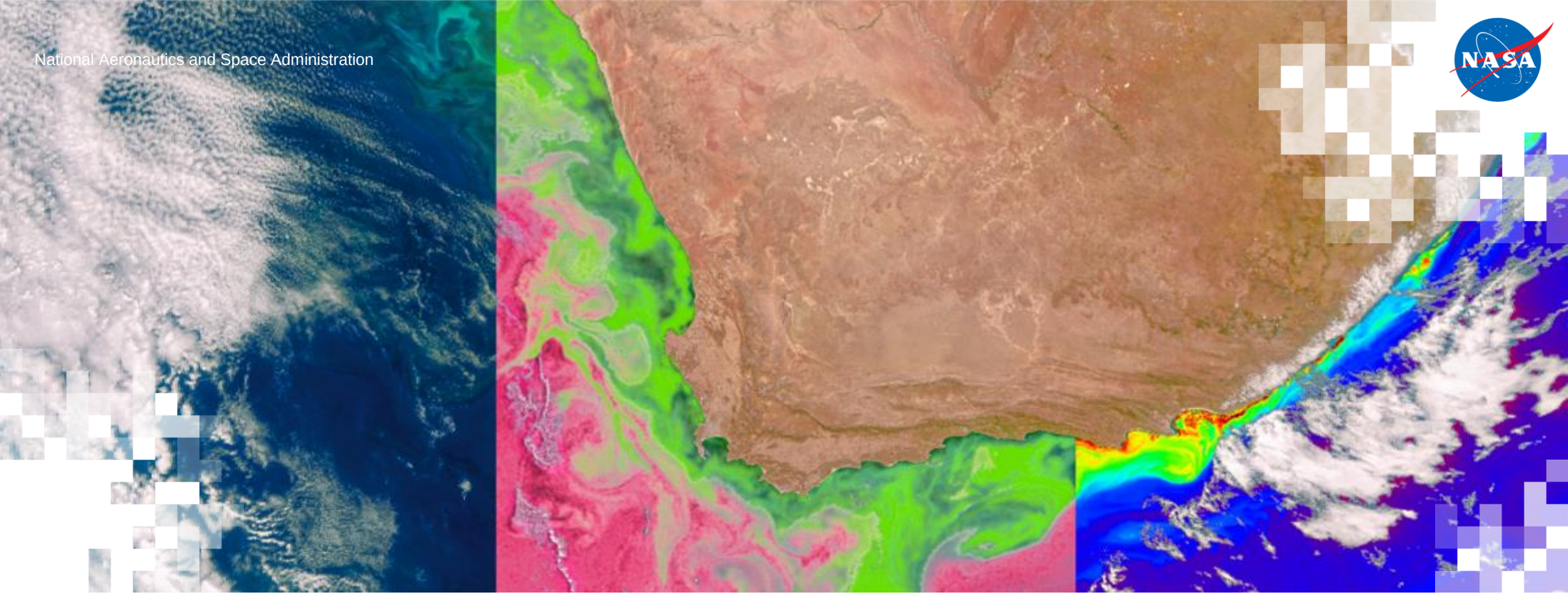
National Aeronautics and Space Administration



Introduction to PACE Hyperspectral Observations for Water Quality Monitoring

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

ARSET Instructor: Amita Mehta

Guest Instructors: Anna Windle (NASA GSFC/SSAI) & Carina Poulin (NASA GSFC/SSAI)

October 09, 2024

Training Outline

Part 1

Introduction to PACE (Plankton Aerosol, Cloud, ocean, Ecosystem) Mission for Water Quality Monitoring

September 25, 2024

10:00-11:30 AM

Part 2

Overview, Access, and Analysis of PACE Ocean Color Data Products

October 2, 2024

10:00-11:30 AM

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

October 9, 2024

10:00-11:30 AM

Homework

Opens October 9 – Due October 24 – Posted on Training Webpage

A certificate of completion will be awarded to those who attend all live sessions and complete the homework assignment(s) before the given due date.

Part 2 Review

- Applications Program: Inform decision making activities in water resources, fisheries, and ecosystem areas.
- Examples of PACE Early Adopters: Aquaculture Site Selection, Enhanced Cholera Risk Models, Hypercoast Water Quality Monitoring for Lakes and Estuaries.
- Description and access to multiple levels of PACE data: PACE Data Access Landing Page
- Data Access: Through OB.DAAC and Earthdata.
- NASA Worldview: Useful for near real-time PACE true-color images and Chlorophyll–a concentration data visualization.
- Demonstration of SeaDAS: Useful for PACE data analysis and visualization.

Part 3 Objectives

By the end of this training, participants will be able to:

- Access OCI Remote Sensing Reflectances and Level-2 and -3 Water Quality Parameters from Earthdata using Open-Source Python Software/Jupyter Notebooks
- Visualize OCI Remote Sensing Reflectances and Level-2 and -3 Water Quality Parameters using Open-Source Python Software/Jupyter Notebooks
- Identify Steps to Customize the Provided Jupyter Notebook Software for Other Areas of Interest and Time Frames

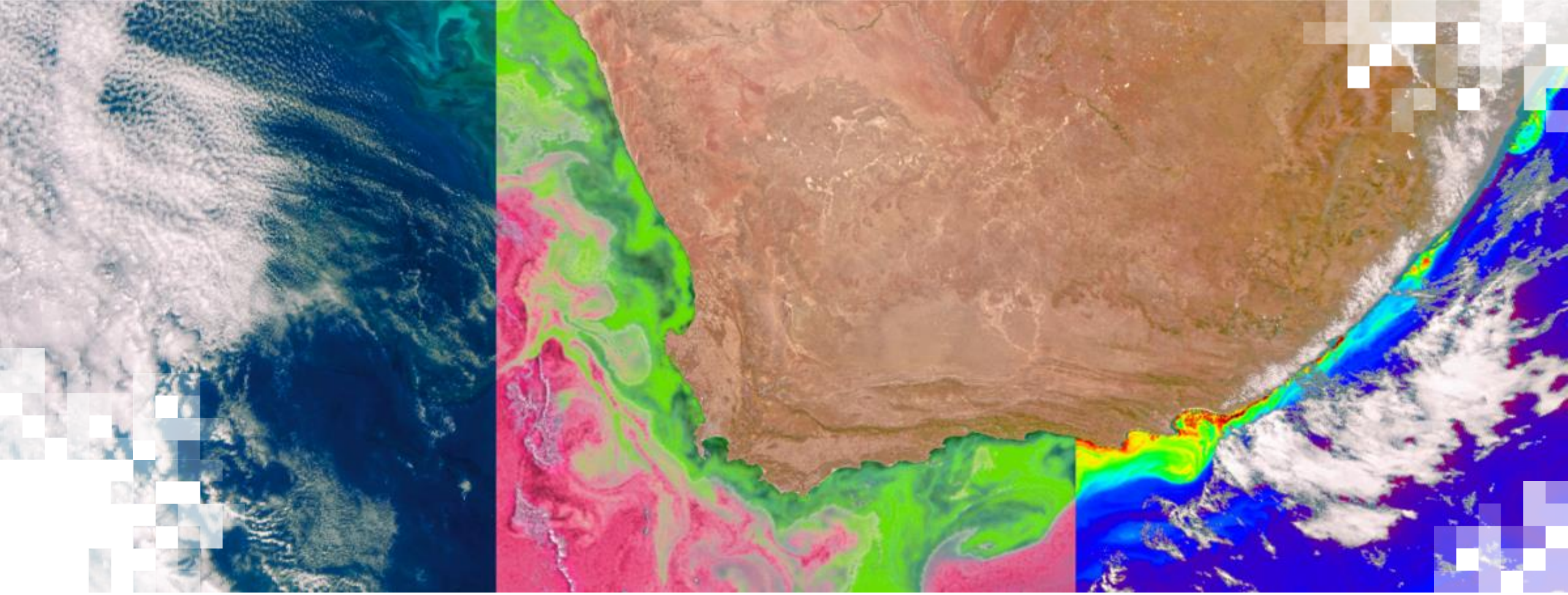
How to Ask Questions

- Please put your questions in the Questions box and we will address them at the end of the webinar.
- Feel free to enter your questions as we go. We will try to get to all of the questions during the Q&A session after the webinar.
- The remainder of the questions will be answered in the Q&A document, which will be posted to the training website about a week after the training.

Part 3 – Trainers

Anna Windle
Postdoctoral Fellow
NASA GSFC, SSAI

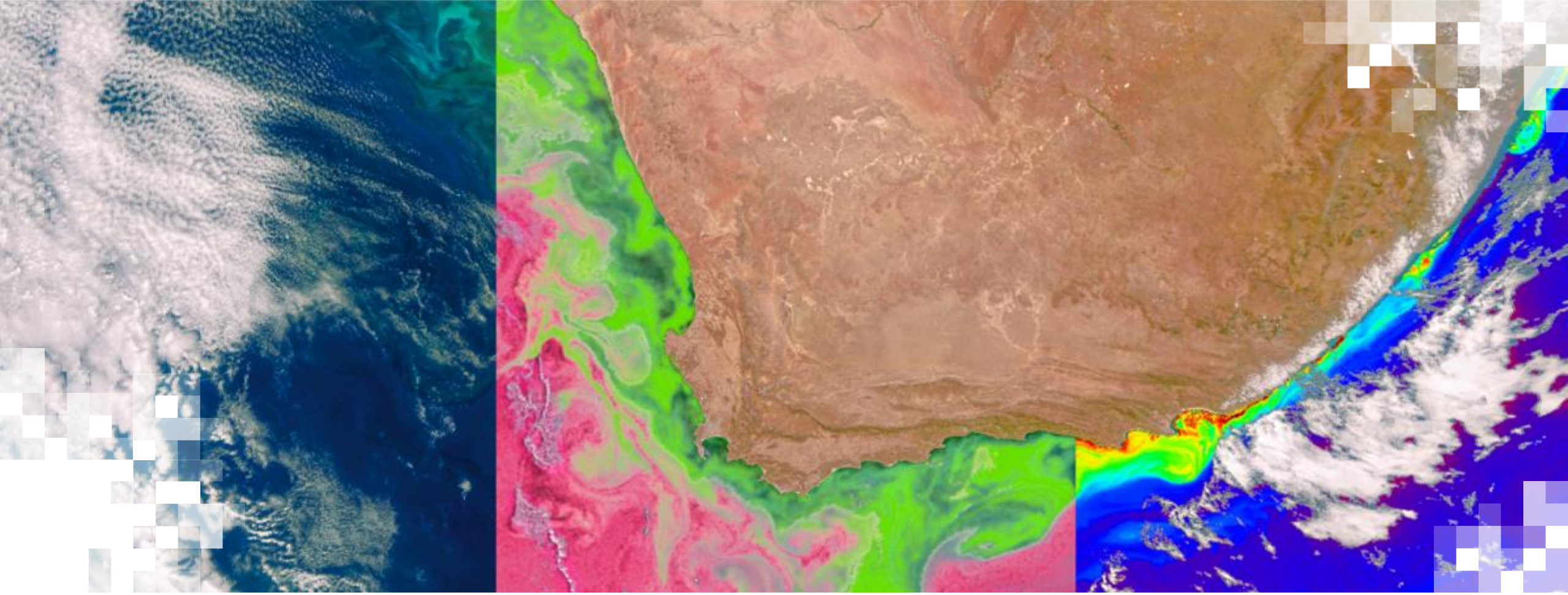
Carina Poulin
Scientific Designer
NASA GSFC, SSAI



Access and Visualization of PACE/OCI Data using Python/Jupyter Notebook Software Overview

PACE: A New Era for Water Quality Monitoring

- PACE Launch: February 8, 2024
- New Data Opportunities:
  - Hyperspectral Ocean Color Data
  - Hyper- and Multi-Spectral Polarimetry Data
- New data challenges!



Orientation to Earthdata Cloud Access

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.

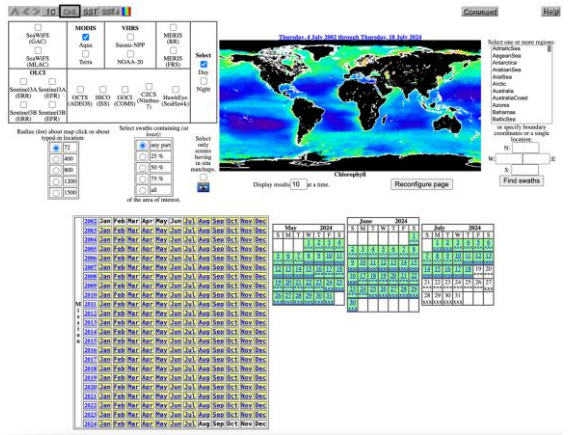
How can I access PACE data that's in the cloud?

Three options:

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

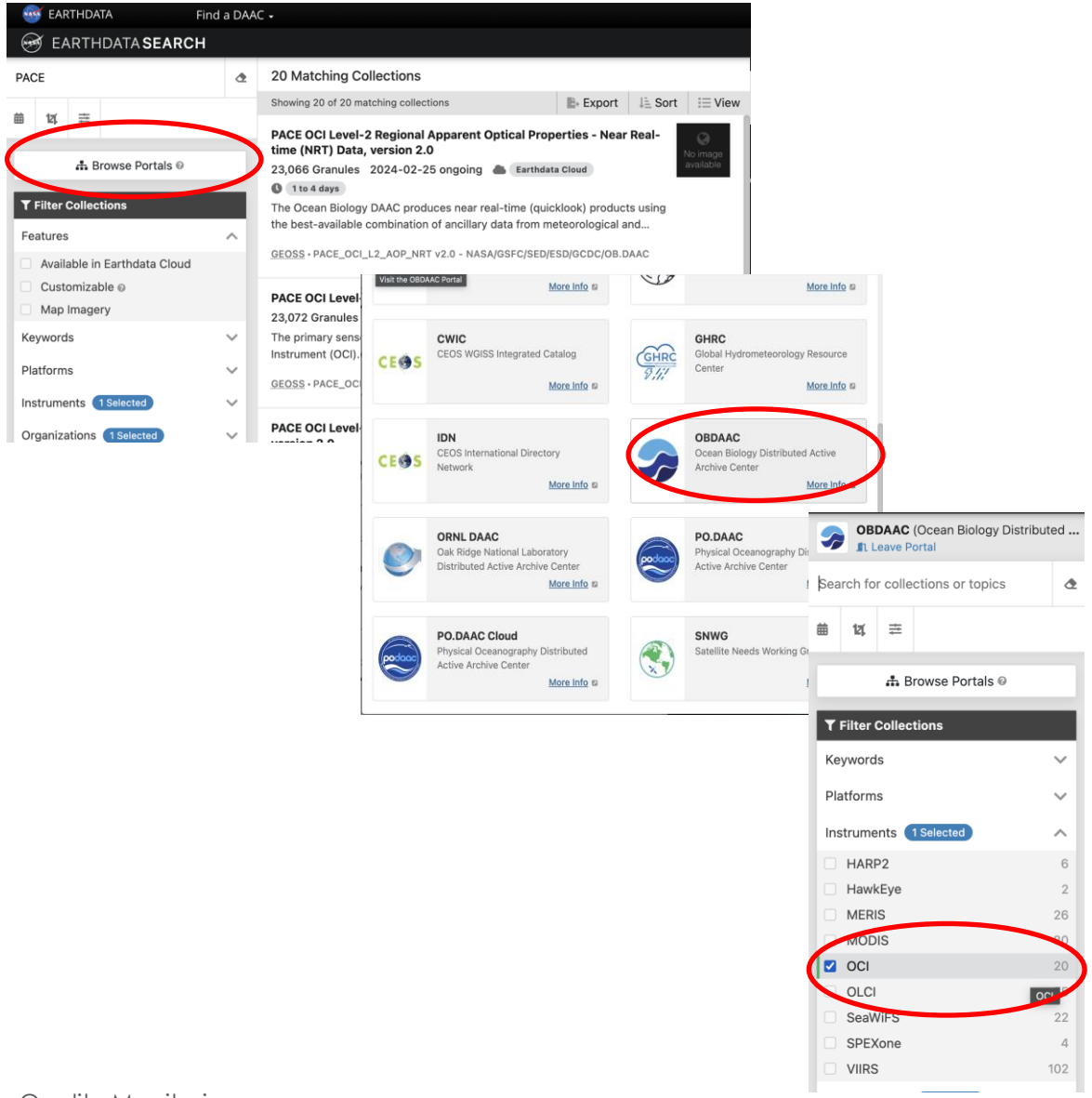
Note: the OB.DAAC Level 1 & 2 browser does not support access to PACE data

R.I.P.

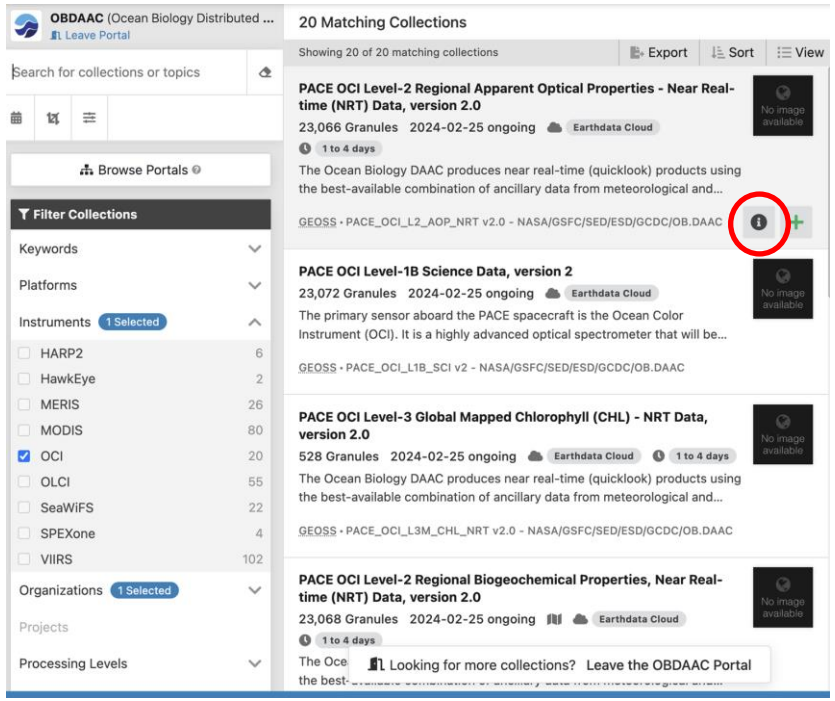


Earthdata Search OB.DAAC Portal

1. Navigate to: https://search.earthdata.nasa.gov/search
2. Top left, click "Browse Portals"
3. Click on "OBDAAC"
4. Filter Instruments to "OCI"



Data of Interest



Shortname →

Search Results (20 Collections)

PACE OCI Level-2 Regional Apparent Optical Properties - Near Real-time (NRT) Data, version 2.0

PACE_OCI_L2_AOP_NRT Version 2.0

Related URLs

View More Info

Temporal Extent

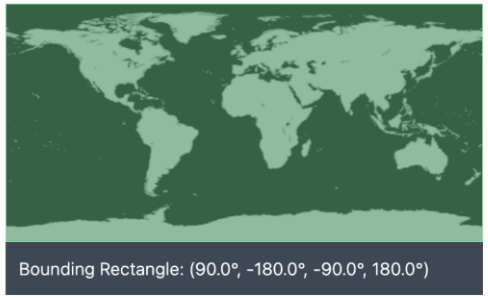
2024-02-25 ongoing

GIBS Imagery Projection Availability

None

Science Keywords

EARTH SCIENCE > ATMOSPHERE > ATMOSPHERIC RADIATION



The Ocean Biology DAAC produces near real-time (quicklook) pr

For Developers

OBPG

PROCESSOR

No contact information for this data center.

NASA/GSFC/SED/ESD/GCDC/OB.DAAC

DISTRIBUTOR ARCHIVER

sdps@oceancolor.gsfc.nasa.gov

Fax: 301-286-0268

Cloud Access

AWS Cloud

Available for access in-region with AWS Cloud

Region
us-west-2

Bucket/Object Prefix
s3://ob-cumulus-prod-public/

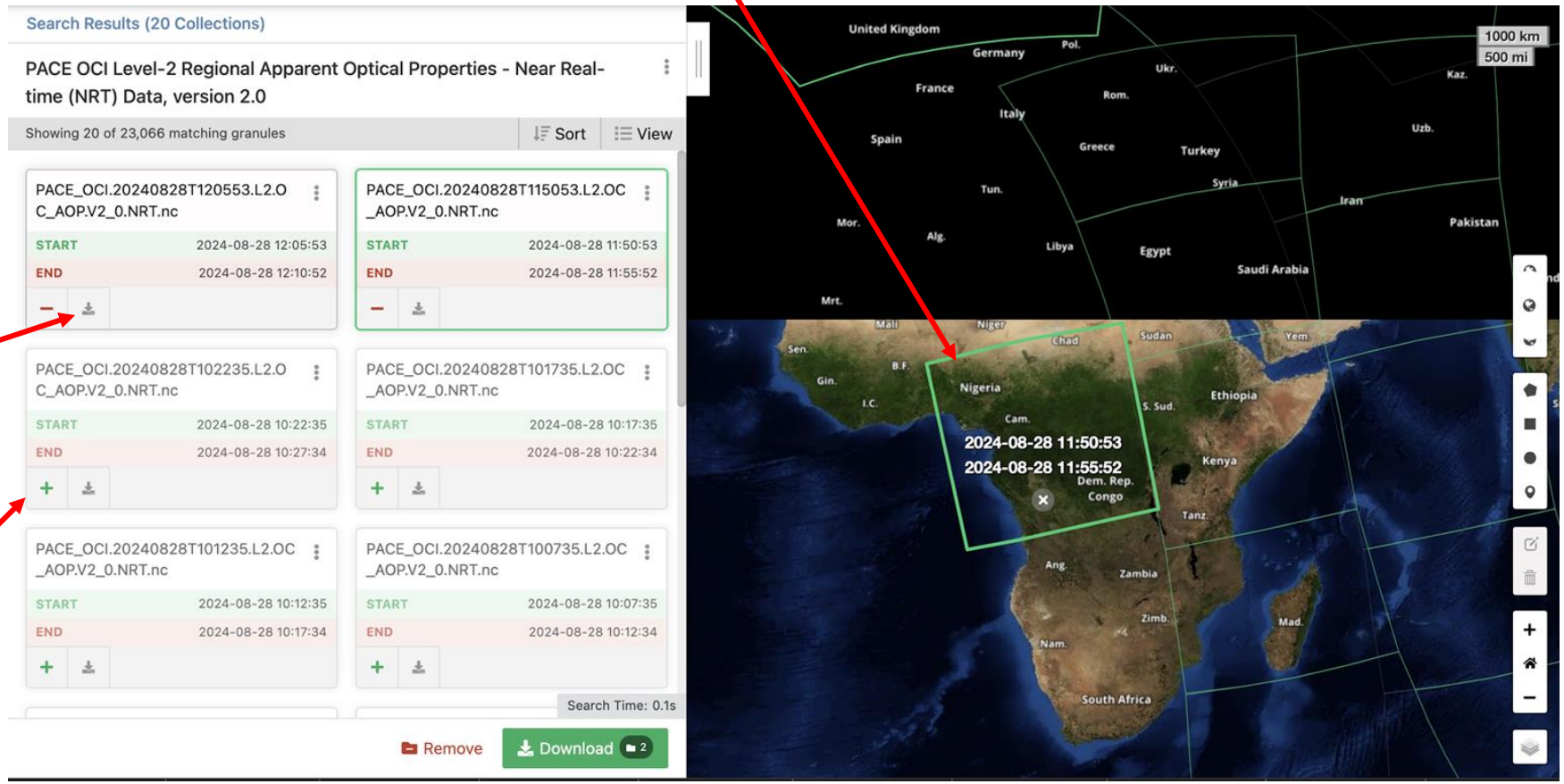
AWS S3 Credentials
Get AWS S3 Credentials | Documentation

Download Data

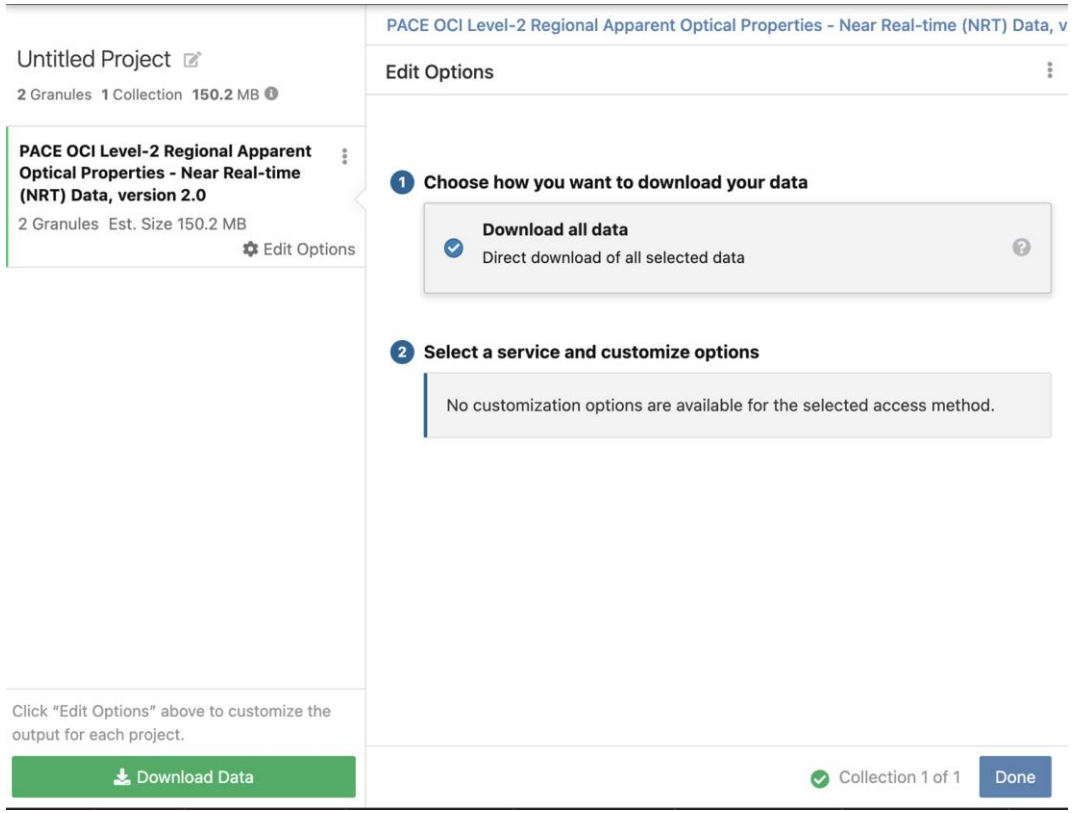
Selecting a file highlights the granule on the map.

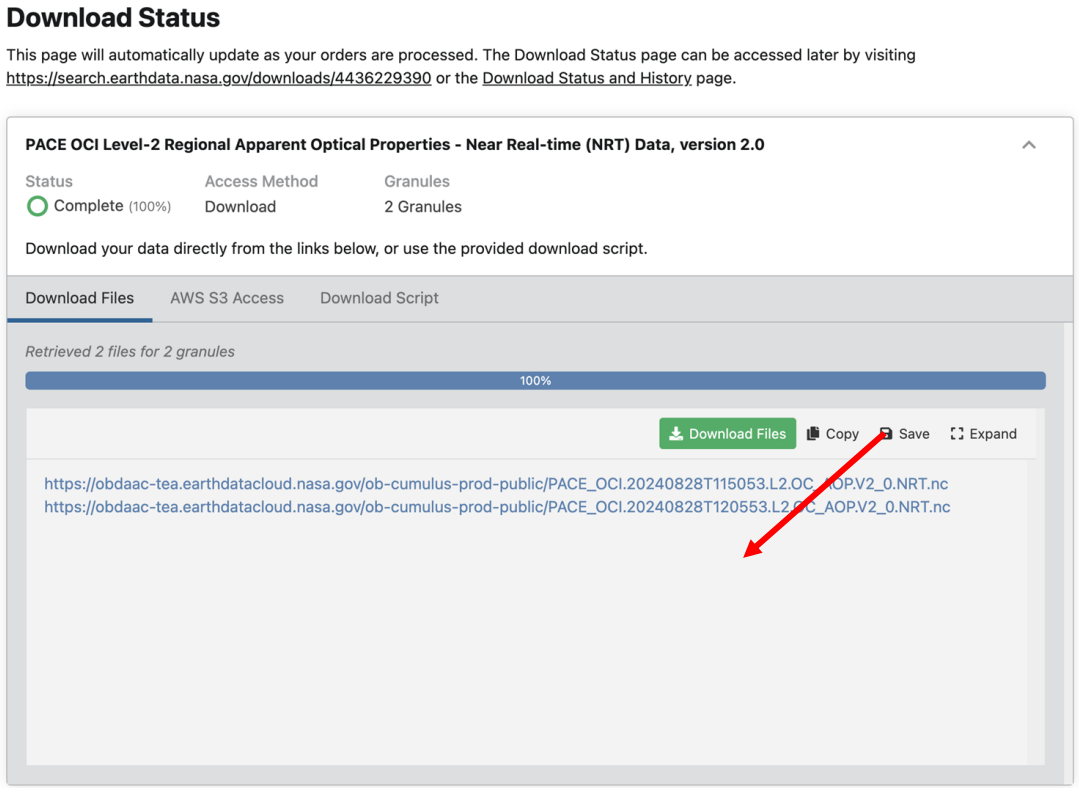
Download individual files directly.

Add multiple files to download.



Analyze Data in the Tool of Your Choice





Can pull these local files into whatever you're used to analyzing satellite data with – Python, Matlab, R, SeaDAS, etc.

Or…

earthaccess Python Library

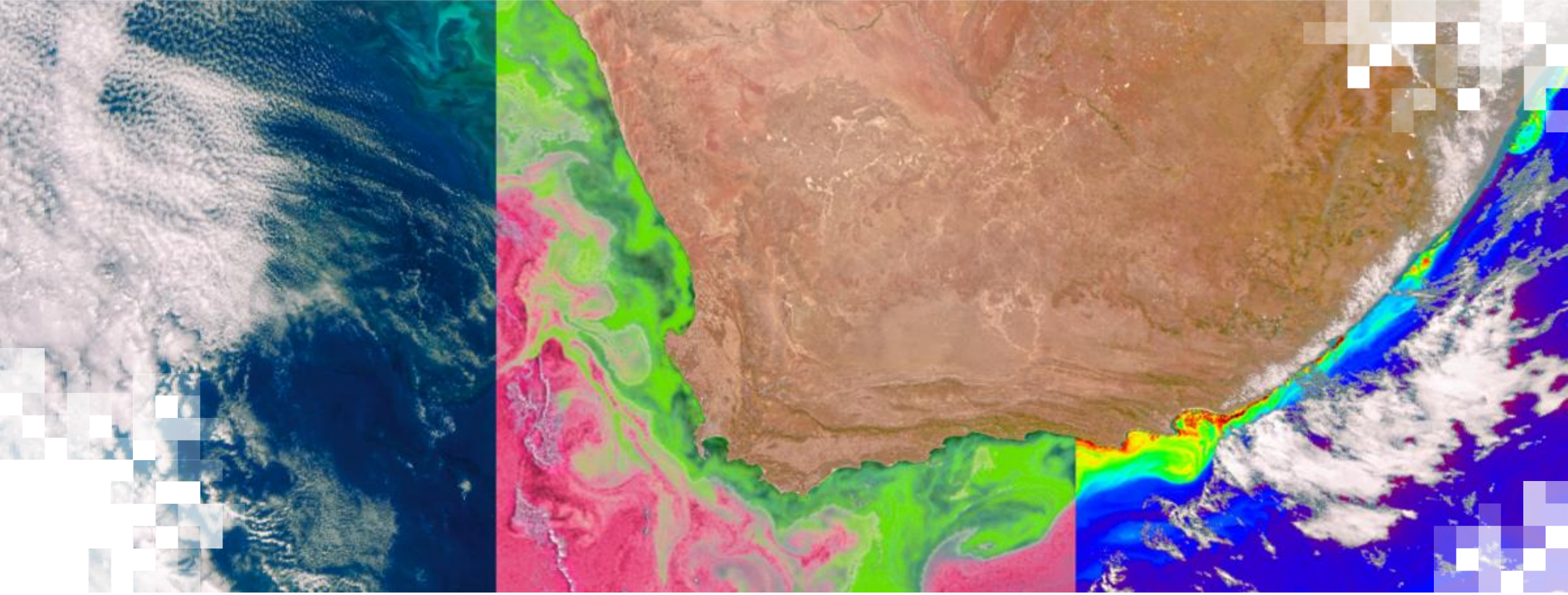
- Easy way to search, download, or stream NASA Earth science data using a few lines of code.
- earthaccess is under active development.
  - Feel free to submit Issues on their Github if something is not working or you have a suggestion.
- Anyone can contribute! Check out the Contributing Guide.
- This is what we will use to access PACE data in the Jupyter Notebook tutorials.

Two Ways to Run Jupyter Notebooks

1. Locally – Following Instructions Listed in Prerequisites
   - Using the predefined environment.yml to install JupyterLab and required Python libraries

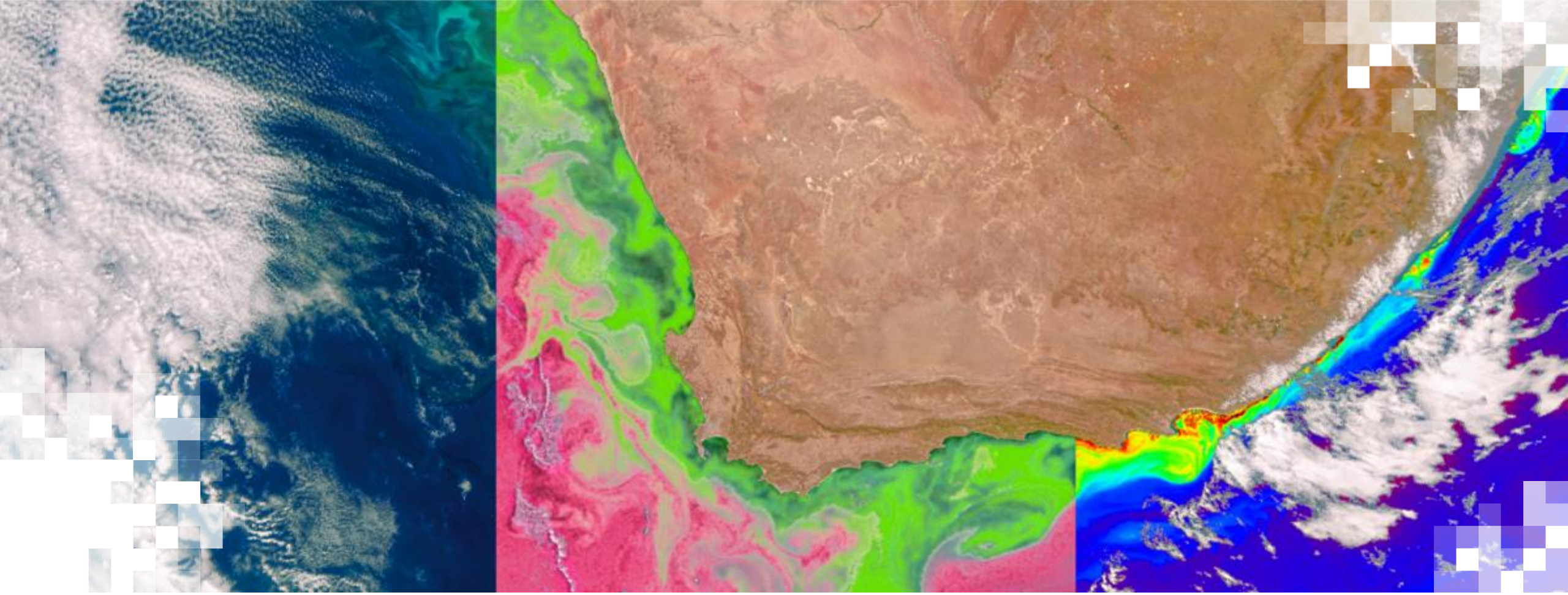
1. In the Cloud
   - If you have access to an Elastic Compute Cloud (EC2), such as a cloud-based JupyterHub
     - Examples: JupyterHubs Maintained by Openscapes, CryoCloud, NASA Goddard's Open Science Studio
   - EC2 needs to be running on AWS us-west-2 region
   - See NASA Earthdata Cloud Cookbook for more information on cloud computing

Since not everyone has equal access to an EC2, we will be demonstrating how to run the notebooks locally.



Tutorial of Earthdata Cloud Access

Tutorial Lead: Anna Windle, Postdoc
NASA GSFC Ocean Ecology Lab



Visualization of Optical Remote Sensing Data for Water Quality Monitoring

PACE Data Products

- PACE Data Products Table

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
TOA atmosphere radiances from OCI	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
TOA 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
TOA 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

Ocean Properties to be Produced by OCI
Bio-optical and biogeochemical properties of seawater constituents in the sunlit upper ocean.

Product	Description and Use	Units	Availability	Status	Additional Info
Ocean sensing reflectances	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
Reflectance	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
Diffuse wavelength	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
Diffuse attenuation coefficients	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
Phytoplankton absorption coefficients	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
Non-algal particle plus dissolved organic matter 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
Chromophoric dissolved organic matter absorption 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
Spectral coefficients of chromophoric dissolved 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
Non-algal particle matter absorption coefficients	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
Particulate matter absorption coefficients	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
Particle backscattering coefficients	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
Fluorescence height	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
Photosynthetically available radiation (PAR)	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
Concentration of chlorophyll-a	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

PACE Data Products – What to Know About Sensors

- What You Should Know About PACE Data

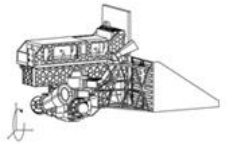
This is a summary of the general information one needs to use PACE data. See the complete release notes for the most current PACE data on the OB.DAAC website.

Orbit

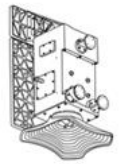
The PACE satellite is in a Sun-synchronous polar orbit, with a local Equatorial solar crossing time of 1 pm for the ascending (daytime) note. The descending orbital node happens during local nighttime, and none of PACE's sensors collect science data at night.

PACE Instruments

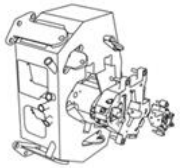
OCI
Ocean Color Instrument



HARP-2
Hyper Angular Rainbow Polarimeter



SPEXone
Spectro-Polarimeter for Planetary EXploration



OB.DAAC Data processing levels

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

Product maturity levels

Standard	Provisional	Test	Diagnostic

PACE Data Products – What to Know About Data Levels

- What You Should Know About PACE Data

OB.DAAC Data processing levels

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

Product maturity levels

Standard	Provisional	Test	Diagnostic
Products are produced by an algorithm that has community consensus and have been validated.	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.	Results have not yet been reviewed by algorithm developers and or may be known to have substantial errors in implementation that are under investigation.	Products that are produced to support analysis of algorithm behavior, but that are not intended for science.

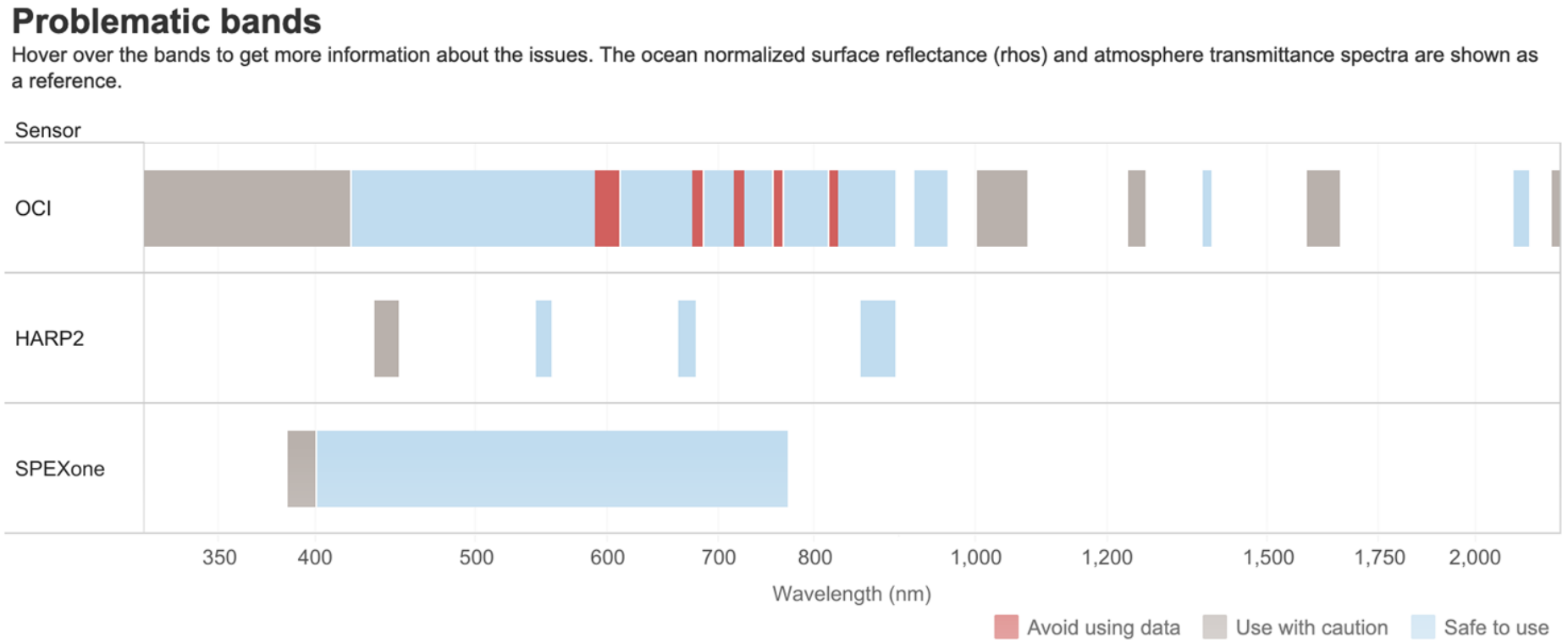
Known data issues

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 Data Products – What to Know About Bands

- What You Should Know About PACE Data



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
NA			Geolocation performance is subject to more comprehensive evaluation.

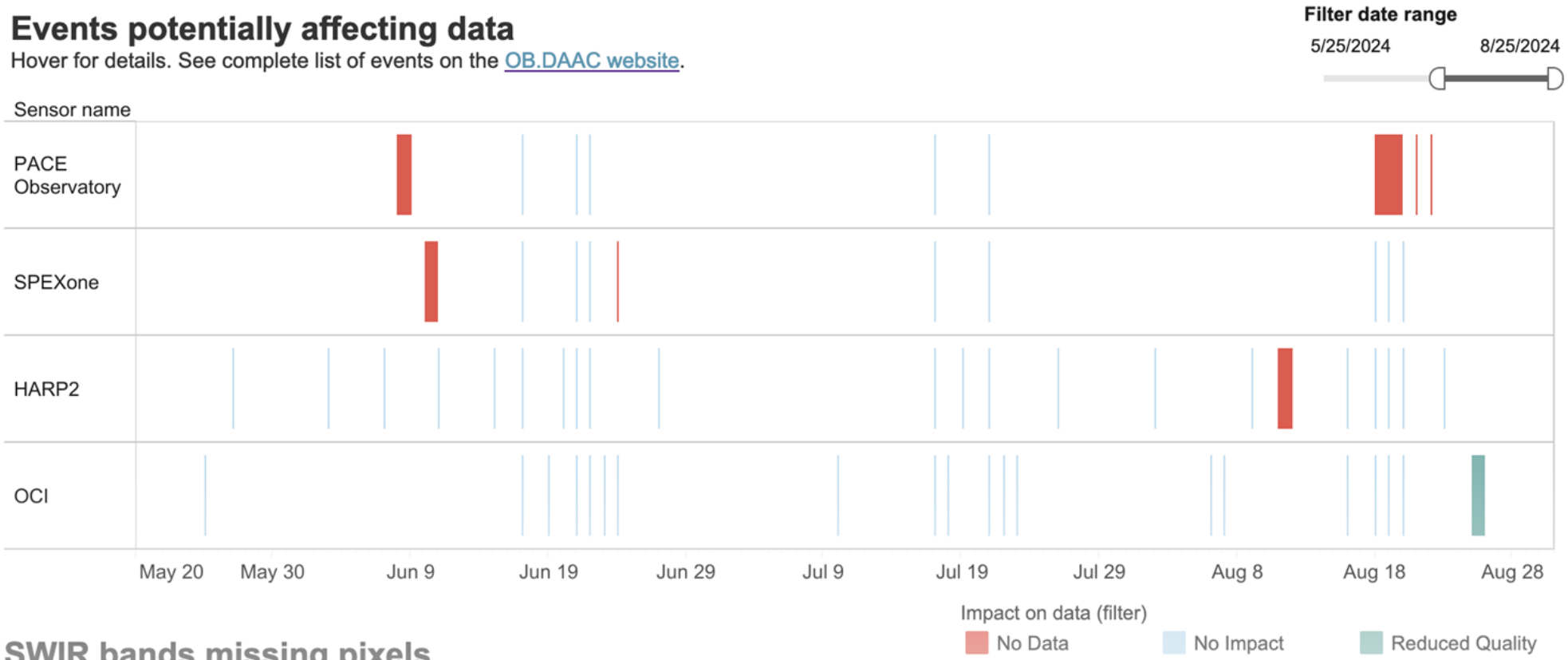
Filter Sensor or Processing Level

Sensor

- (All)
- HARP2
- OCI

PACE Data Products – What to Know About Events Affecting Data

- What You Should Know About PACE Data



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 Data Visualization Examples for Today

Now that you know more about PACE data, you are ready to visualize it.

In the following Jupyter Notebook you will make:

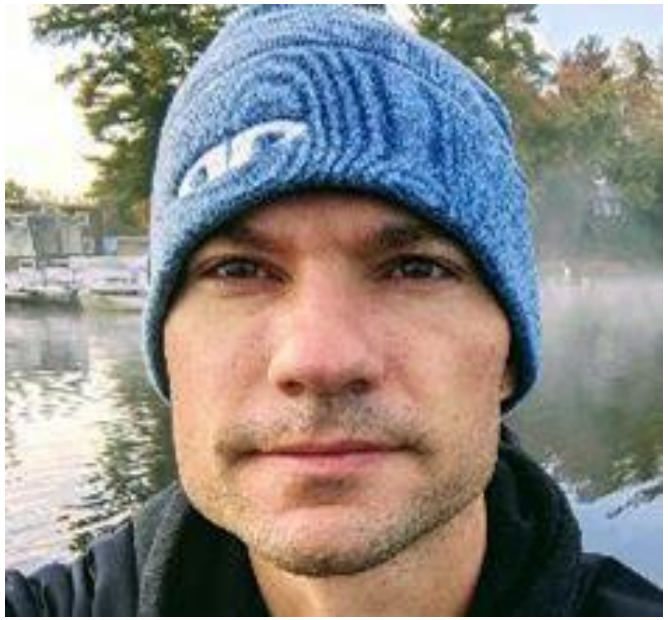
- An Easy Global Chlorophyll-a Map
- A Map of the Global Oceans in Quasi True Color
- A Full Rrs Spectra from Global Oceans
- A Water Quality Parameter Map of a Specific Area

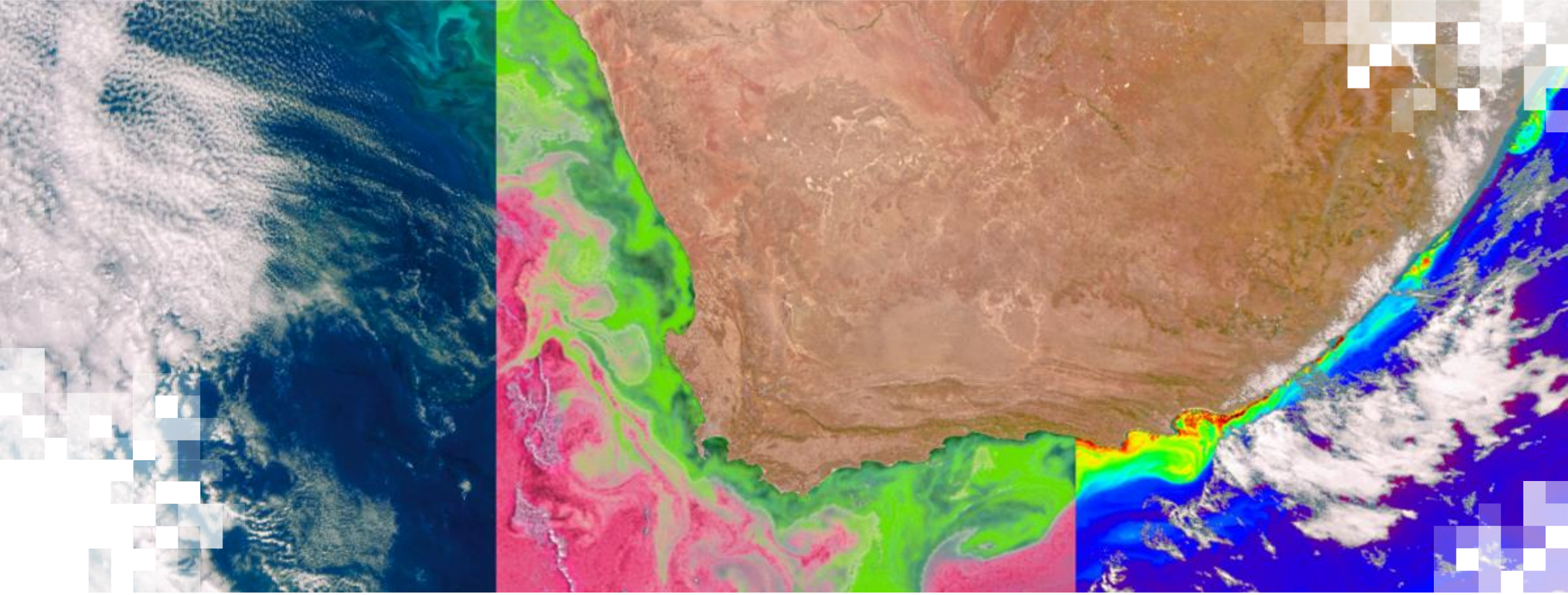
Acknowledgements

Ian Carroll

Research Scientist

NASA GSFC, UMBC





Training Summary

PACE Sensors

- PACE data products are available for oceans/estuaries, atmosphere, and land from PACE-OCI, HARP2, and SPEXone.
- OCI Observations are useful for Water Quality Applications.
- HARP2 and SPEXone will aid in atmospheric correction.

PACE Ocean Color Advances and Limitations

Advancements:

- Hyperspectral from 315 nm to 895 nm
- Spectral resolution of 5 nm bandwidths for Hyperspectral range
- Spectral sampling of 1.25 or 2.5 nm for Hyperspectral range (184 bands)
- Amazing signal to noise ratio – even for 5 nm bandwidths
- High UV sensitivity from ~340 nm
- 9 Short-Wave Infrared (SWIR) bands for atmospheric correction including turbid waters (ocean sensitive)
- Nearly daily global coverage

Limitations:

- Spatial resolution of ~1.1 km constrains use within inland and near-shore waters and near ice floes

Challenges:

- Lack of verified hyperspectral algorithms
- Need for more comprehensive hyperspectral field measurements

PACE Ocean Color Data Products, Access, and Analysis

- Multiple Levels of PACE Data:
  - PACE Data Access Landing Page
- Data Access:
  - OB.DAAC and Earthdata
- NASA Worldview:
  - Useful for near real-time PACE true-color images and Chlorophyll–a concentration data visualization.
- SeaDAS:
  - Useful for PACE data analysis and visualization.

Product	L2 Suite	Description and Use	Units	Availability	Status	Additional Info
Spectral top-of-atmosphere radiances from OCI	*N/A*	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
Spectral top-of-atmosphere radiances and polarimetry from SPEXone	*N/A*	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	*N/A*	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.

Product	L2 Suite	Description and Use	Units	Availability	Status	Additional Info
Spectral remote sensing reflectances	OC_AOP	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, Stamnes, Zhang In situ measurement protocols
Surface reflectance	SFREFL	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 (Lyapustin) and ISOFIT
Apparent visible wavelength	OC_AOP	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 coefficients	OC_IOP	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 phytoplankton absorption coefficients	OC_IOP	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, Pahlevan, Siegel, Barnes, Stamnes, Chowdhary In situ measurement protocols
Spectral non-algal particle plus dissolved organic matter absorption coefficients	OC_IOP	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, Stamnes, Chowdhary In situ measurement protocols
Spectral particle backscattering coefficients	OC_IOP	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, Pahlevan, Barnes, Stamnes, Chowdhary, Zhang, Odermatt
Fluorescence line height		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
Daily photosynthetically available radiation (PAR)	OC_PAR	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
Concentration of chlorophyll-a	OC_BGC	Near surface concentration of the photosynthetic pigment chlorophyll-a. Provides proxies for algal biomass, ecosystem health and function, and eutrophication.	mg m^{-3}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Provisional	ATBD SAT members: Gaube, Shuchman, Siegel, Pahlevan, Zhai, Chowdhary, Odermatt In situ measurement protocols
Concentration of particulate organic carbon	OC_BGC	Near surface concentration of the particulate organic carbon. It is a proxy for all living material (phytoplankton, zooplankton, bacteria) and detritus. It is also a venue through which organic carbon, sequestered through the photosynthesis, is transfered towards higher trophic levels and into the deep ocean.	mg m^{-3}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Test	ATBD In situ measurement protocols
Concentration of particulate inorganic carbon		Concentration of particulate inorganic carbon in the surface of the ocean. Used to track the presence and abundance of calcite containing phytoplankton in the open ocean (coccolithophores).	mol m^{-3}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Test	ATBD
Concentration of phytoplankton carbon	OC_BGC	Concentration of carbon contained in phytoplankton cells. Provides a proxy for phytoplankton biomass that is often used in primary productivity algorithms and biogeochemical and Earth System models.	mg m^{-3}	Level-2 1-km at nadir; daily - Level-3 4-km; daily, 8-day, monthly, annual	Test	SAT member: Westberry ATBD

PACE Ocean Color Data Access using Python/Jupyter Notebooks

- PACE data are located on an Amazon Web Service (AWS) Cloud Data Storage (S3) Buckets.
- Overview of Python libraries for data search, download, and visualization, and stream data from Earthdata Cloud using:
  - earthdata_cloud_access.jp
  - ARSET_PACE_visualization.jp
- Software and sample data files used in the training are available from the training webpage.

Homework and Certificates

- **Homework:**
  - One homework assignment
  - Opens on 9/10/2024
  - Access from the training webpage
  - Answers must be submitted via Google Forms
  - **Due by 24/10/2024**

- **Certificate of Completion:**
  - Attend all three live webinars (attendance is recorded automatically)
  - Complete the homework assignment by the deadline
  - You will receive a certificate via email approximately two months after completion of the course.

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Acronyms

- CZCS: Coastal Zone Color Scanner Experiment
- EMIT: Earth Surface Mineral Dust Source Investigation
- EnMAP: Environmental Mapping and Analysis Program
- EO-1: Earth Observing One Satellite
- HARP2: Hyper-Angular Rainbow Polarimeter-2
- HICO: Hyperspectral Imager for the Coastal Ocean
- MODIS: Moderate Resolution Imaging Spectroradiometer
- OCI: Ocean Color Instrument
- PACE: Plankton, Aerosol, Cloud, and ocean Ecosystem
- PRISMA: PRecursore IperSpettrale della Missione Applicativa
- SeaDAS: Sea, Earth, and Atmosphere Data Analysis System
- SeaWiFS: Sea-Viewing Wide Field-of-View Sensor
- SPEXone: Spectro-Polarimeter for Planetary Exploration
- VIIRS: Visible Infrared Imaging Radiometer Suite

Resources

- OBPG Tutorials and Data Recipes
  - OCI File Structure Notebook
  - OCSSW Tools Notebook
  - HARP2 Data Visualizations Notebook
- PACE Hackweek Website
- SeaDAS


APPLIED REMOTE SENSING TRAINING PROGRAM
TRAIN - EMPOWER - ADVANCE

Thank You!