

# User-Driven Ocean and Coastal Management via the NASA PACE Applications Program

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## Abstract

The Plankton, Aerosol, Cloud, and Ocean Ecosystem (PACE) mission is NASA's next great investment in Earth Science, continuing NASA's legacy of over forty years of satellite ocean color measurements. PACE, expected to launch in 2023, will advance our Earth-observing and monitoring capabilities through hyperspectral imaging and multi-angle polarimetric observations of ocean, atmosphere, and land ecosystems. PACE will give us an unprecedented view of our home planet and will support user-driven environmental applications through research and applied science to address societal challenges and inform decision-making. The PACE Applications program seeks to strengthen the ties between science and decision-making through programming such as the Early Adopter initiative, workshops and focus sessions, and information-sharing and co-production activities. Practical applications of PACE data include waterborne pathogen monitoring and prediction, harmful algal bloom species discrimination and early-detection, support for best-management practices for estuary and watershed health, as well as sustainable fishery and aquaculture practices. Hyperspectral and polarimetric PACE data will provide water resource managers and decision-makers with highly accurate ocean color and atmospheric observations that will directly improve their operational products and applied technologies, ultimately fulfilling real-world needs. This presentation will highlight PACE's novel hyperspectral and polarimetric capabilities, introduce PACE's standard and exploratory data products, outline the PACE Applications Program, share real-world coastal applications of PACE data, and summarize the results of the 2021 PACE Applications Water Quality Focus Session and the 2021 PACE Applications Workshop as they relate to community engagement and capacity development. Finally, we will share the revamped PACE Applications Outreach Strategy and how it will be used to promote partnerships within the existing user communities of practice and new user communities of potential for greater societal benefit.



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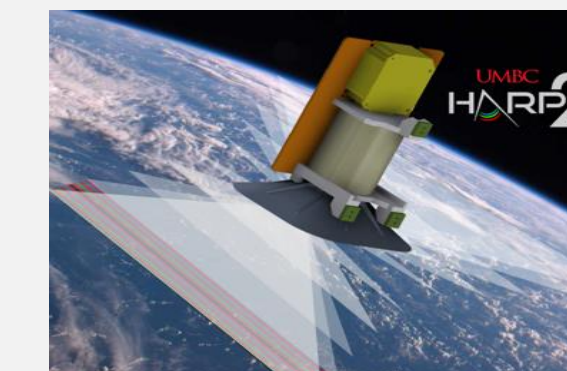
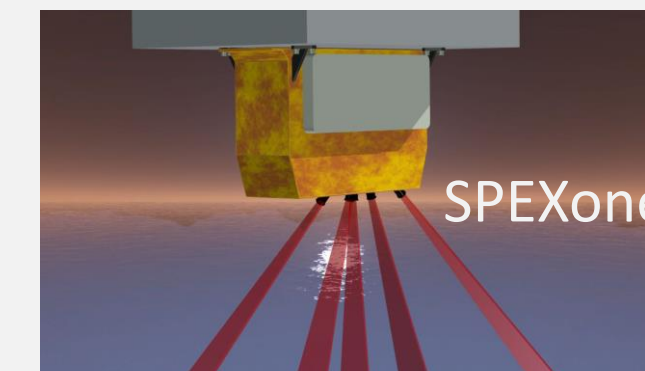
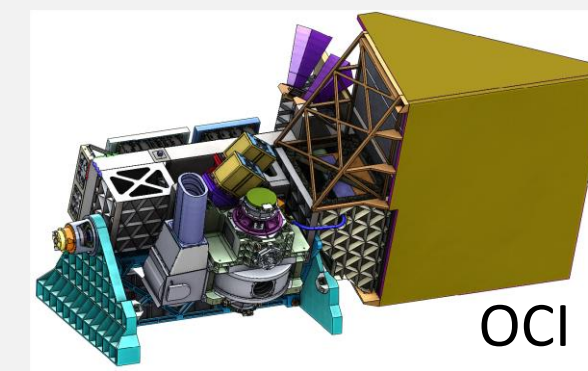


## 1. Background: the Plankton, Aerosol, Cloud, and Ocean Ecosystem (PACE) Mission

PACE, expected to launch in 2024, will extend and improve NASA's 20-plus years of global satellite observations of our living ocean, aerosols, and clouds and initiate an advanced set of climate-relevant data records. PACE will continue NASA's multi-decade, global record of satellite ocean color, clouds and atmospheric aerosol particles observations from SeaWiFS, MODIS, MISR, and VIIRS; and provide new measurements of aerosols, clouds, aquatic biology, ecology, and biogeochemistry through the spectral resolution of the Ocean Color Instrument (OCI) and multi-angle polarimetry. By determining the distribution of phytoplankton, PACE will help assess water quality & ocean health. It will also continue key measurements related to air quality and climate.

### Key Mission Characteristics:

- **Hyperspectral ocean color instrument (OCI)** – 345-890 nm in 5 nm steps – plus, SWIR bands @ 940, 1038, 1250, 1378, 1615, 2130, & 2260 nm
- **Two contributed multi-angle polarimeters (HARP2 & SPEXone)**
- 2-day global coverage to solar & sensor zenith angles of 75° & 60°
- Sun-synchronous, polar orbit with an Equatorial crossing time of 13:00
- 675-km altitude & 98° inclination
- Class C (limited redundancy) for 3 years of operations & 10 years of fuel



## 2. PACE Applications Program

The goal of the PACE Applications Program is to foster new partnerships and innovative thinking that will generate inventive solutions that aid society, including in ocean and coastal management. Goals include:

- Address community user needs & concerns with PACE data products
- Grow relevance & sustainability of PACE
- Demonstrate the societal value & utility of PACE

**Applications** are user-driven innovative uses of NASA PACE data products to complement and improve decision-making activities and provide practical solutions to meet societal needs. **Applied Research** provides fundamental knowledge of how PACE data products may be scaled & integrated into users' policy, business, and management activities to improve decision-making.

## 3. PACE Applications Programming

### Partnership Development, End User Engagement, and Outreach

- Connecting with partner organizations, communities, and/or networks during conferences, workshops, and other events virtually and in-person
- Presenting on the PACE Applications program and sharing information

### Early Adopter Program

- Working with researchers and decision-makers to promote applied science and applications research designed to scale and integrate PACE data into policy, business, and management activities that benefit society and inform decision making

### Community-specific Focus Sessions and Surveys

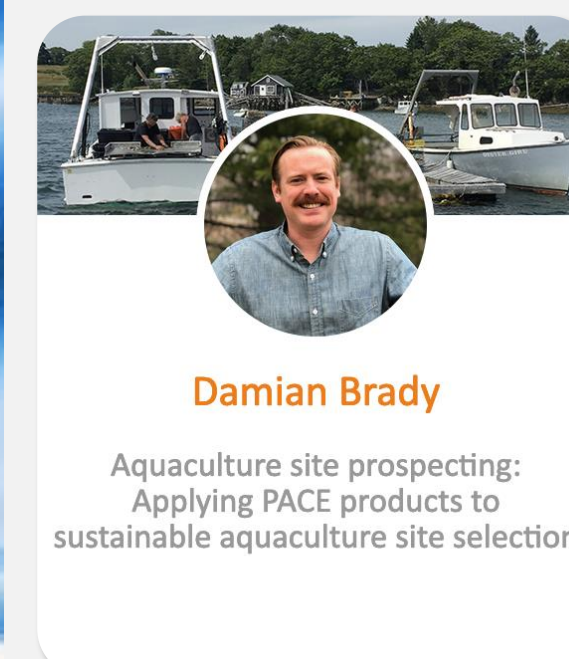
- Engaging with members of the science community through community focus sessions, surveys, and assessments

### Annual Application Workshops

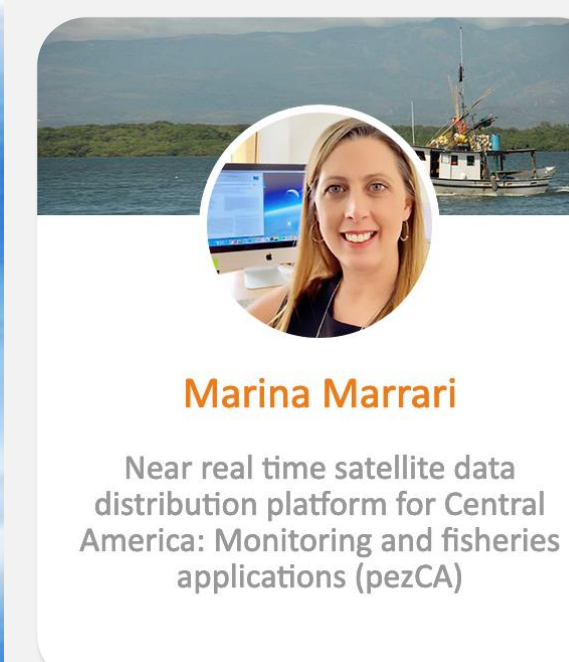
- Facilitating annual applications workshops to share PACE mission updates, identify and explore end user needs, identify new partnerships and applications, and foster community engagement and discussion



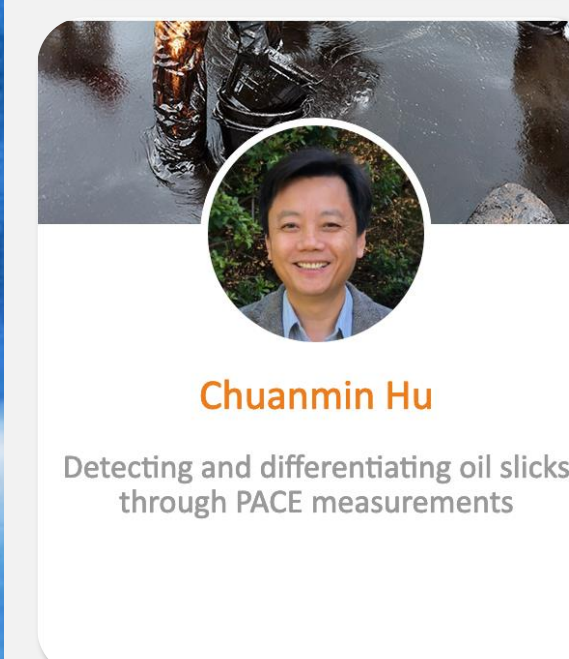
## 4. Example Applications: PACE Early Adopters



Enabling sustainable **aquaculture site selection** for the Gulf of Maine. Sea scallop aquaculture is a promising field of bivalve aquaculture due to large sea scallop trade deficit and the potential market for cultured sea scallops. PACE resolution would be optimal for site selection tools for these species if we can relate phytoplankton size to feeding rates.



Development of a free mobile app serving satellite data for **red tide monitoring** in Pacific Central America. PACE will represent a valuable source of operational ocean color data and will expand the products available, soon to include operational products for red tide detection & monitoring in collaboration with coastal communities.



Disaster response and mitigation through **detection and mapping of oil slicks and spills** in the Gulf of Mexico. PACE with hyperspectral bands covering the 380 - 1000 nm spectral region and the shortwave infrared (1.2 & 1.6 mm) can spectrally differentiate various types of oil slicks and quantify oil thickness.

## 5. Outreach to Promote New Partnerships

To continue to work toward the Applications Program goals of partnership development and end user outreach, an outreach strategy is being refined for implementation in 2022. This strategy will include:

- Completion and expansion of **user persona profiles** to ensure that all possible end users and their needs are considered
- Identifying **new communities across sectors** to expand the possible user community, particularly in non-traditional sectors outside of NASA and research
- Development of **community/user-specific messaging and content**, including case studies that reflect mission synergies, audience technical level, thematic area, or other specific priorities
- Pursuing **active outreach** to new and existing communities (including via presentations, conversations, community focus sessions, discussions, etc.) and **passive outreach** (through a PACE newsletter and email list-serv, publications in popular or grey literature, contributions to external newsletters, etc.).
- **Identification and formalization of new PACE Early Adopters!**

