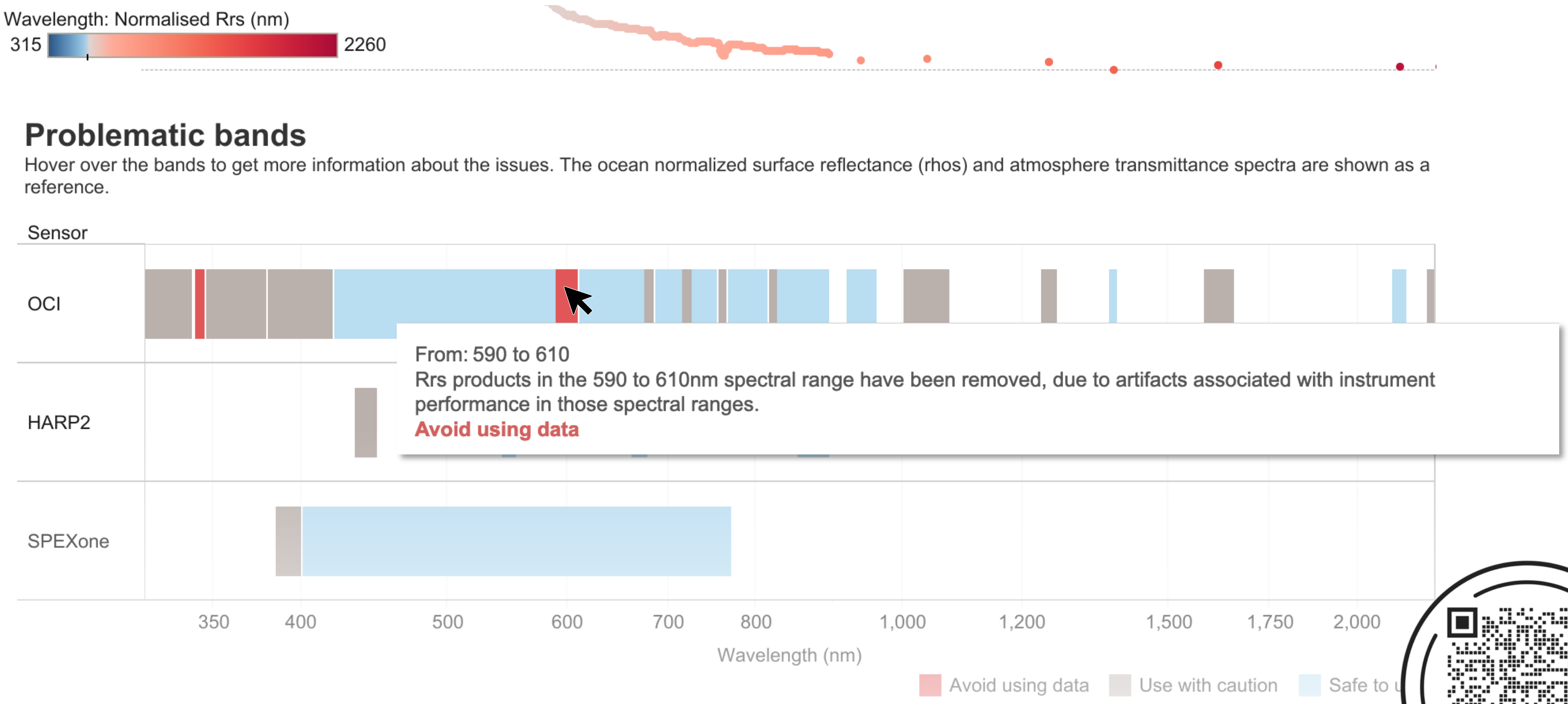
PACE is already providing high-quality data. However, some issues have to be noted before using it. Some particular bands, influenced by instrument or atmospheric characteristics, should be avoided for the moment.
Other issues affect the entire dataset, and some events affect data availability. See below for details.

Reference spectra (for indicative purposes)

[PACE Science Data Reprocessing: Version 3]

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

PACE DATA PRODUCTS – WHAT TO KNOW



[PACE Science Data Reprocessing: Version 3](https://pace.oceansciences.org/about_pace_data.htm)

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

PACE DATA PRODUCTS – WHAT TO KNOW

Issues affecting all bands

Sensor	Processing le..	Product suite..	Issue details
HARP2	Level 1A/B/C	NA	Alignment related false polarization needs further evaluation and improvement
			Polarimetric performance is subject to comprehensive evaluation, particularly in the accuracy of DoLP and reference plane orientation.
			The red scale factor trends higher than the non-red factor by about 25%. This will result in a larger subtraction of the red data as compared to the non-red data. This will affect the radiometric data and we need to test the new correction.
OCI	Level 1A/B/C	All	Horizontal striping can occur for bands between 650nm and 900nm for scan angles from +3.9deg to +14.6deg (scan pixels 680 to 800). For open ocean scenes, the TOA signal usually varies less than 1%, but close to bright sources (such as a coastline) the striping over ocean can be severa..
			Occasional outliers are seen in OCI dark data, especially in the area of the South Atlantic Anomaly. These outliers can corrupt the background subtraction for a complete scan line, leading to striping in the L1B data. The algorithm to calculate the background subtraction in the L1B cod..
		NA	The optical design of the OCI SWIR detector assembly (SDA) causes the bands to view different locations along-scan at a given time, and the data are packetized by time. The bands are pixel-shifted into alignment with the hyperspectral bands. This results in fill pixels at the start or ..
	Level 2	All	The current processing extends to higher view zenith angles than the heritage sensors. The atmospheric correction becomes increasingly difficult at these extreme geometries, and erroneously elevated reflectance has been observed in red wavelengths near scan edge. These..
			When the OCI instrument tilt changes, near the subsolar point of the PACE orbit, the sensor passes through extreme glint conditions (direct specular reflection). This results in systematic artifacts in the Rrs retrievals due to error in the atmospheric correction. In V2, these cases were ..
		LANDVI (Land Surface Indices)	Contribution from aerosols is not currently removed from surface reflectance data, which may cause residual artifacts in vegetation index calculations.
			Data is cloud masked using the "Cloud and Cloud-Adjacent" product, which will mask extra pixels in the vicinity of clouds and bright targets.
			The NDSI algorithm does not currently incorporate a snow impossible mask

Filter Sensor or Processing Level

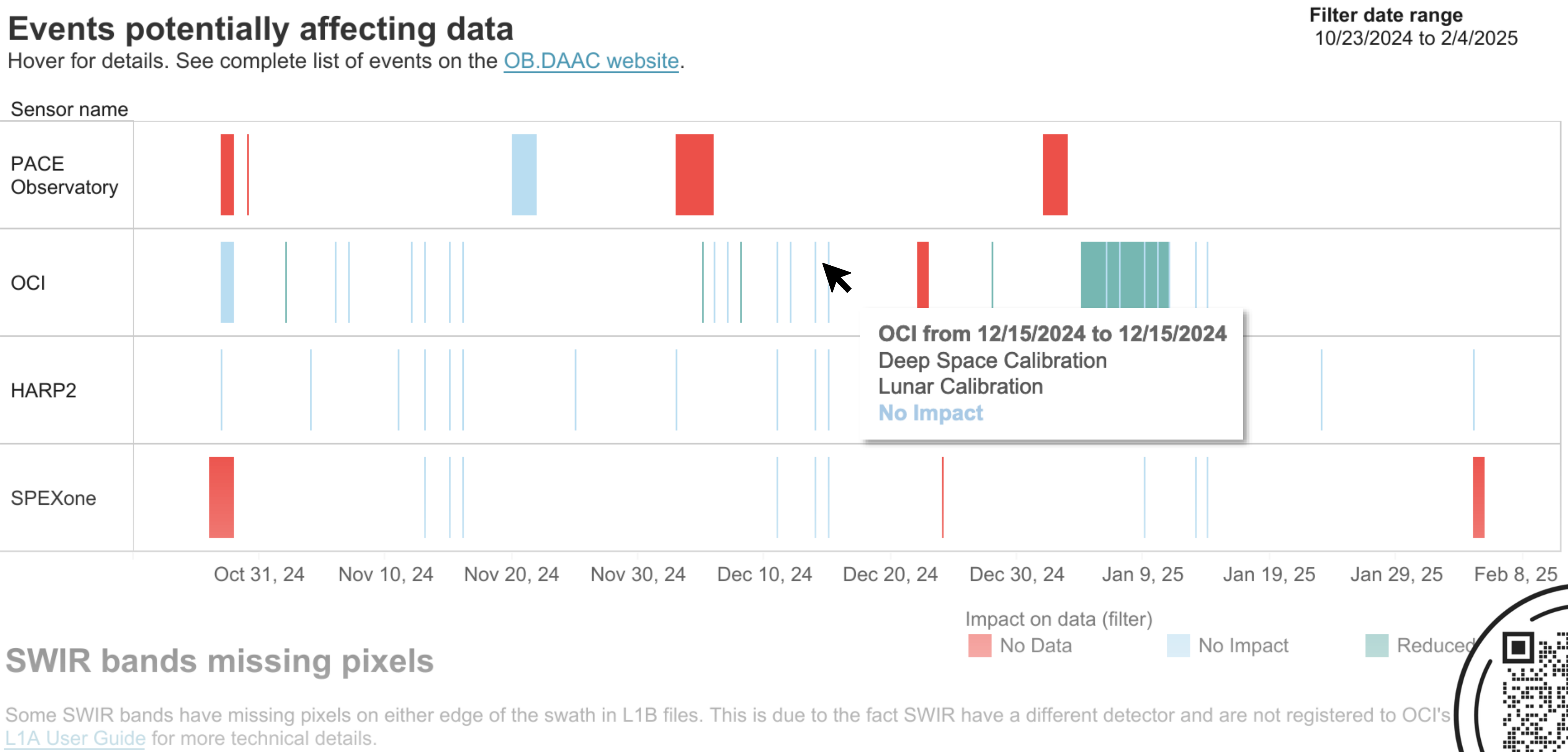
Sensor
- [x] HARP2
- [x] OCI
- [x] SPEXone

Processing level
- [x] Level 1A/B/C
- [x] Level 2
- [x] Level 3

[PACE Science Data Reprocessing: Version 3](https://pace.oceansciences.org/about_pace_data.htm)

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

PACE DATA PRODUCTS – WHAT TO KNOW



[PACE Science Data Reprocessing: Version 3](https://pace.oceansciences.org/about_pace_data.htm)

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

PACE DATA PRODUCTS – WHAT TO KNOW

No Data | No Impact | Reduced Quality

SWIR bands missing pixels

Some SWIR bands have missing pixels on either edge of the swath in L1B files. This is due to the fact SWIR have a different detector and are not registered to OCI's CCD bands. See L1A User Guide for more technical details.

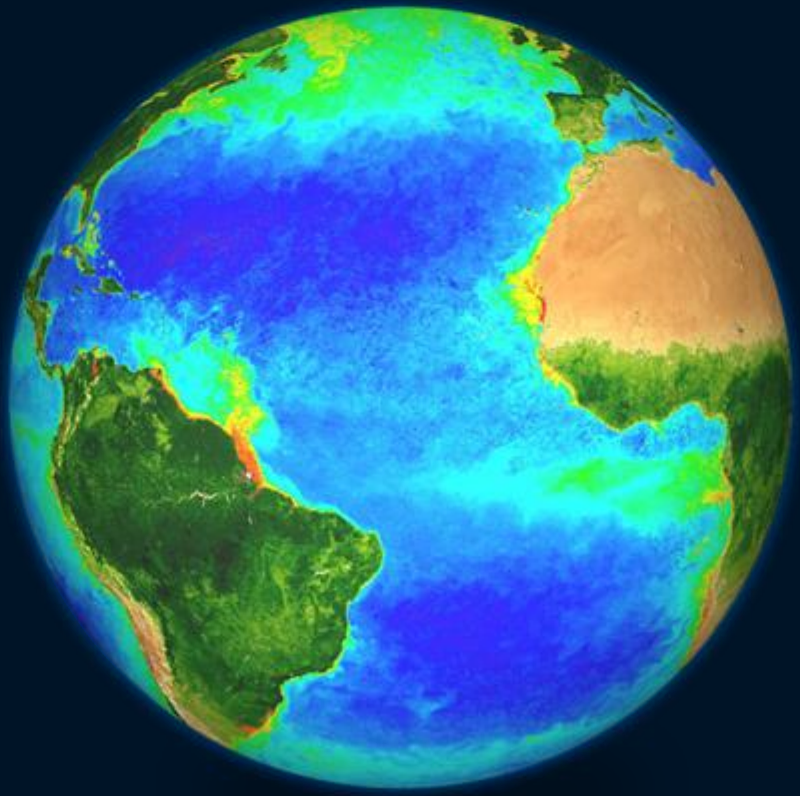
Bands affected

on western edge of swath

on eastern edge of swath

[PACE Science Data Reprocessing: Version 3](https://pace.oceansciences.org/about_pace_data.htm)

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



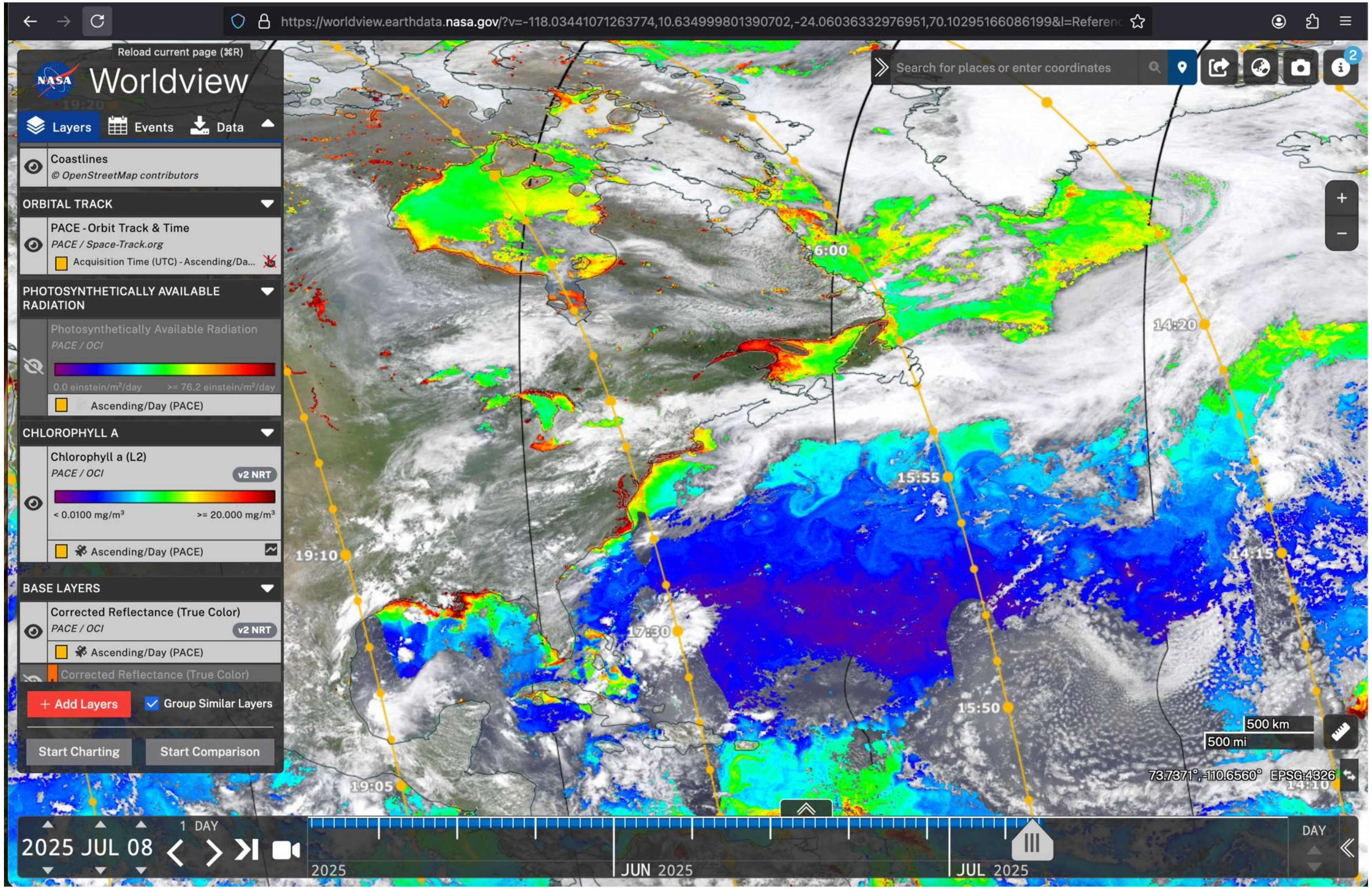
Earthdata Cloud Access and PACE file structure

Tutorial Lead: Anna Windle

Explore imagery with NASA Worldview

(PACE true color reflectance, orbit and track time, chla, PAR)

worldview.earthdata.nasa.gov



Where is PACE data located?

In the cloud!

Specifically, an AWS cloud that is physically in Oregon.

This is called the AWS us-west-2 region

PACE data is located in AWS Cloud Data Storage (S3) Buckets in this cloud

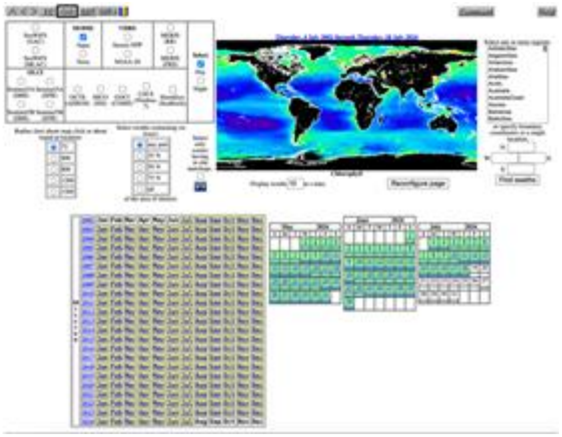
How can I access PACE data that's in the cloud?

Three options:

1. Earthdata Search OB.DAAC portal
2. OB.DAAC Level 3 & 4 Browser
3. OB.DAAC File Search

Note: the OB.DAAC Level 1 & 2 browser does not support access to PACE data

R.I.P.



Earthdata Search OB.DAAC portal

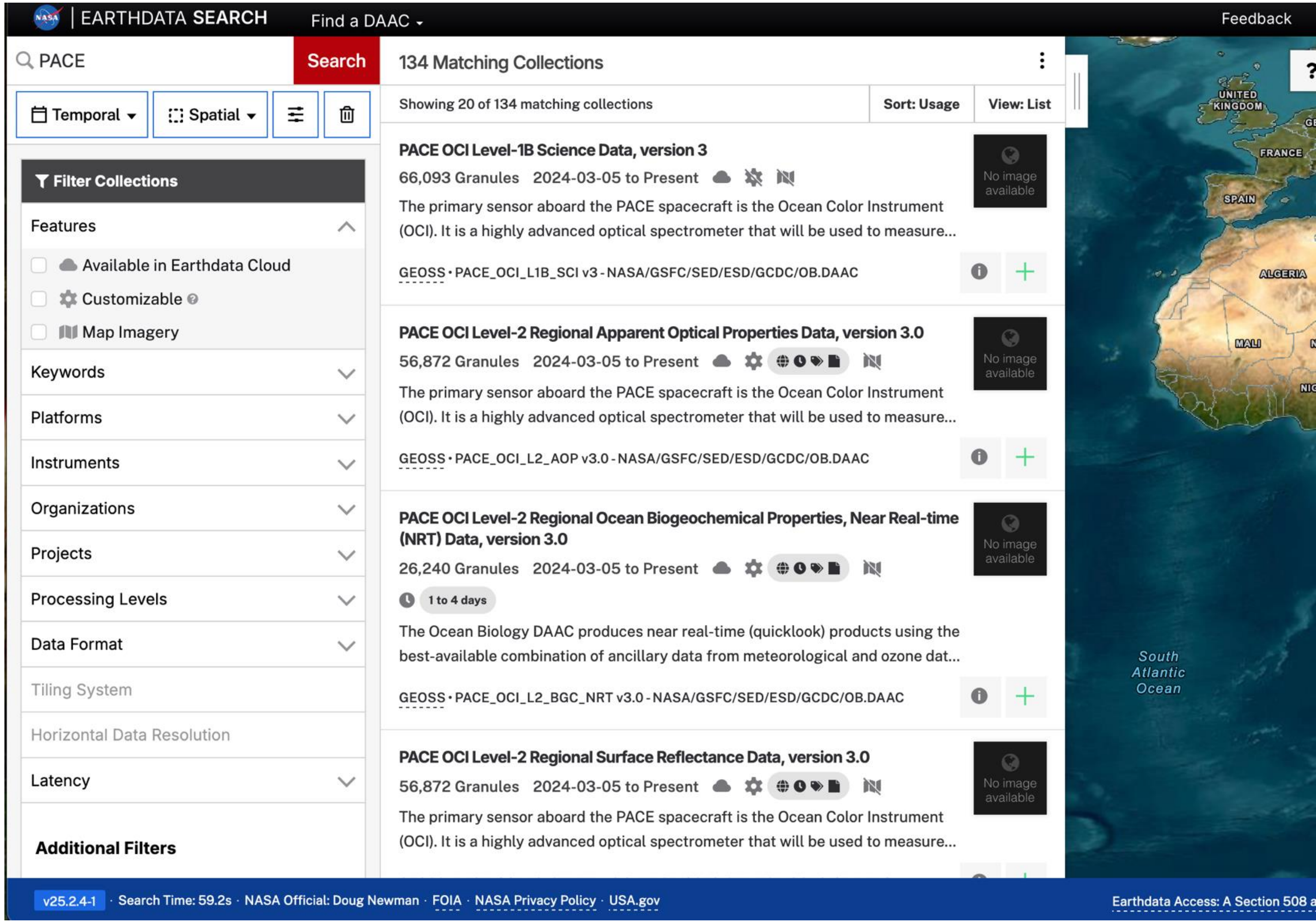
https://search.earthdata.nasa.gov/search

Top left click “Browse Portals”

Click on “OBDAAC”

Filter Instruments to “OCI”

You can directly download netcdfs and run analysis just like you would with previous OC data.



Everyone can access PACE data in the cloud, and some of you may be able to process it in the cloud as well

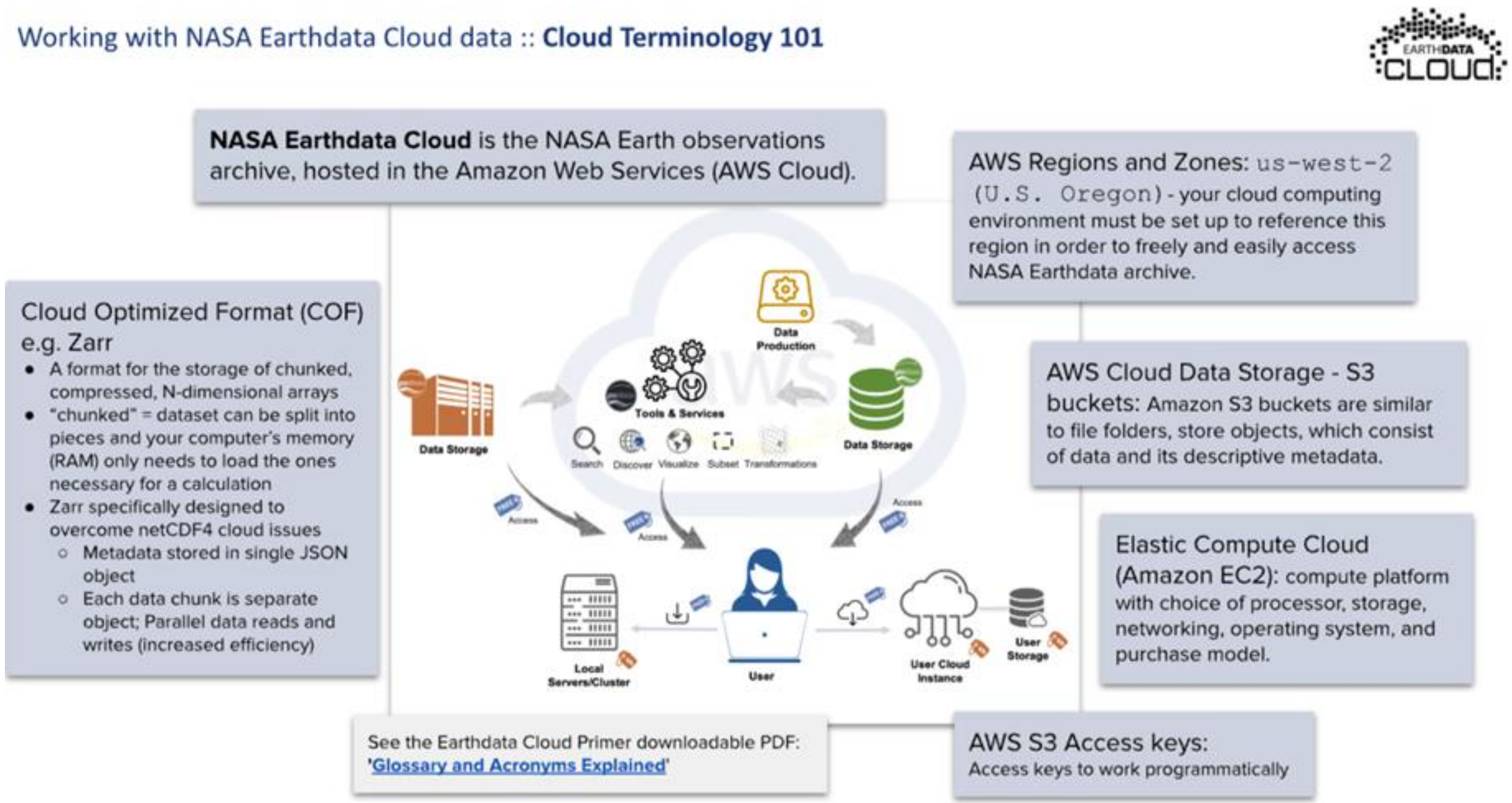
- To *process* data in the cloud, you need an Elastic Compute Cloud (e.g. EC2).

- This allows you to “stream” and analyze PACE data without it every touching your local computer.

What if you don’t have access to an Elastic Compute Cloud?

- Universities are beginning to get institutional AWS accounts
- You can budget cloud services in proposals

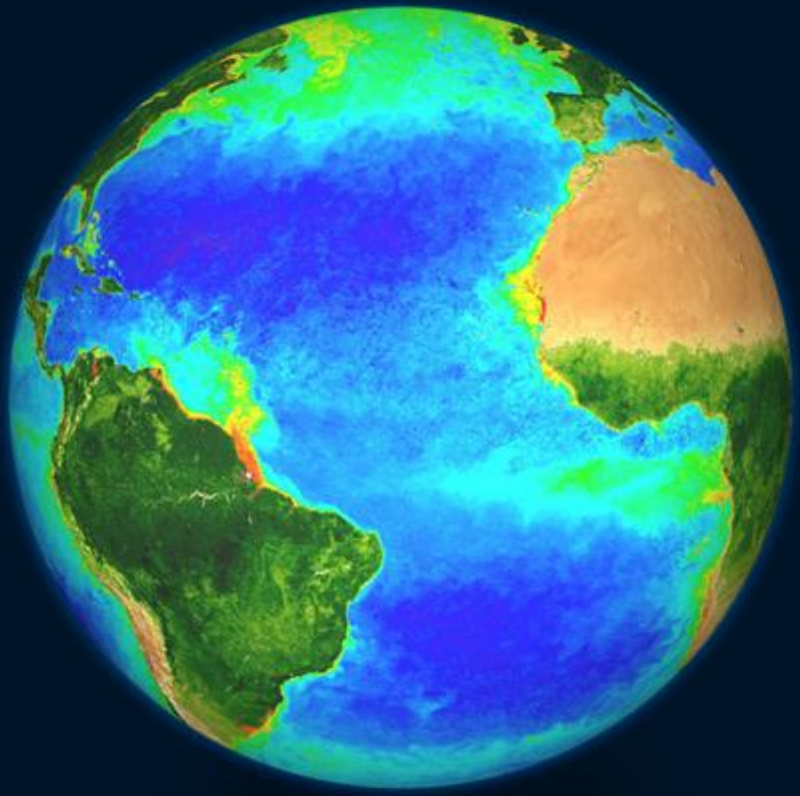
Great resource: NASA Earthdata Cloud Cookbook
https://nasa-openscapes.github.io/earthdata-cloud-cookbook/



earthaccess python library

earthaccess
A Python Library for NASA Earthdata

- Easy way to search, download, or stream NASA Earth science data using a few lines of code
- earthaccess is under active development
  - Feel free to submit Issues on their Github if something is not working, have a suggestion
- Anyone can contribute: checkout the Contributing Guide



PACE data processing with OCSSW/SeaDAS

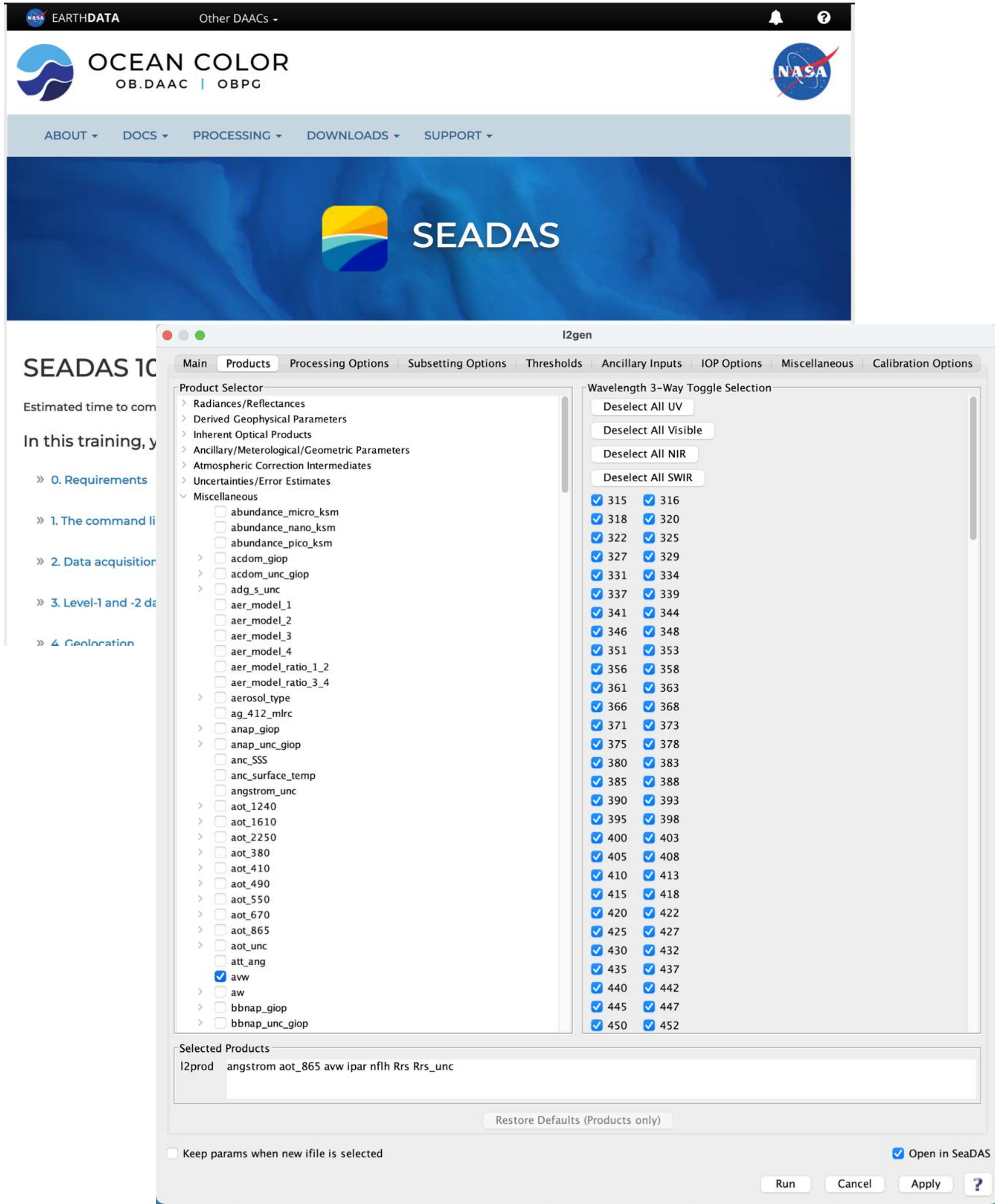
SEADAS | OCSSW

- OCSSW : Ocean Color Science Software
- Maintained by NASA's Ocean Biology Processing Group (OB.DAAC)
- Official public distribution is SeaDAS
- GUI –data processing , visualization tools, statistics tools
- Command line usage –data processing

Used since before SEAWIFS (1994)!
Supports 15+ missions
Almost infinite options –JUST A FEW TODAY!

➢ Not working in the cloud for now but working towards it. Very soon!

➢ Tip: Use SeaDAS GUI to explore parameters and export PAR file!



Installing and Running OCSSW Command-line Tools

Authors: Carina Poulin (NASA, SSAI), Ian Carroll (NASA, UMBC), Anna Windle (NASA, SSAI)

2. Install OCSSW

The OCSSW software is not a Python package and not available from `conda` or any other repository. To install it, we begin by aquiring an installer script from the OB.DAAC. This script is actually part of OCSSW, but we can use it independently to download and install the OCSSW binaries suitable for our system.

In [2]:
```
wget https://oceandata.sci.gsfc.nasa.gov/manifest/install_ocssw
```

```
--2024-06-11 16:39:01--  https://oceandata.sci.gsfc.nasa.gov/manifest/install_ocssw
Resolving oceandata.sci.gsfc.nasa.gov (oceandata.sci.gsfc.nasa.gov)... 169.154.128.84, 2001:4d0:2418:128::84
Connecting to oceandata.sci.gsfc.nasa.gov (oceandata.sci.gsfc.nasa.gov)|169.154.128.84|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 46637 (46K) [application/octet-stream]
Saving to: 'install_ocssw.1'

install_ocssw.1     100%[===================>]  45.54K  --.-KB/s    in 0.1s

2024-06-11 16:39:01 (408 KB/s) - 'install_ocssw.1' saved [46637/46637]
```

Similarly, we'll need the manifest module imported by the installer.

In [3]:
```
wget https://oceandata.sci.gsfc.nasa.gov/manifest/manifest.py
```

```
--2024-06-11 16:39:04--  https://oceandata.sci.gsfc.nasa.gov/manifest/manifest.py
Resolving oceandata.sci.gsfc.nasa.gov (oceandata.sci.gsfc.nasa.gov)... 169.154.128.84, 2001:4d0:2418:128::84
Connecting to oceandata.sci.gsfc.nasa.gov (oceandata.sci.gsfc.nasa.gov)|169.154.128.84|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 28390 (28K) [application/octet-stream]
Saving to: 'manifest.py.1'

manifest.py.1       100%[===================>]  27.72K  --.-KB/s    in 0.08s

2024-06-11 16:39:05 (344 KB/s) - 'manifest.py.1' saved [28390/28390]
```

Before you can use a downloaded script, you need to change its mode to be executable.

In [ ]:
```
chmod +x install_ocssw
```

Take a look at the different OCSSW "tags" you can install. It is recommended to use the most recent one for the installation, which is T2024.16 at the time of writing this tutorial. Tags starting with "V" are operational versions, and tags starting with "T" are test versions. Use "T" to process the latest data products, but keep in mind that processing can change a lot between tags. Other tags are deprecated, including those starting with "R".

In [4]:
```
./install_ocssw --list_tags
```

```
T2021.16
T2021.17
T2021.18
T2021.19
T2021.20
T2021.21
T2021.22
T2021.23
T2021.24
T2021.3
```

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

Processing with OCSSW Tools: l2gen, l2bin, and l3mapgen

Authors: Carina Poulin (NASA, SSAI), Ian Carroll (NASA, UMBC), Anna Windle (NASA, SSAI)

In [19]:
```
par = {
    "ifile": l2gen_ifile,
    "ofile": str(l2gen_ifile).replace("L1B", "L2"),
    "suite": "BGC",
    "l2prod": "chlor_a",
    "atmocor": 1,
}
write_par("l2gen.par", par)
```

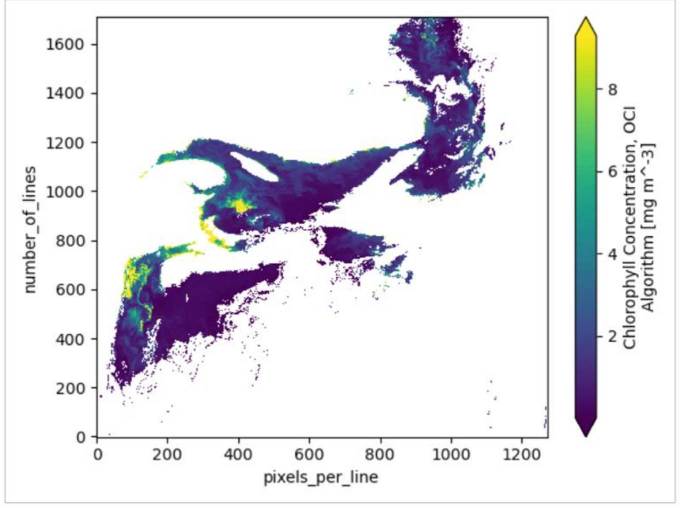
With the parameter file ready, it's time to call `l2gen` from a `%%bash` cell.

In [20]:
```
%%bash
source $OCSSWROOT/OCSSW_bash.env

l2gen par=l2gen.par
```

```
Loading default parameters from /tmp/ocssw//share/common/msl12_defaults.par
Input file granules/PACE_OCI.20240427T161654.L1B.nc is PACE L1B file.

Loading characteristics for OCI
Opening sensor information file /tmp/ocssw//share/oci/msl12_sensor_info.dat
  Bnd   Lam       Fo    Tau_r      k_oz     k_no2    t_co2   awhite        aw       bbw
    0  314.550  112.026 4.873e-01 4.208e-01 3.281e-19 1.000e+00 0.000e+00 2.305e-01 6.356e-03
    1  316.239   92.478 6.485e-01 5.806e-01 2.961e-19 1.000e+00 0.000e+00 1.633e-01 7.727e-03
    2  318.262   85.195 7.410e-01 5.473e-01 2.844e-19 1.000e+00 0.000e+00 1.278e-01 8.187e-03
    3  320.303   82.175 7.809e-01 4.609e-01 2.833e-19 1.000e+00 0.000e+00 1.105e-01 8.271e-03
    4  322.433   80.733 7.906e-01 3.543e-01 2.898e-19 1.000e+00 0.000e+00 9.950e-02 8.190e-03
    5  324.649   86.251 7.915e-01 2.567e-01 3.018e-19 1.000e+00 0.000e+00 9.079e-02 8.041e-03
    6  326.828   95.932 7.891e-01 1.907e-01 3.132e-19 1.000e+00 0.000e+00 8.475e-02 7.871e-03
    7  328.988  101.672 7.700e-01 1.386e-01 3.251e-19 1.000e+00 0.000e+00 8.211e-02 7.627e-03
    8  331.305  101.708 7.404e-01 9.852e-02 3.417e-19 1.000e+00 0.000e+00 8.089e-02 7.342e-03
    9  333.958   97.745 7.204e-01 6.830e-02 3.572e-19 1.000e+00 0.000e+00 7.656e-02 7.132e-03
```

If successful, the `l2gen` program created a netCDF file at the `ofile` path. The contents should include the `chlor_a` product from the `BGC` suite of products. Once this process is done, you are ready to visualize your "custom" L2 data. Use the `robust=True` option to ignore outlier chl a values.

In [21]:
```
dataset = xr.open_dataset(par["ofile"], group="geophysical_data")
plot = dataset["chlor_a"].plot(cmap="viridis", robust=True)
```



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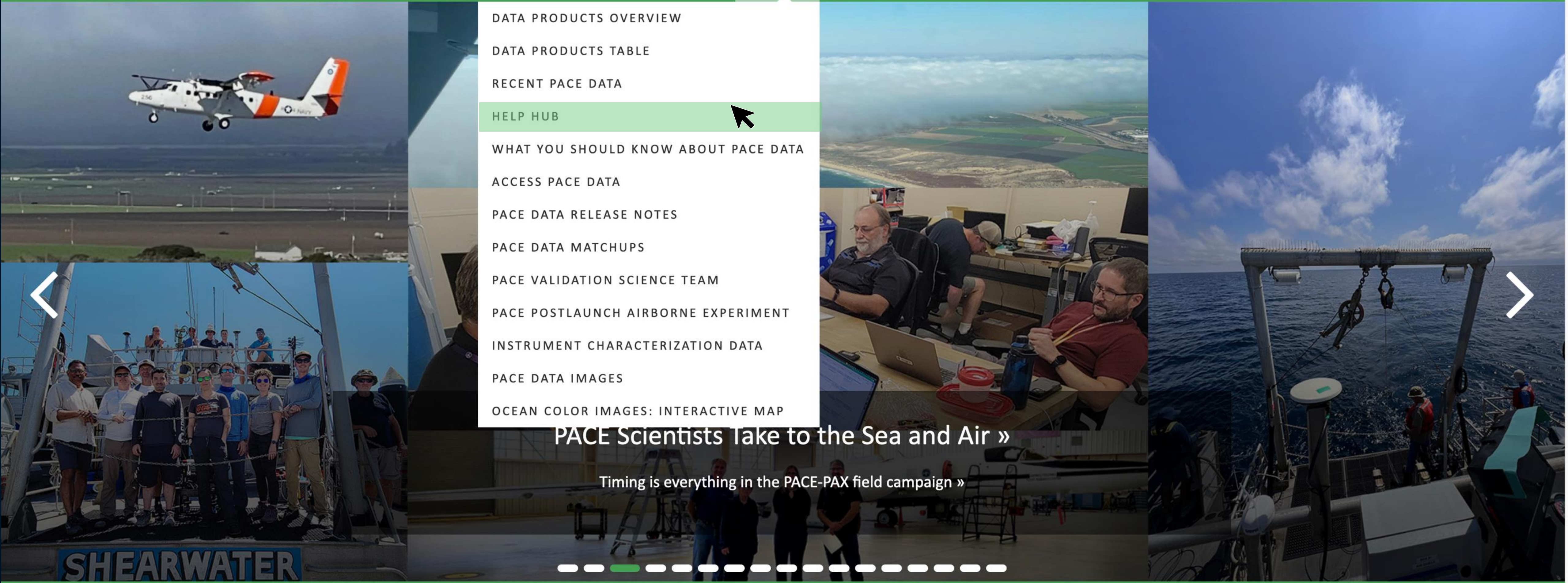
National Aeronautics and Space Administration

PACE Plankton, Aerosol, Cloud, ocean Ecosystem

HOME | ABOUT | MISSION | SCIENCE | APPLICATIONS | DATA | LEARN MORE | NEWS | EVENTS | GALLERY | DOCUMENTS

- DATA PRODUCTS OVERVIEW
- DATA PRODUCTS TABLE
- RECENT PACE DATA
- HELP HUB
- WHAT YOU SHOULD KNOW ABOUT PACE DATA
- ACCESS PACE DATA
- PACE DATA RELEASE NOTES
- PACE DATA MATCHUPS
- PACE VALIDATION SCIENCE TEAM
- PACE POSTLAUNCH AIRBORNE EXPERIMENT
- INSTRUMENT CHARACTERIZATION DATA
- PACE DATA IMAGES
- OCEAN COLOR IMAGES: INTERACTIVE MAP



MISSION ELAPSED TIME	DAYS 371	HR 12	MIN 59	ORBIT NUMBER	5442	APPROXIMATE POSITION	LAT -63	LON -82	SATELLITE LIGHTING	DAY	CLICK TO SEE ON MAP

HELP HUB

Satellite data processing can be difficult.

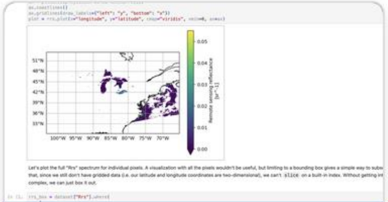
We're here to help you climb out of that hole!

Help Hub Core

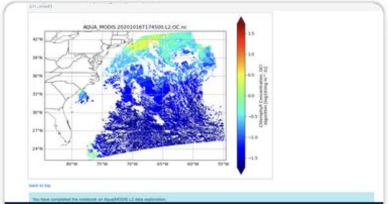
PACE | MODIS | Python | Interactive

Learn the essential things you need to know to access and process data in this series of Jupyter Notebooks.

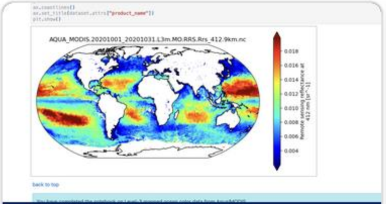
Cloud Data Access (OCI Example)



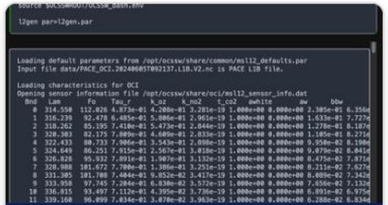
File Structure (OCI Example)



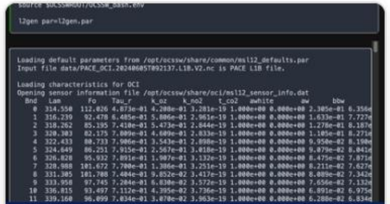
Explore Level-2 Ocean Color Data



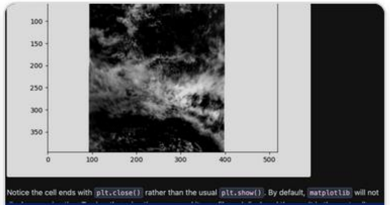
Explore Level-3 Ocean Color Data



Installing the SeaDAS Command Line Tools (OCSSW)



Processing with the SeaDAS Command Line Tools (OCSSW)



HARP2 Data Visualization

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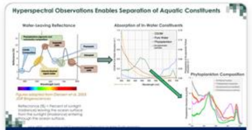
ARSET - Introduction to Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE) Hyperspectral Observations for Water Quality Monitoring

PACE | Python | Interactive | SeaDAS

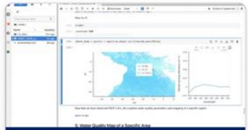
Follow the tutorials presented during the ARSET - Introduction to Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE) Hyperspectral Observations for Water Quality Monitoring. Video recordings are available for all tutorials and slides and Jupyter Notebooks are available when relevant.

ARSET Training Home Page



Part 1: Introduction to the PACE Mission for Water Quality Monitoring

Part 2: Overview, Access, and Analysis of PACE Ocean Color Data Products



Part 3: Access and Visualization of PACE/OCI Data using Python/Jupyter Notebook Software

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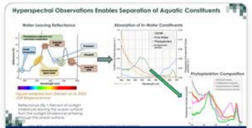

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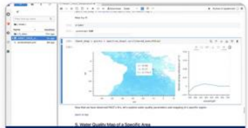

Part 3: Access and Visualization of PACE/OCI Data using Python/Jupyter Notebook Software

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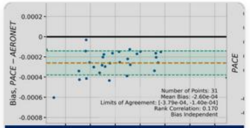
PACE Hackweek 2024 Home Page

Orientation to Earthdata Cloud Access

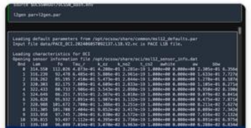
Satellite Data Visualization

Matchups of in-situ Data With Satellite Data (ThoMaS)

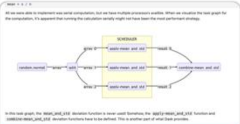


Matchups of in-situ Data With Satellite Data

Collaboration with Git and GitHub



Using the SeaDAS Command Line Tools (OCSSW)



Parallel and Larger-than-Memory Computing

Machine Learning with Satellite Data

Environments and Containers for Reusable Projects

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

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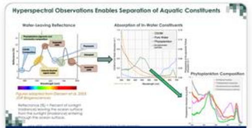
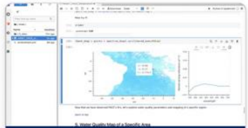


Part 1: Introduction to the PACE Mission for Water Quality Monitoring

Part 2: Overview, Access, and Analysis of PACE Ocean Color Data Products



Part 3: Access and Visualization of PACE/OCI Data using Python/Jupyter Notebook Software

PACE Hackweek 2024

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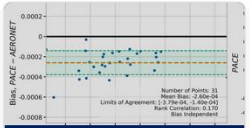

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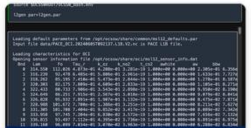

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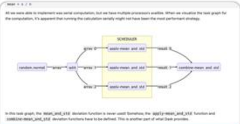

Parallel and Larger-than-Memory Computing

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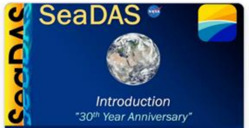
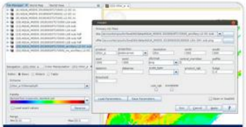
SeaDAS Basics

SeaDAS

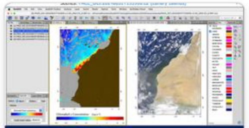
Learn how to use the official software of the OB.DAAC for analysis and visualization of remote sensing data.



SeaDAS Getting Started Video Series

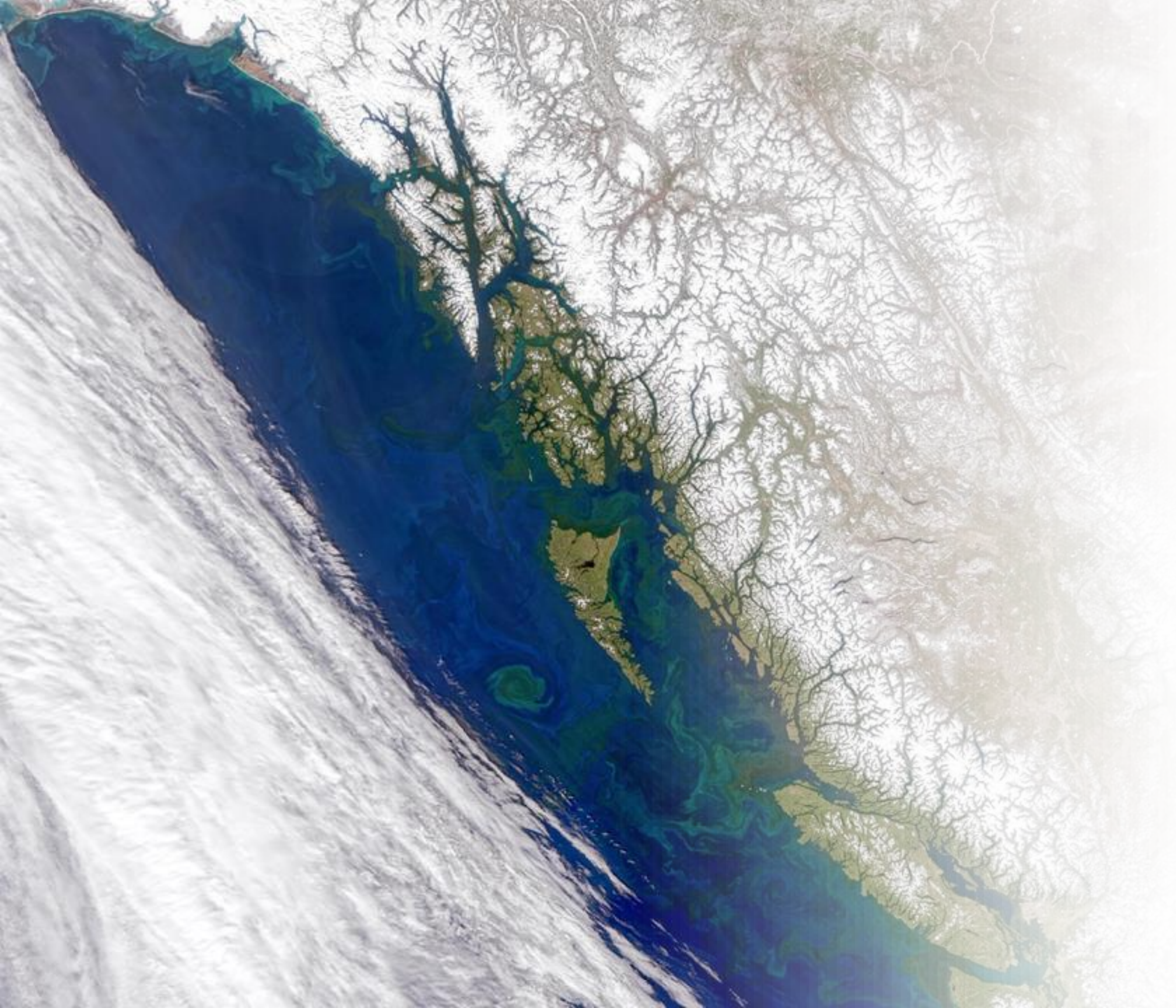


SeaDAS 101 Tutorial



SeaDAS Ocean Optics 2024 Tutorial

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



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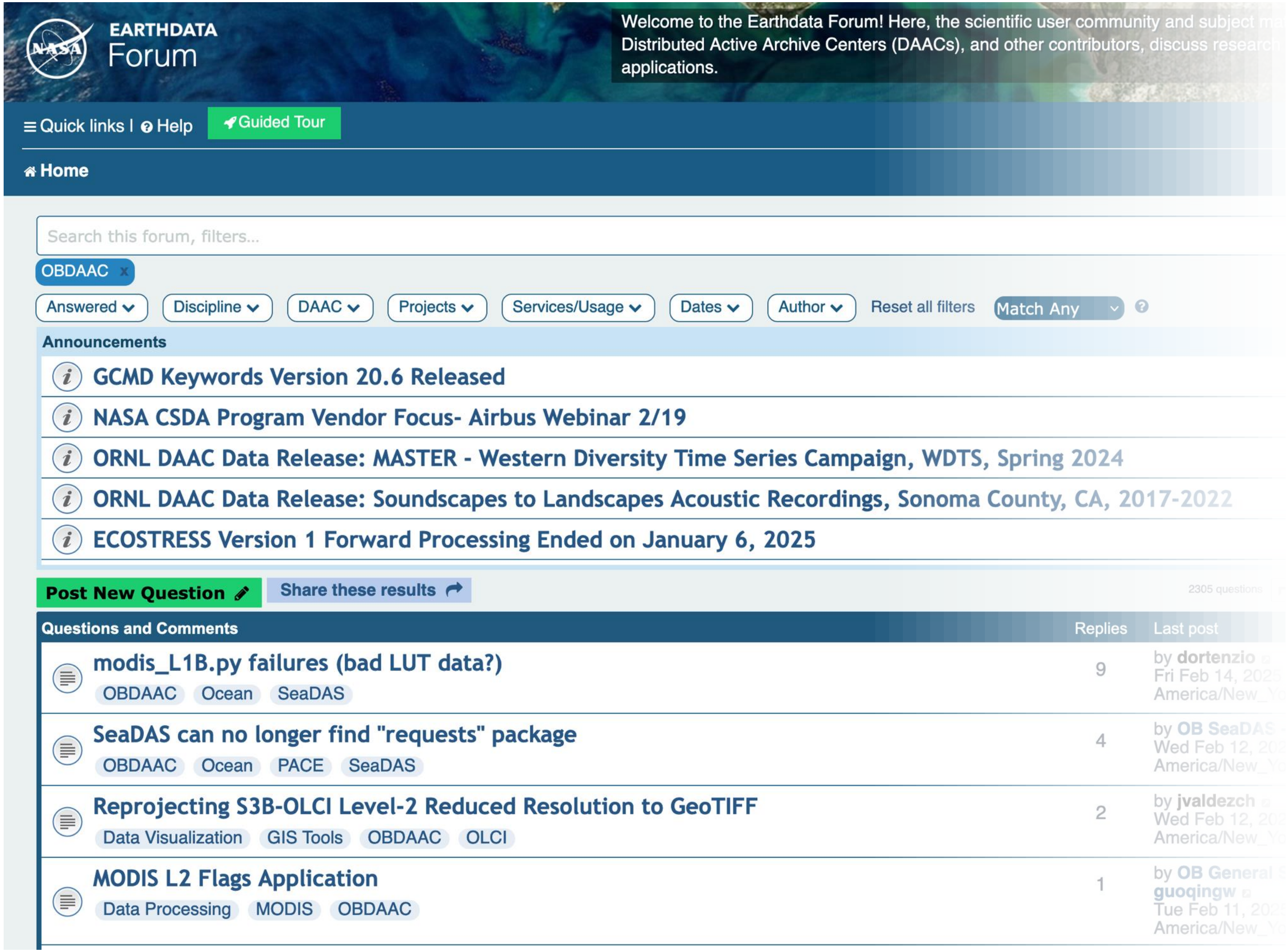


Questions?

Earthdata forum

https://forum.earthdata.nasa.gov/viewforum.php?f=7#tries


PACE DATA HACKWEEK
Tentative: Aug. 3-7, 2025
Univ. Maryland
Baltimore County
A social coding event
#keepingPACE
with NASA's latest great Earth
science mission
OCB
Ocean Carbon
& Biogeochemistry
NASA
PACE
NSF

NOTEBOOK TIME

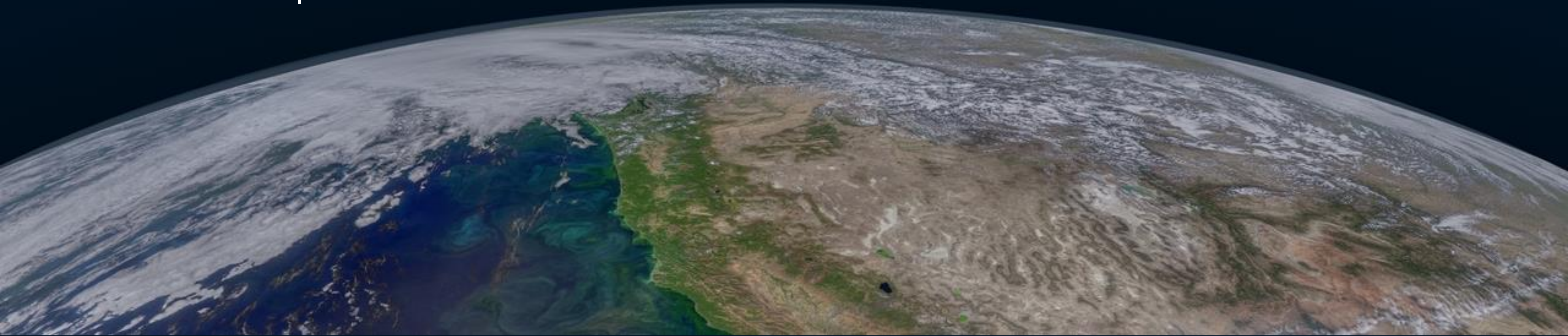
Earthdata login

https://urs.earthdata.nasa.gov/

Environment

```
conda env create -f FICE2025_PACE_environment.yml

conda activate paceenv
```



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