CARICOOS

GLIDERS, SAILDRONES, AND AUTONOMOUS OCEANOGRAPHIC OBSERVATIONS IN THE U.S. CARIBBEAN

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Caribbean Coastal Ocean Observing System (CARICOOS)

ABOUT CARICOOS | US CARIBBEAN REGION

- CARICOOS mission is to provide unquestionably high-priority decision-supporting information for enhancing safety on our coasts and ocean, improving the efficiency of maritime operations, and supporting coastal resource management.

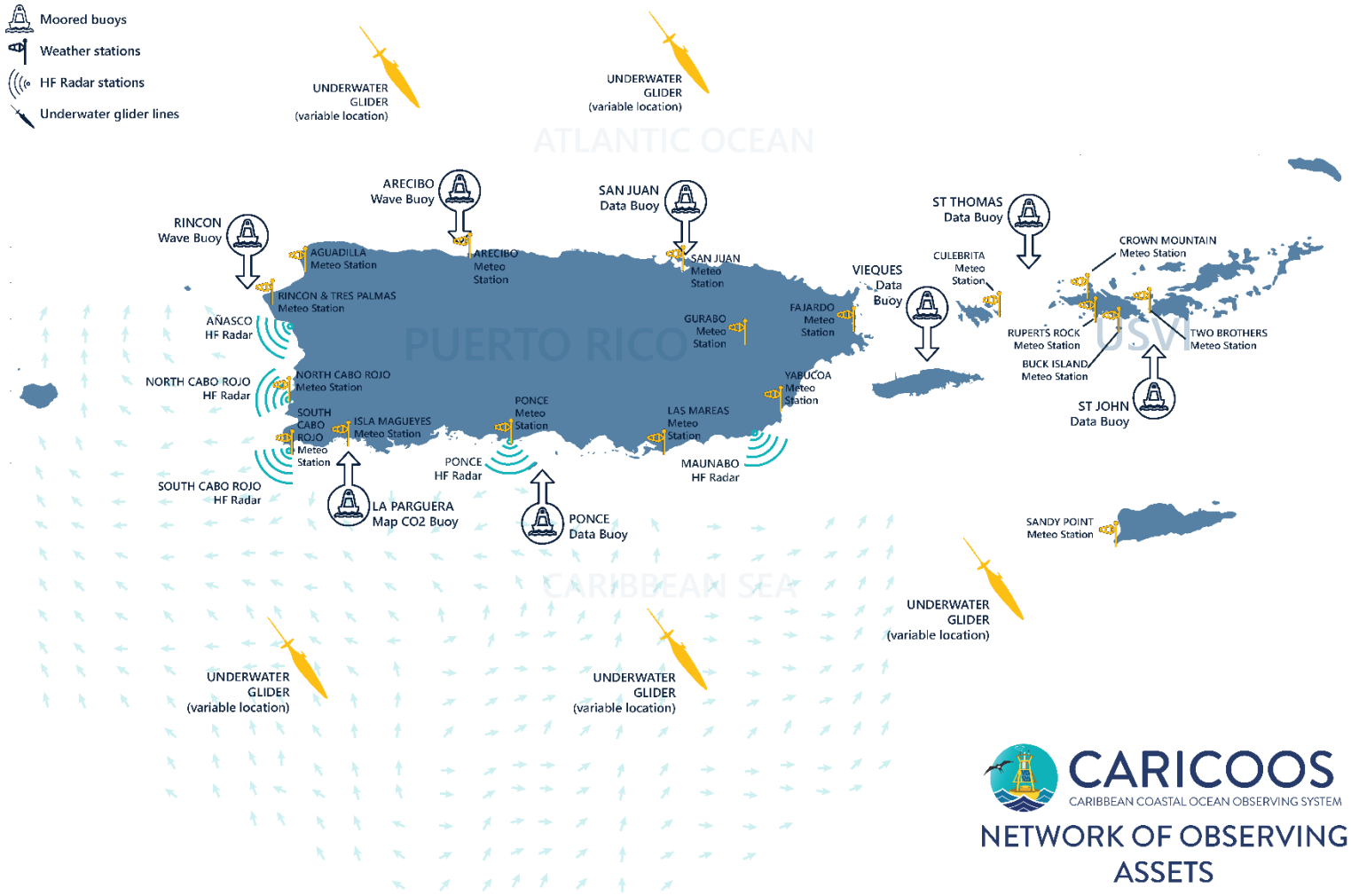
- Through a fully participatory and user-driven approach, CARICOOS aims at the following overarching goals:

  1) **Support** safe and efficient **maritime operations**;

  2) **Minimize impact** from coastal hazards;

  3) **Support** the effective **management of coastal living resources**; and

  4) **Monitor climate variability**

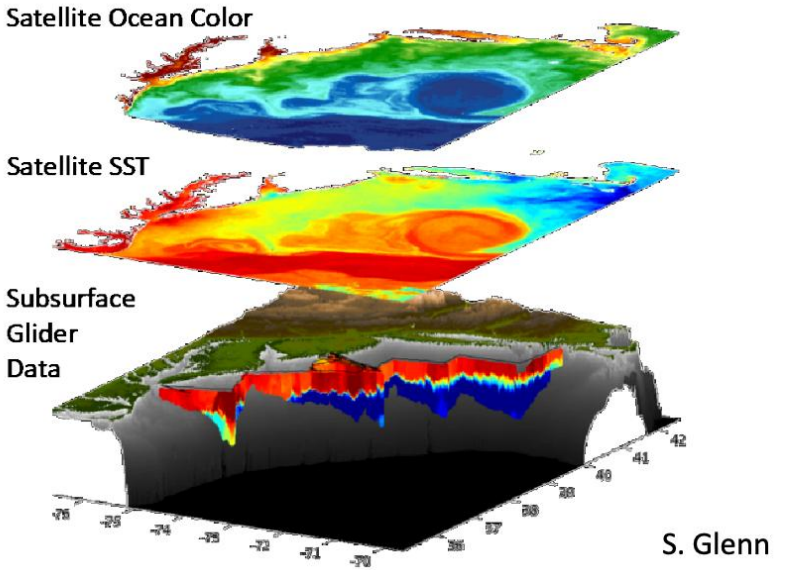


CARICOOS
CARIBBEAN COASTAL OCEAN OBSERVING SYSTEM
NETWORK OF OBSERVING ASSETS

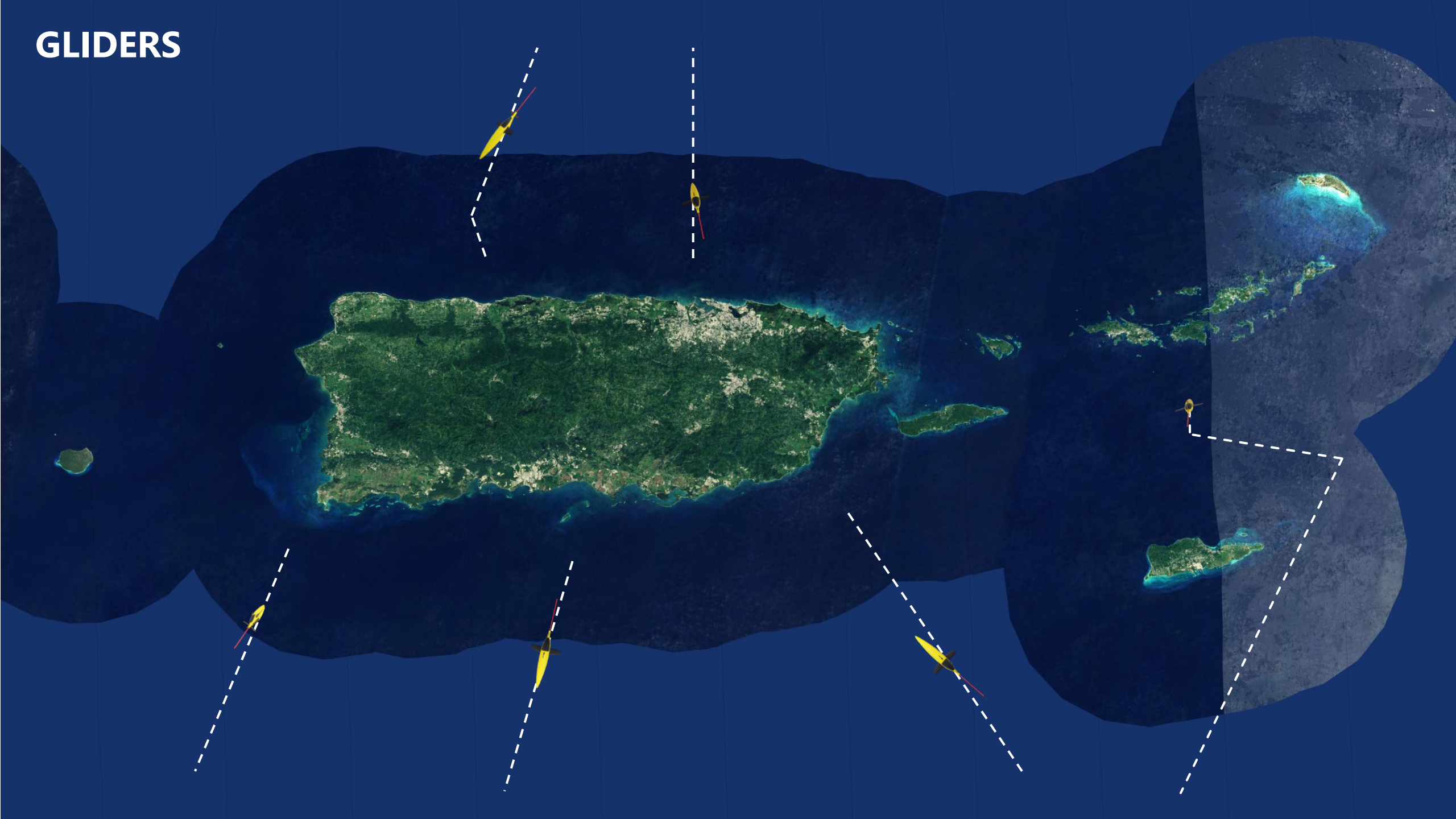
NOAA IOOS RESEARCH
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

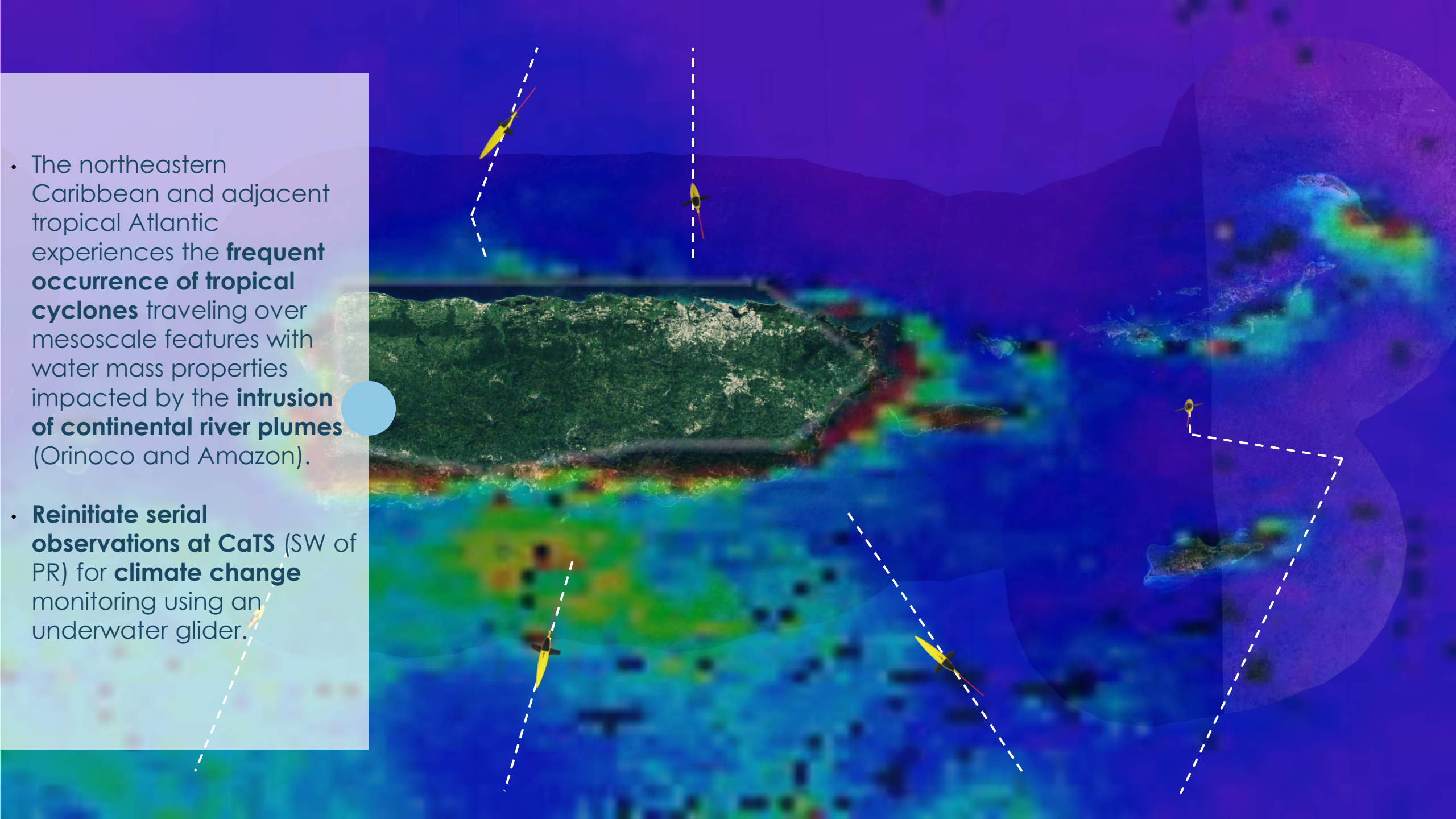
UNDERWATER GLIDERS

- The autonomous underwater vehicles (known as gliders) dive to depths of up to 1,000 meters and travel hundreds of kilometers across the Atlantic Ocean and the Caribbean Sea to monitor ocean temperature, salinity, and current, among other ocean parameters.



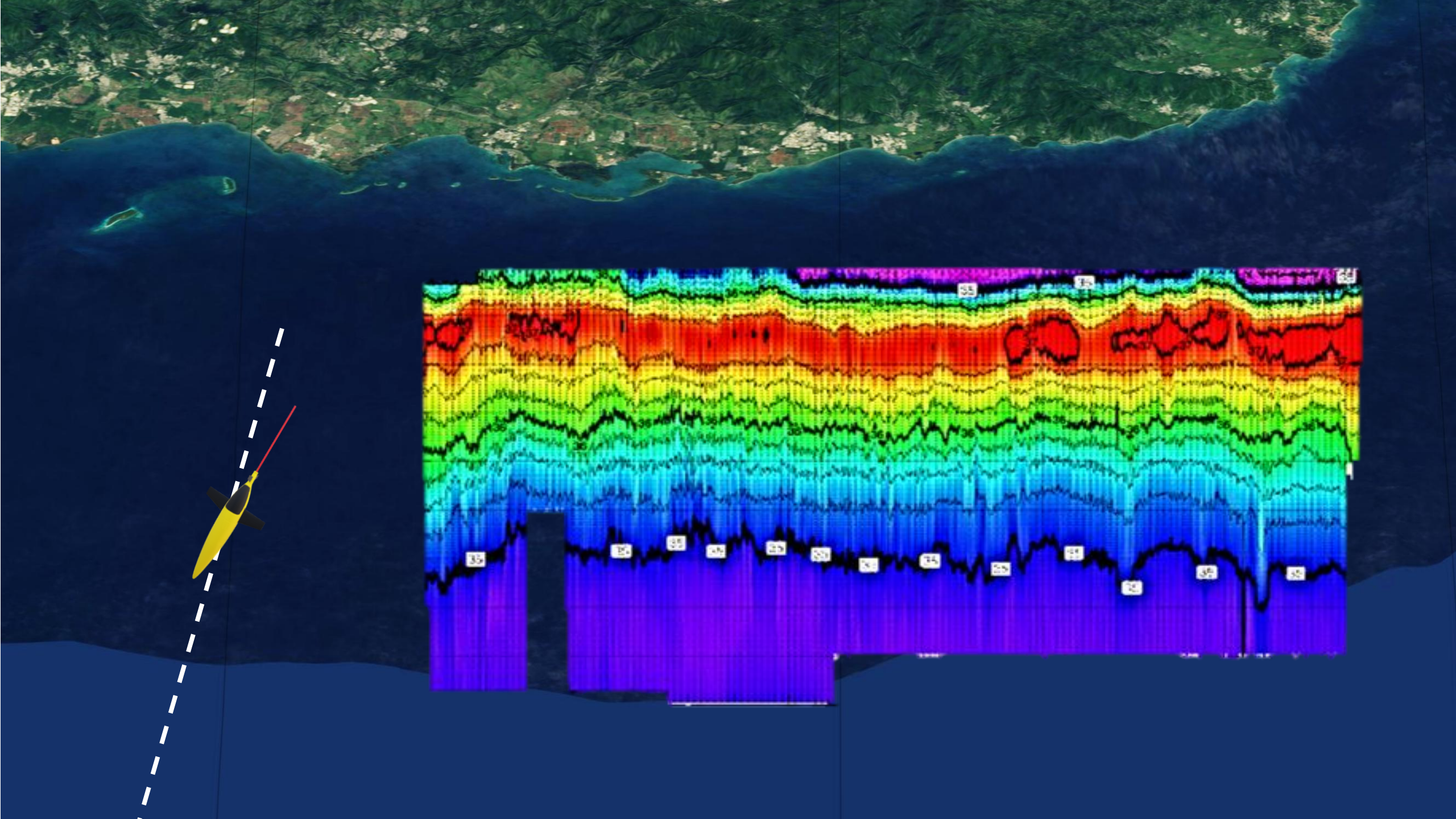
GLIDERS



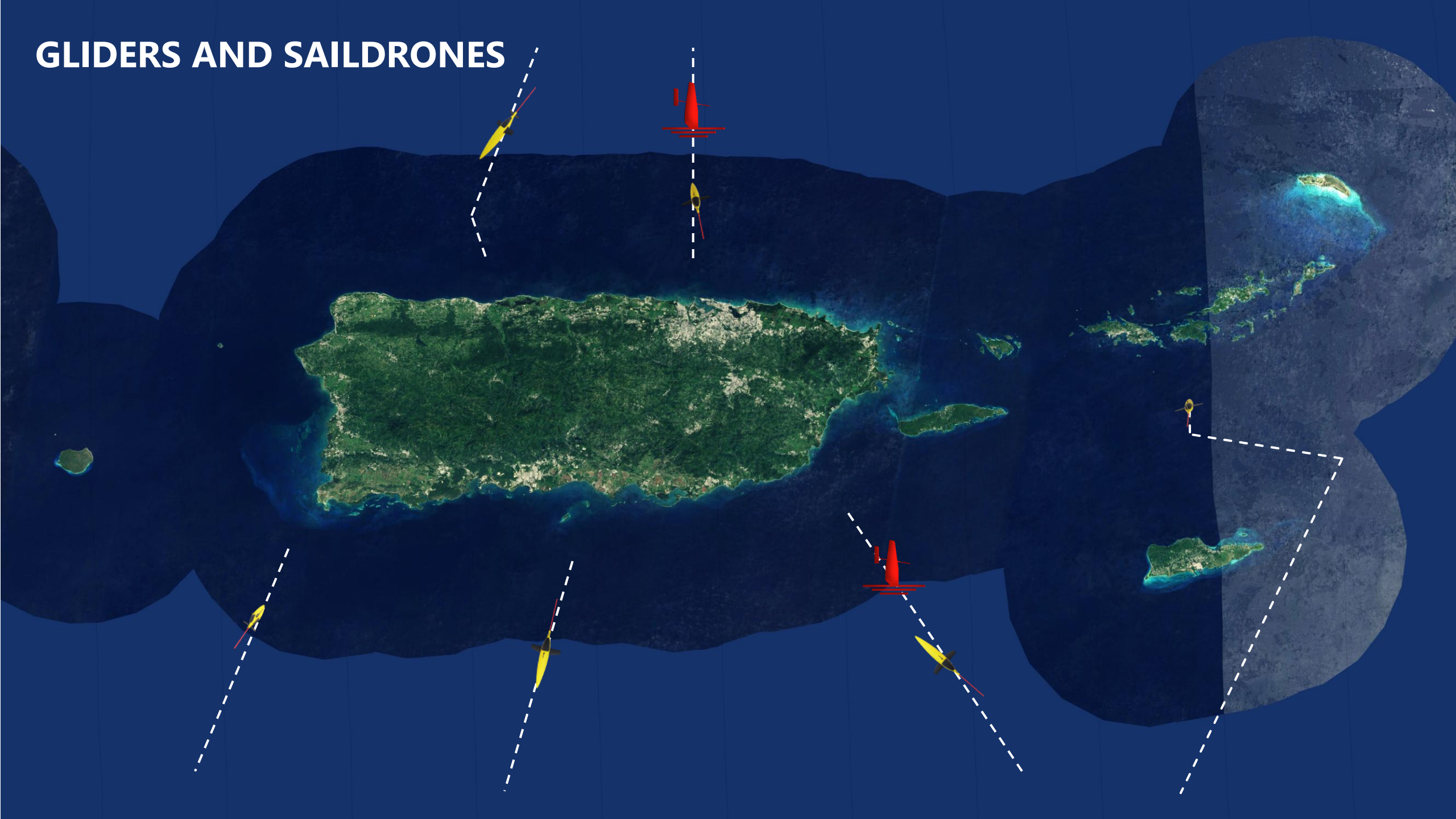


- The northeastern Caribbean and adjacent tropical Atlantic experiences the **frequent occurrence of tropical cyclones** traveling over mesoscale features with water mass properties impacted by the **intrusion of continental river plumes** (Orinoco and Amazon).

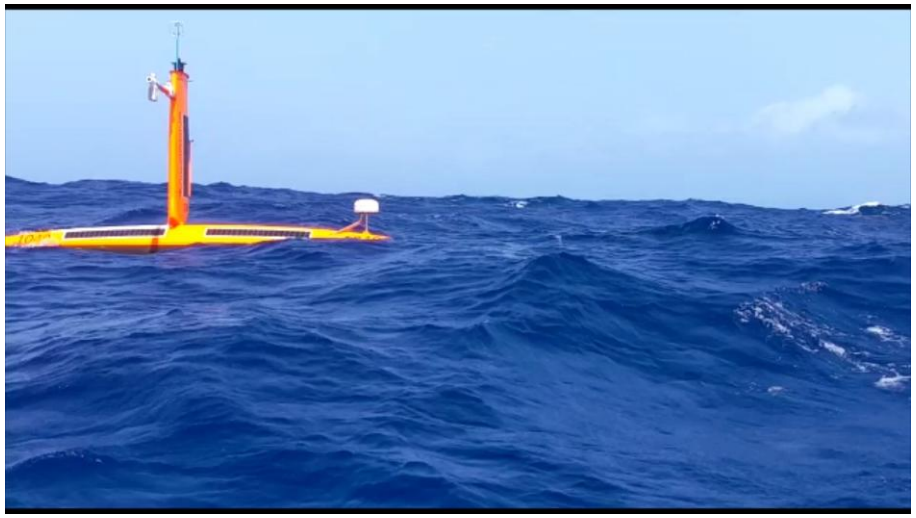
- **Reinitiate serial observations at CaTS** (SW of PR) for **climate change** monitoring using an underwater glider.

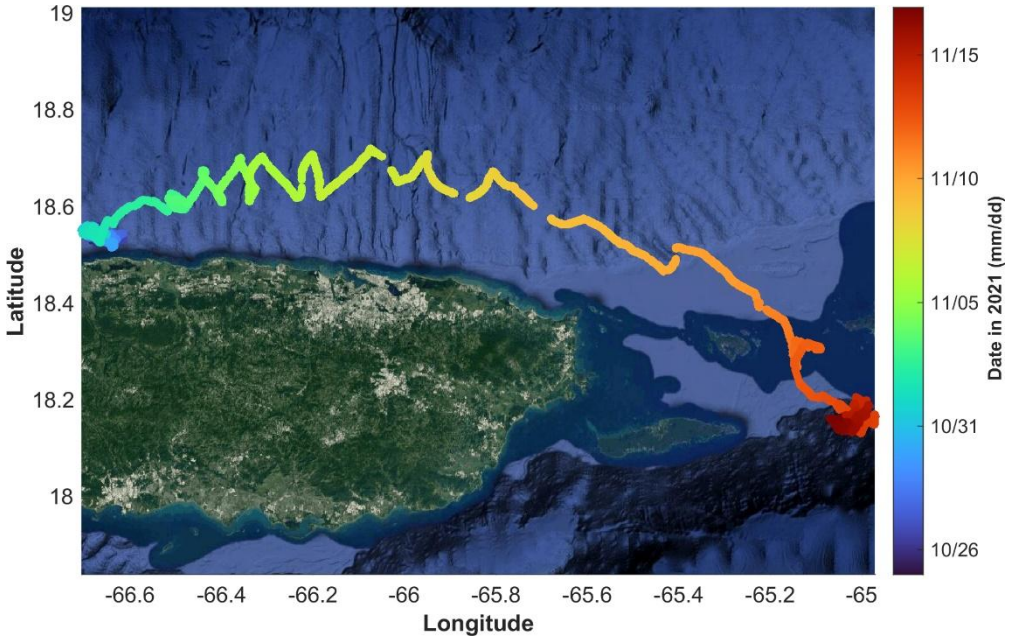


GLIDERS AND SAILDRONES

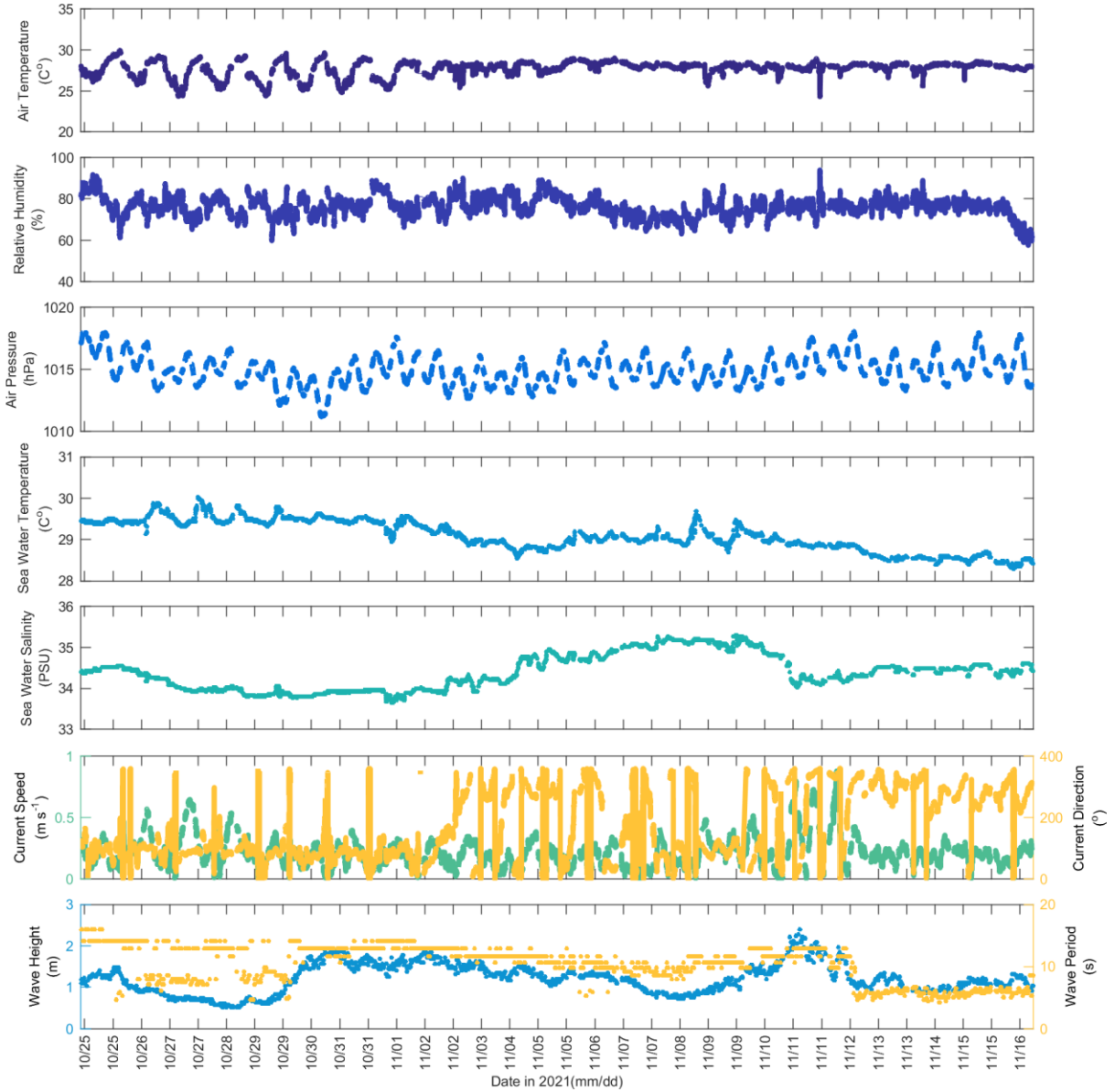


SAILDRONES





DATA



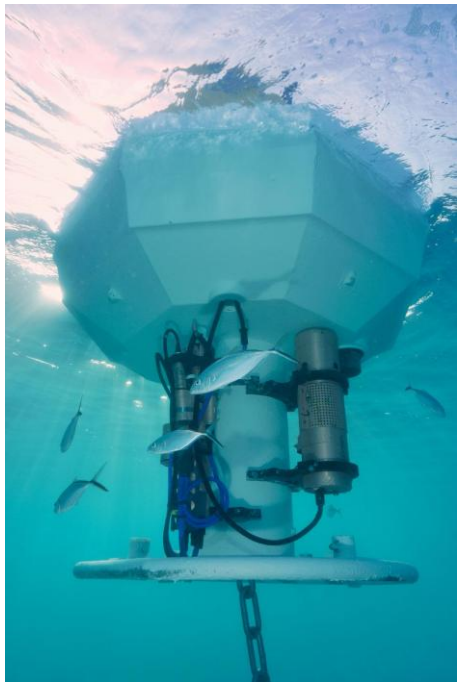
CARICOOS MAPCO$_2$ BUOY

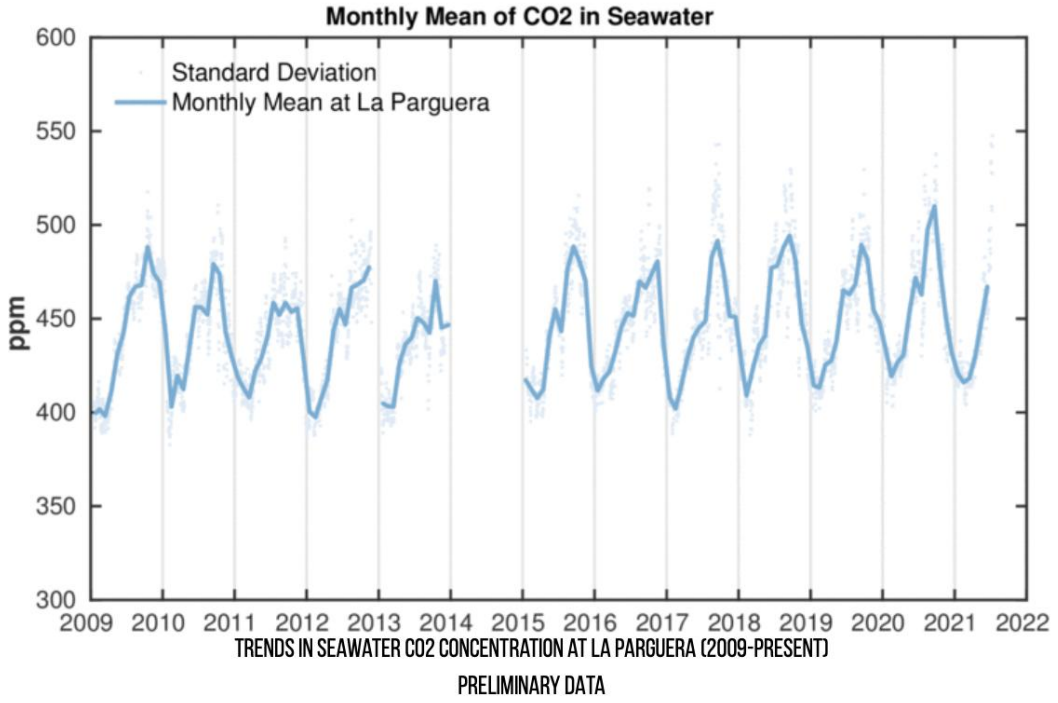
- CARICOOS will continue to provide support for the operation of the MapCO$_2$ buoy and related discrete bi-weekly water sampling/analysis at La Parguera Marine Reserve with funding from NOAA OAP.
- This effort will be paralleled by a regional assessment of dissolved and particulate carbon fluxes required for proper interpretation of MapCO$_2$ buoy/discrete water sample data.

LA PARGUERA
OA BUOY

USER-ORIENTED DATA PRODUCTS
OCEAN ACIDIFICATION

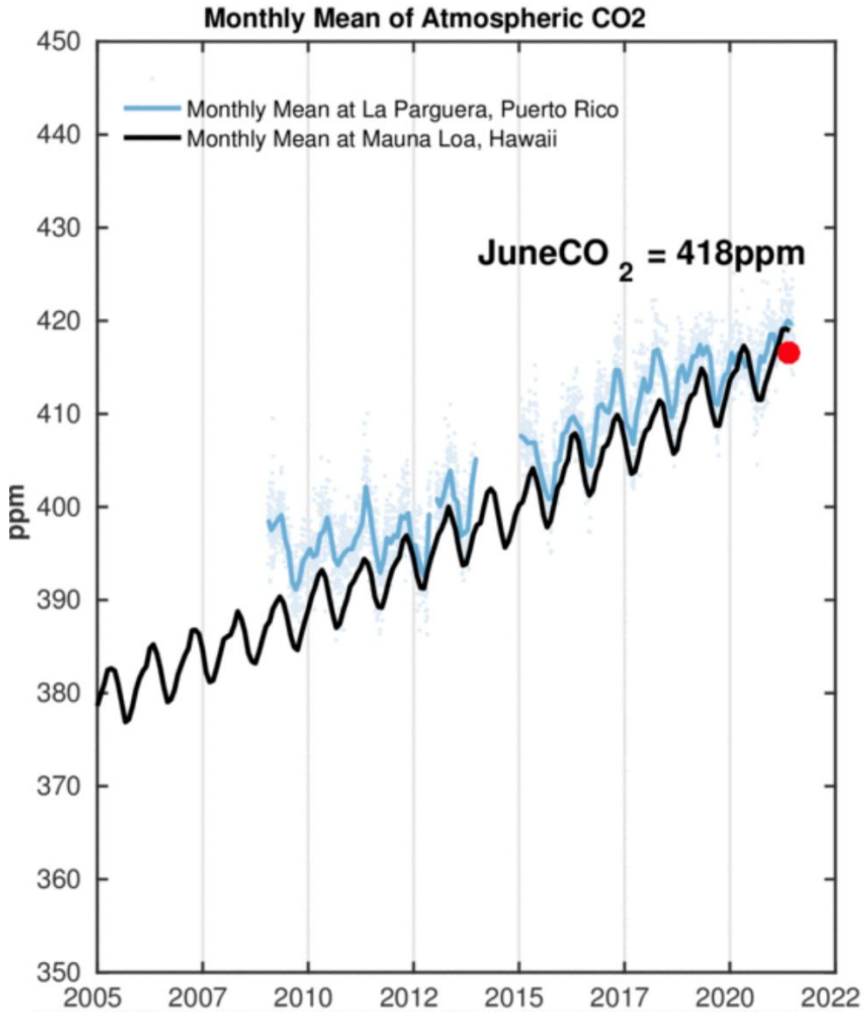
- The Cayo Enrique CO_2 buoy, one of only eleven in the entire world, measures CO_2 in the air and seawater, along with seawater temperature and salinity in the coral reef area of La Parguera, Lajas.





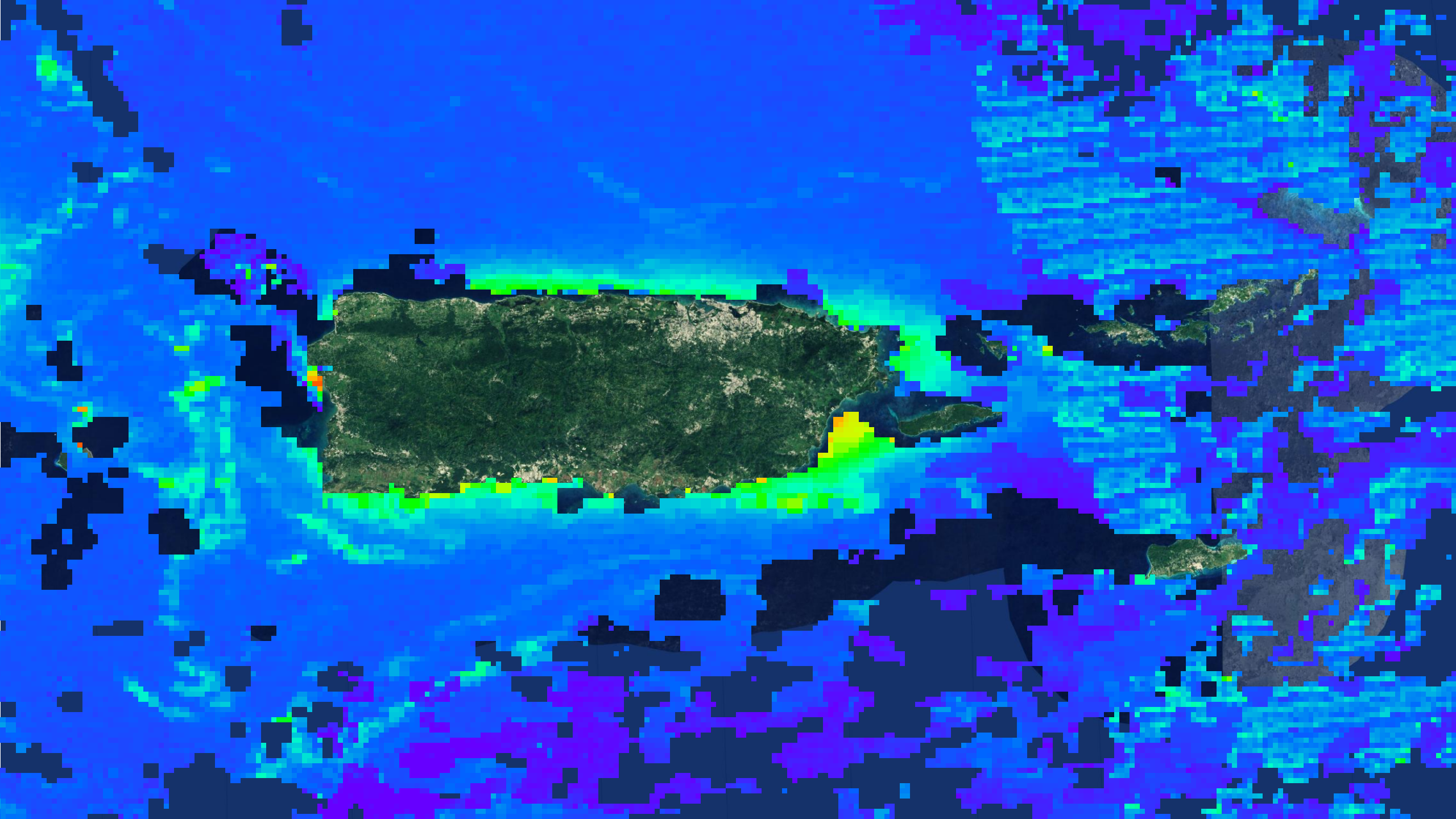
TRENDS IN SEAWATER CO2 CONCENTRATION AT LA PARGUERA (2009-PRESENT)

PRELIMINARY DATA



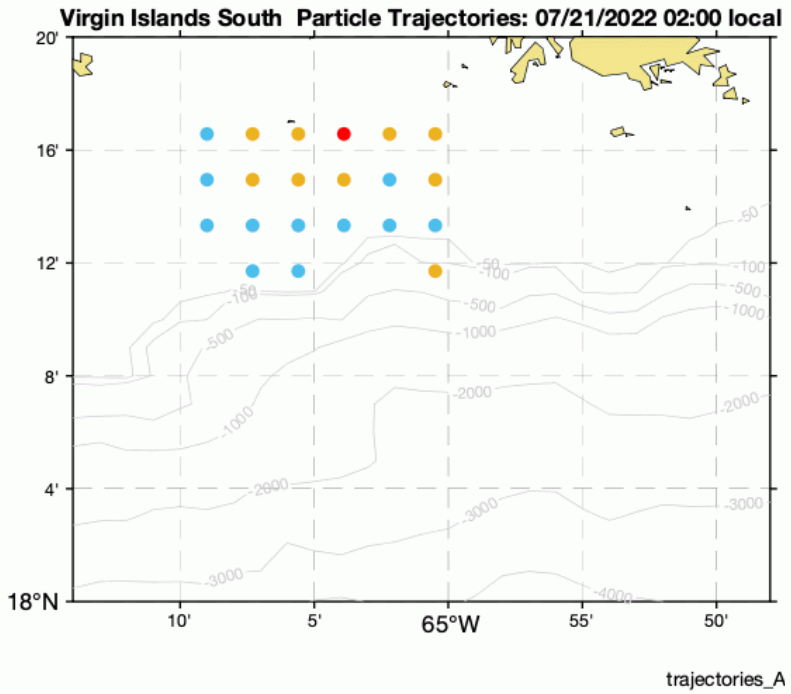
TRENDS IN ATMOSPHERIC CO2 AT LA PARGUERA (2009-PRESENT) AND AT THE MAUNA LOA OBSERVATORY, HAWAII (2005-PRESENT)

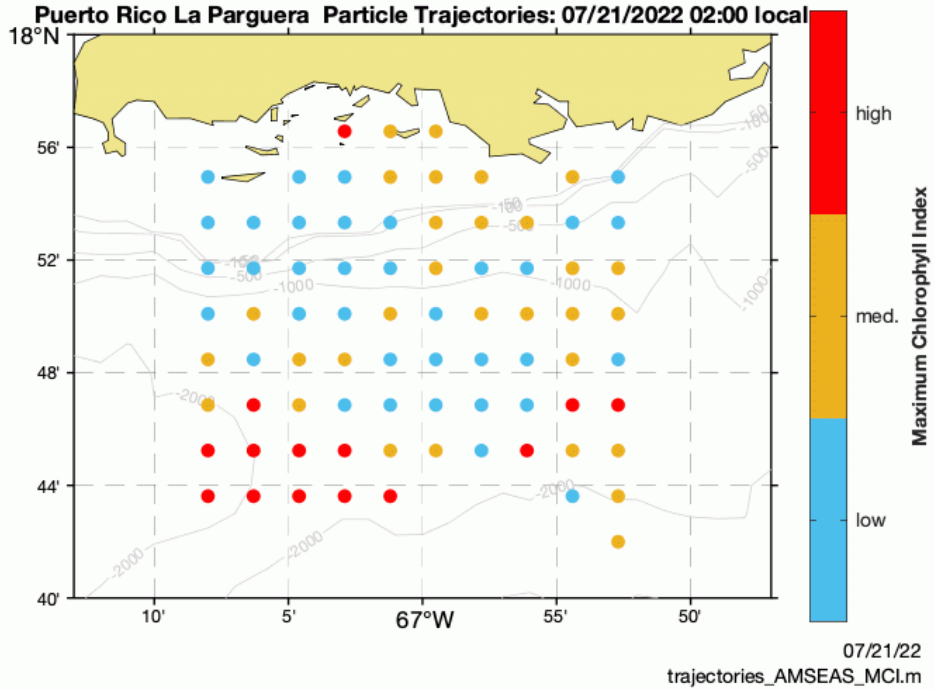
MONTHLY MEAN CO2 MOLE FRACTION DETERMINED FROM DAILY AVERAGES AND EXPRESSED AS PARTS PER MILLION (PPM).



USER-ORIENTED DATA PRODUCTS
SARGASSUM

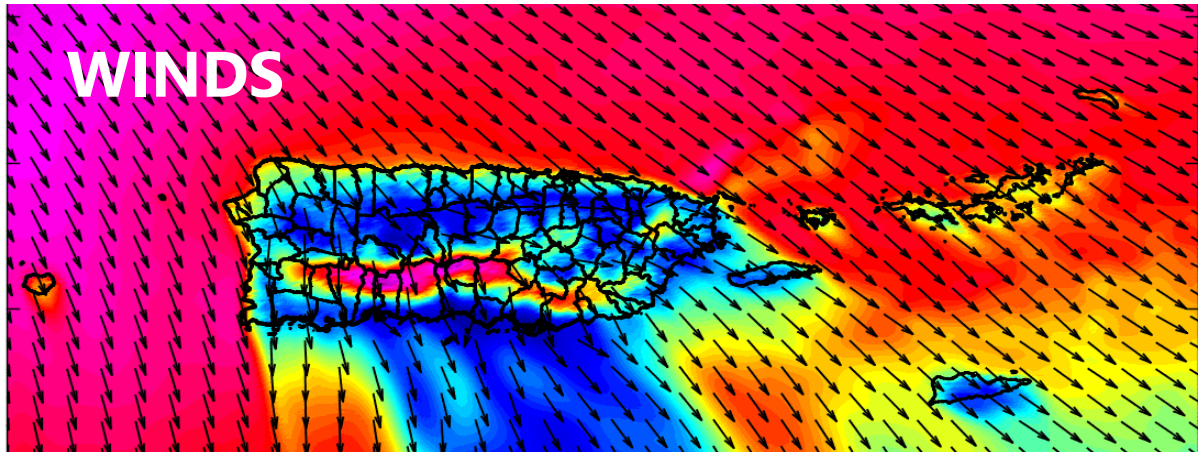
- Development and validation of Sargasso inundation forecast product using MCI imagery & CARICOOS hydrodynamic/ocean circulation model (collaboration with Rutgers University; PI: Dr. H. Roarty).

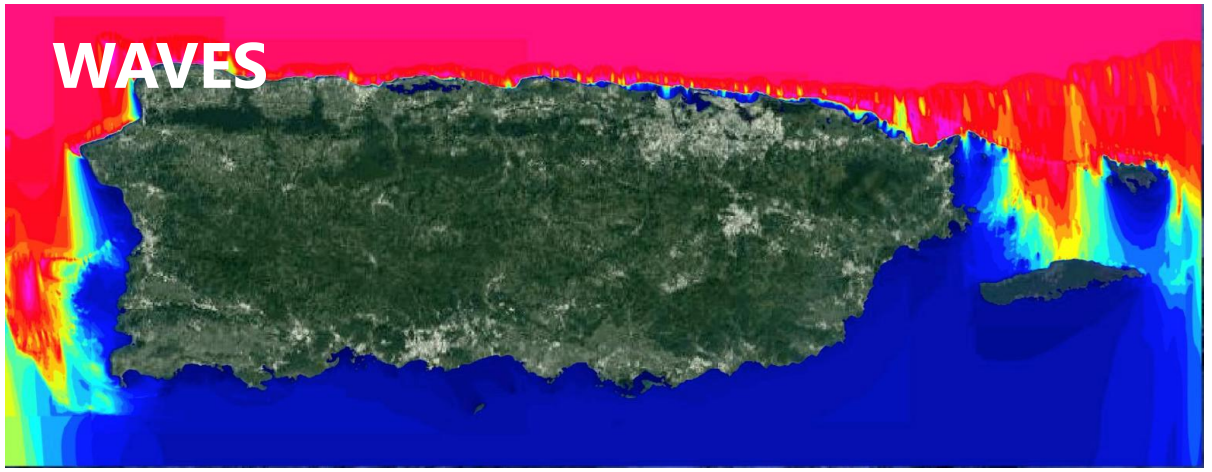


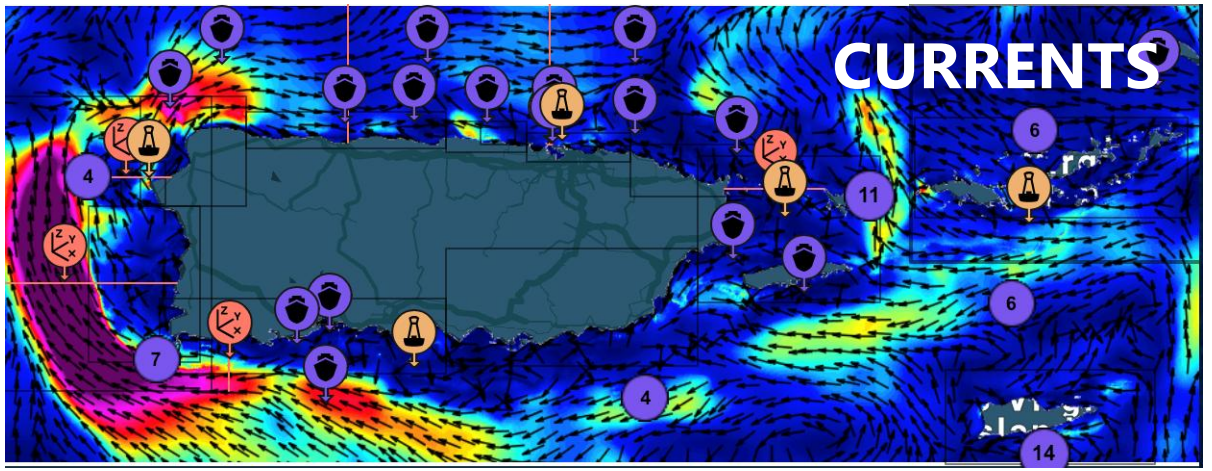


Beta Version:https://marine.rutgers.edu/~hroarty/caricoos/animations/img/PR_LaPar/Puerto_Rico_LaParguera_animation.gif

USER-ORIENTED DATA PRODUCTS FORECAST MODELS







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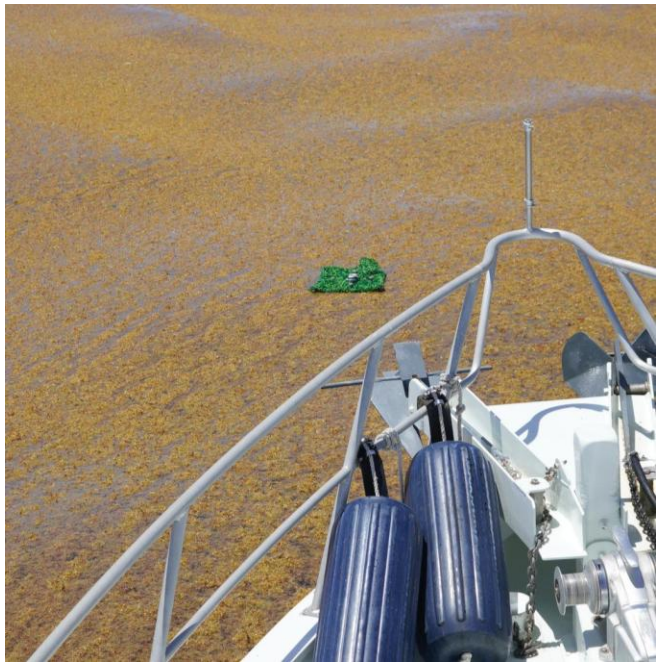
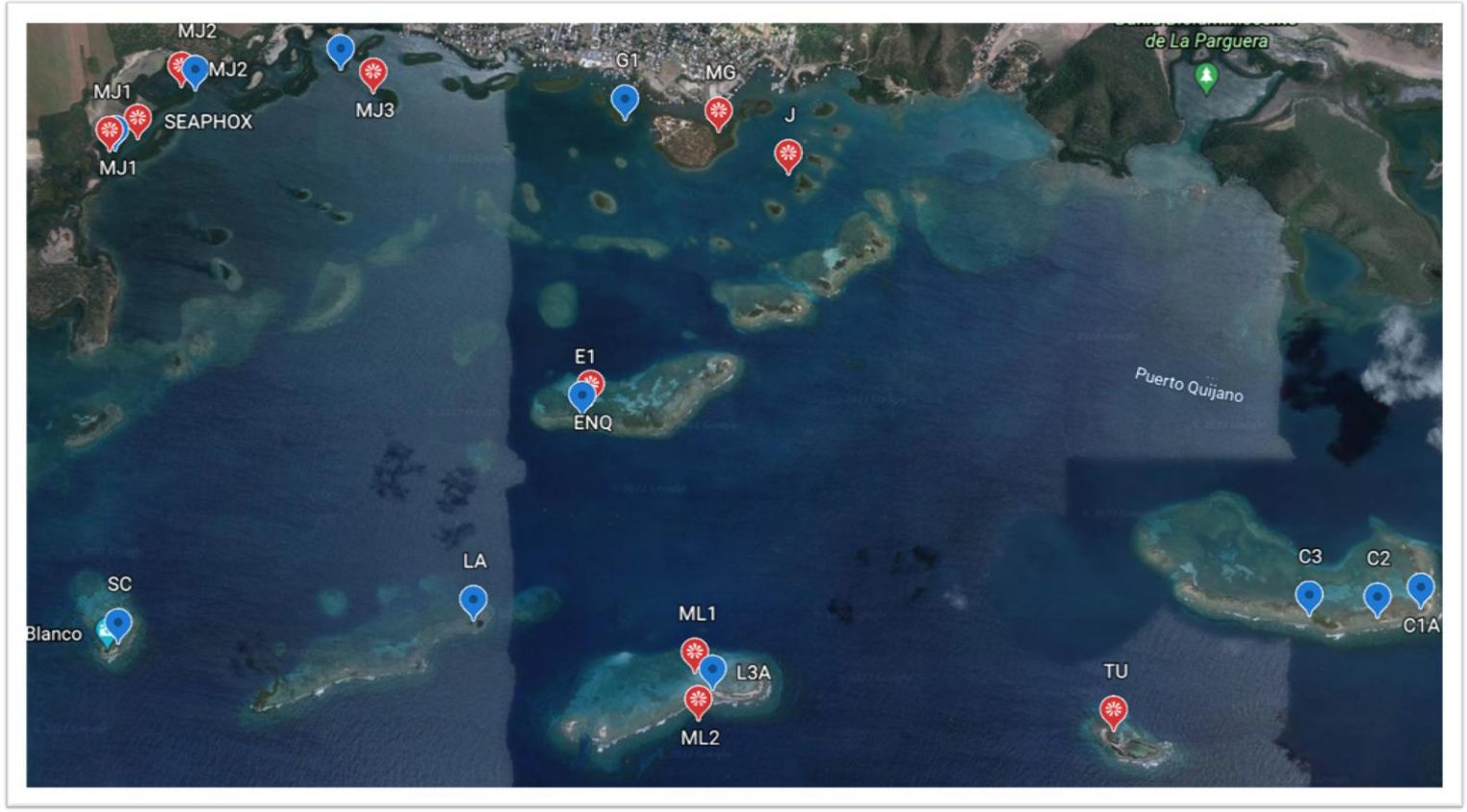


SARGASSO INUNDATION

EFFORTS TOWARDS ASSESSING AND MITIGATING IMPACTS

Weekly monitoring in La Parguera:

- Sargassum influx rate for using traps (11)
- Dissolved oxygen, pH, total alkalinity at 10 stations



SARGASSO INUNDATION

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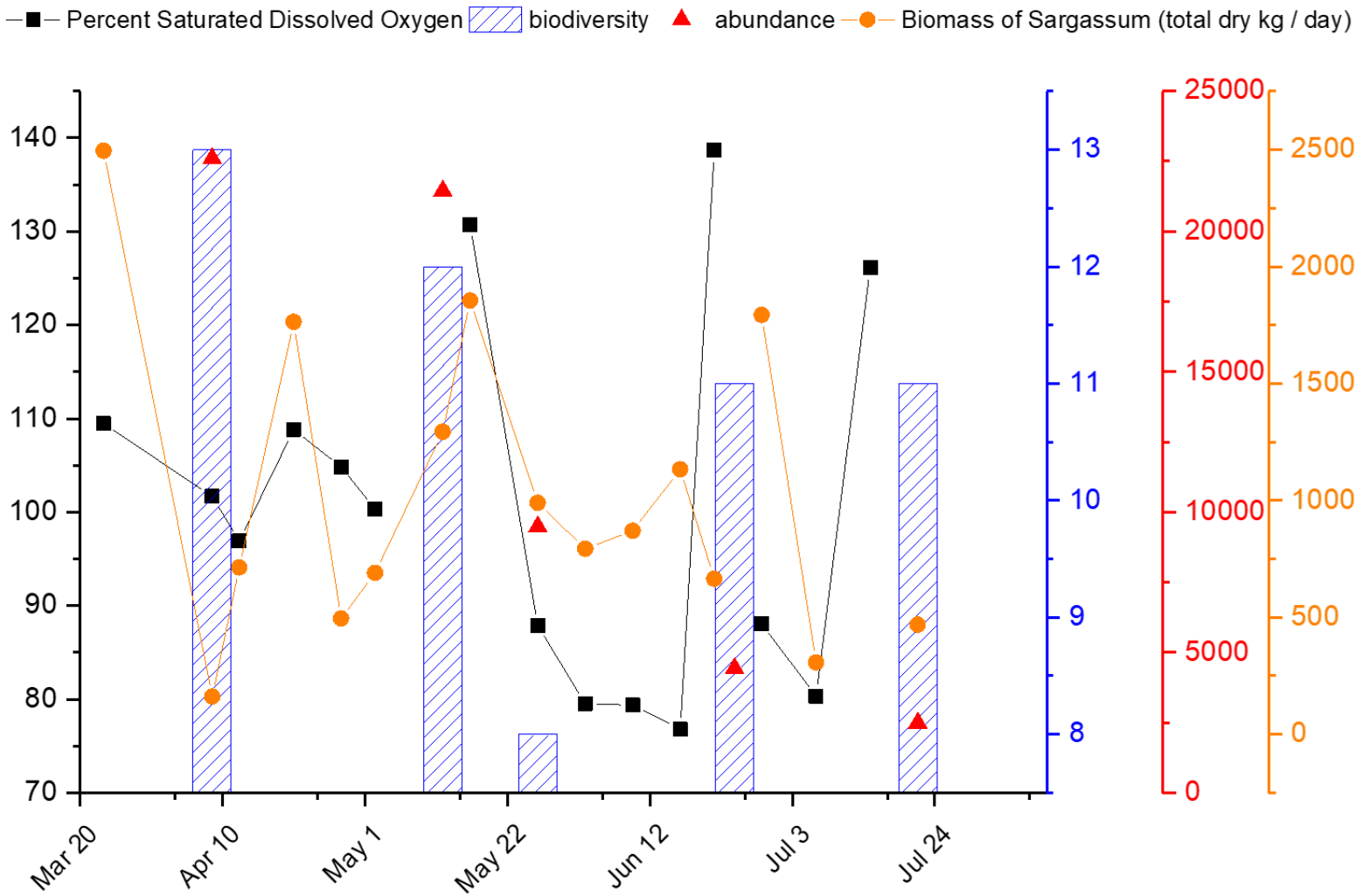


Monitoring Sargassum influx rate for La Parguera using traps and documenting hypoxia and acidification.

USER-ORIENTED DATA PRODUCTS

SATELLITE-DERIVED WATER QUALITY DATA

SOON IN THE DATA PORTAL!

WATER QUALITY VIRTUAL BUOYS

(B.Barnes & C. Hu - USF)

- Time series (2000 – present) of satellite-derived water quality data including SST, PAR, a_{CDOM}, C_a, Turbidity, and $K_d(488)$)]
- Approximately 20 virtual buoys in coastal waters of Puerto Rico and the US Virgin Islands.

Summary | SST | Chlorophyll-a | Turbidity | adg(443) | PAR | Kd(488) | Light Penetration

Station Name: CUL 01 East Puerto Rico Clickable Map

Latitude: 18.266

Longitude: -65.299

Depth in Meters: 25

Current Imagery: /cgi-bin/optics_data?roi=P_RICO&current=1

The table below shows the current conditions (most recent weekly and monthly means) at station CUL 01, derived from MODIS data. Also included are conditions for the current week and month from last year, as well as the long term means (climatologies).

Current conditions which exceed one standard deviation from the climatological mean are considered "anomalies" and are color coded. Positive chlorophyll anomalies, for example, may indicate phytoplankton bloom conditions at the station. Negative SST anomalies in winter might adversely affect several marine organisms (e.g., manatees, fish, corals, and sea turtles).

Summary Table Guide

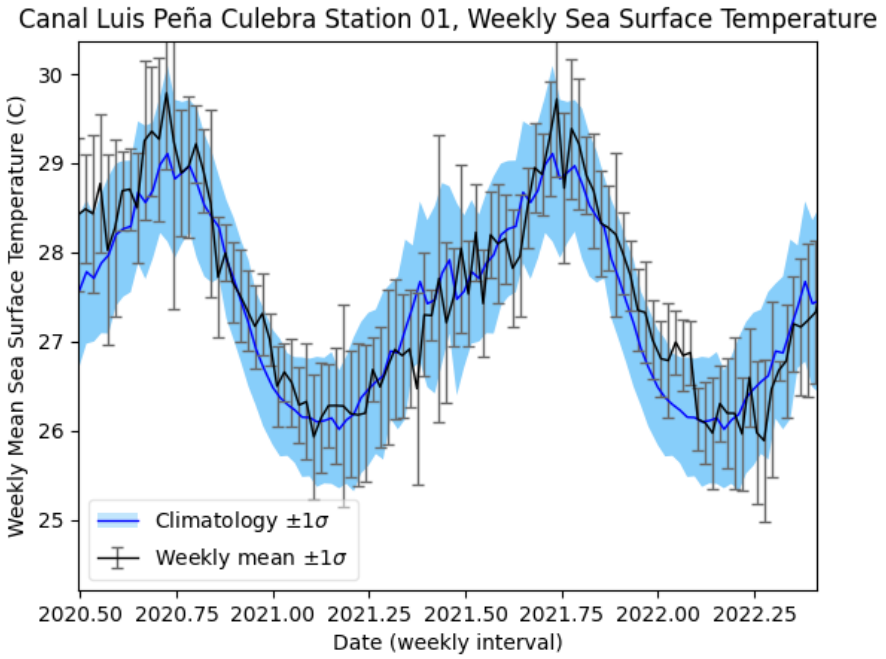
Severe Positive Anomaly	Current data ≥ 2 st. dev. above climatology
Moderate Positive Anomaly	Current data ≥ 1 st. dev. above climatology
No Anomaly	Current data within 1 st. dev. of climatology
Moderate Negative Anomaly	Current data ≤ 1 st. dev. below climatology
Severe Negative Anomaly	Current data ≤ 2 st. dev. below climatology

This table is intended to provide a visual guide to current and developing conditions at this station. However, caution must be used in interpreting anomaly data. Due to limitations of MODIS measurements, the normal climatological conditions for certain stations or time spans may not be fully characterized. As such, truly anomalous conditions may not be identified. Alternatively, detected anomalies may actually be within the climatological norm.

Current running weekly (7-day) mean in the table below is from 2022-06-22 through 2022-06-28, the current running monthly (30-day) mean is from 2022-05-30 through 2022-06-28. (YYYY-MM-DD)

Product	Weekly Mean	Monthly Mean	Weekly Last Year	Monthly Last Year	Weekly Climatology	Monthly Climatology
SST (C°)	28.46	27.75	27.54	27.41	27.49	27.64
Chlorophyll-a (mg m^{-3})	0.23	0.19	0.75	0.66	0.37	0.31
Turbidity (NTU)	0.22	0.15	0.02	0.03	0.11	0.09
$a_{dg}(443)$ (m^{-1})	0.02	0.01	0.02	0.02	0.01	0.01
PAR (Ein m^{-2} day^{-1})	59.20	59.67	59.19	59.24	59.22	59.46
$K_d(488)$ (m^{-1})	0.05	0.04	0.08	0.08	0.06	0.06
Light Penetration (%)	32.80	36.71	12.09	14.11	23.47	27.45

SEA SURFACE TEMPERATURE



USER-ORIENTED DATA PRODUCTS

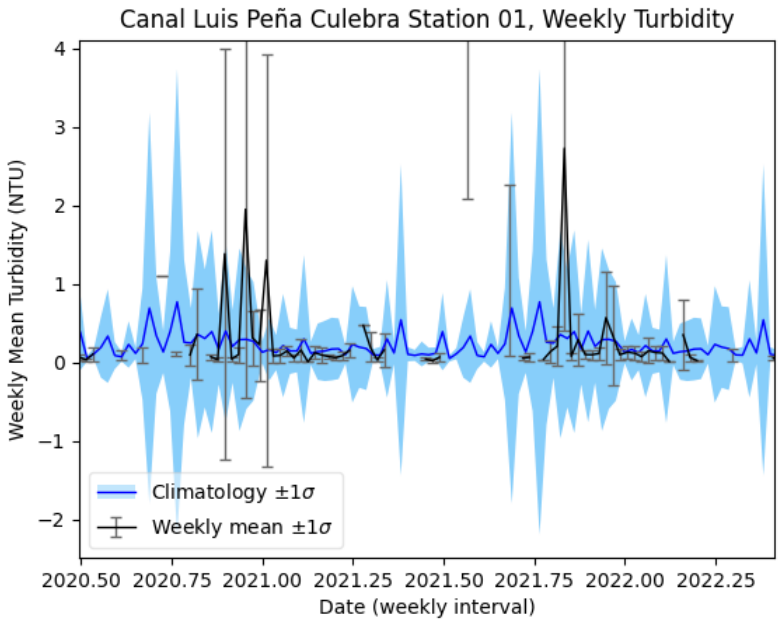
SATELLITE-DERIVED WATER QUALITY DATA

SOON IN THE DATA PORTAL!

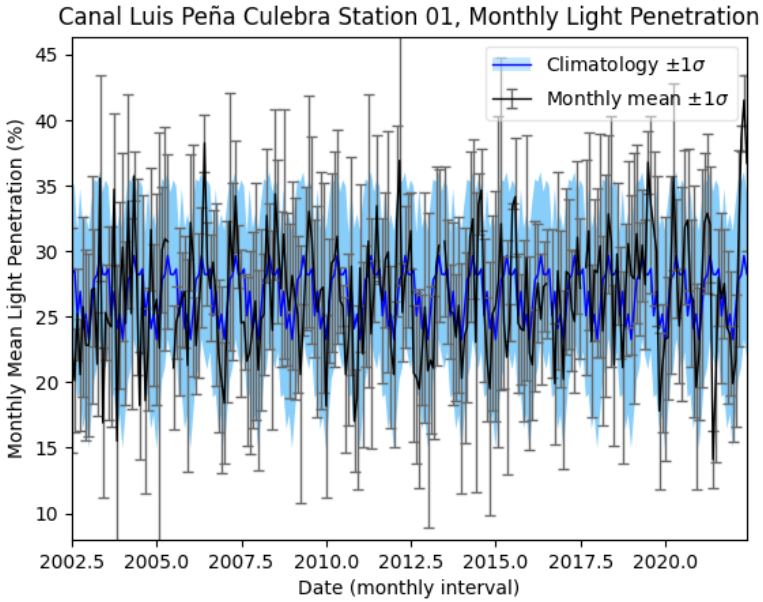
WATER QUALITY VIRTUAL BUOYS -EXAMPLES

(B.Barnes & C. Hu - USF)

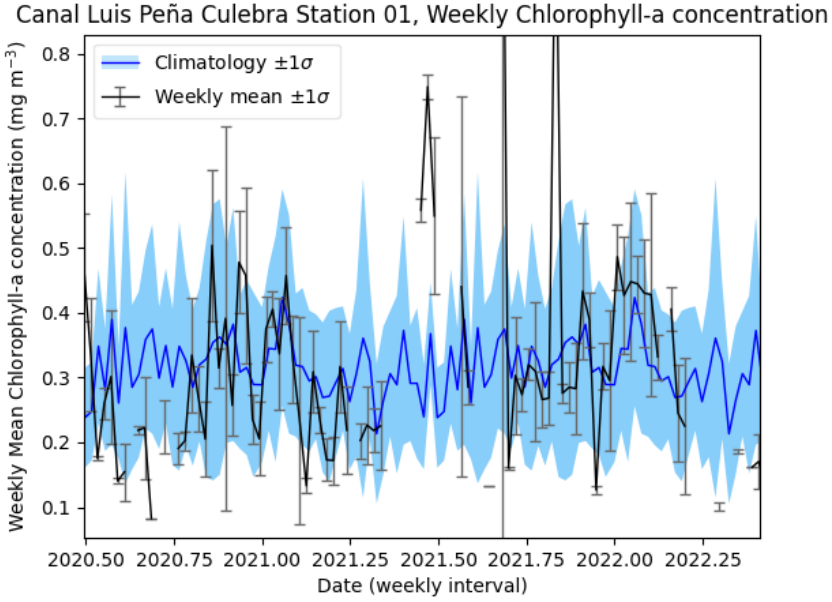
TURBIDITY



LIGHT PENETRATION



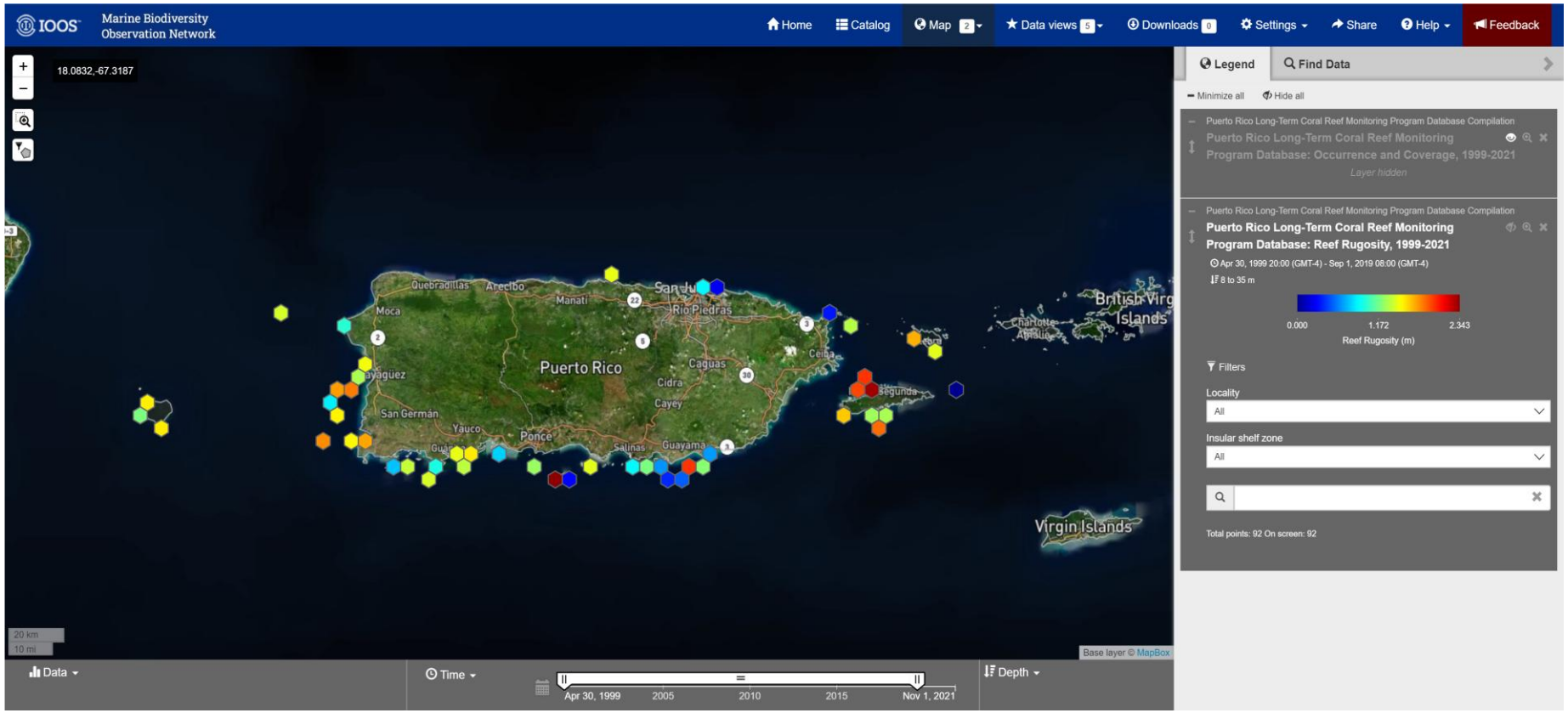
CHLOROPHYLL-a CONCENTRATION



USER-ORIENTED DATA PRODUCTS
BIODIVERSITY DATASET

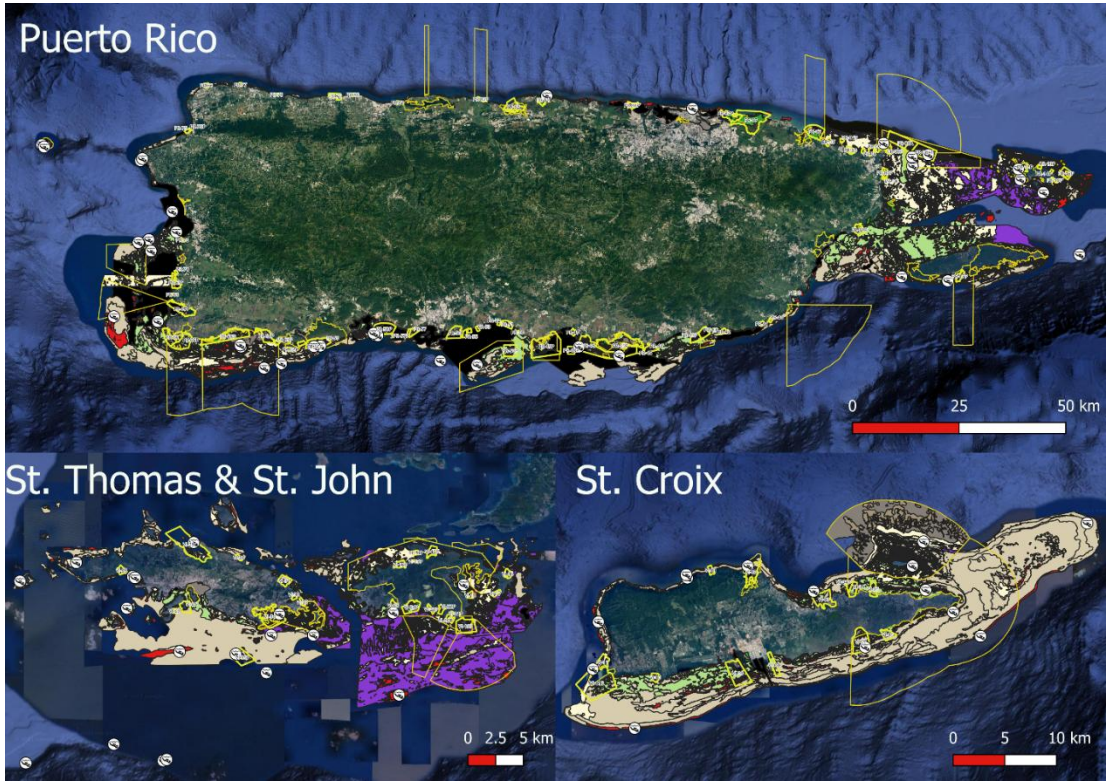
- Marine Biodiversity Observation Network (MBON)

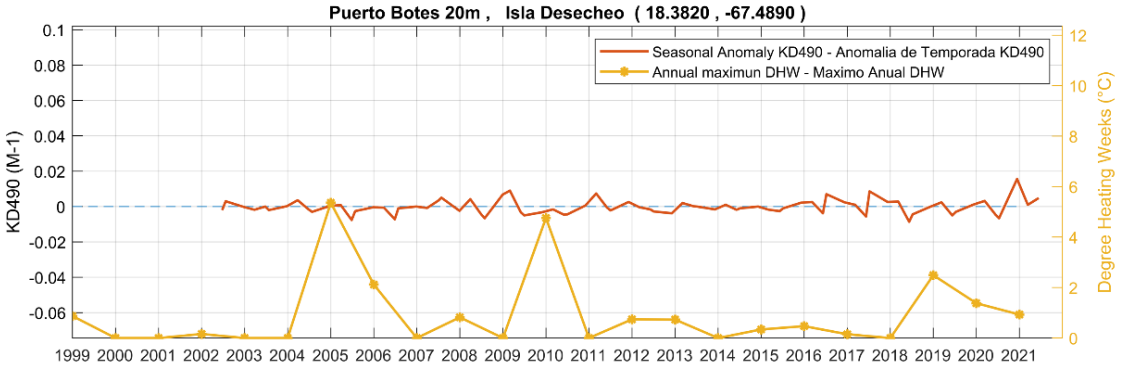
- DwC translated datasets available in OBIS:
  - Puerto Rico Coral Reef Monitoring Program (PRCRMP): 1999-2021
  - USVI Territorial Coral Reef Monitoring Program (TCRMP): 2001-2019
  - Fish Assemblages of Artificial Reefs in Puerto Rico: 2018

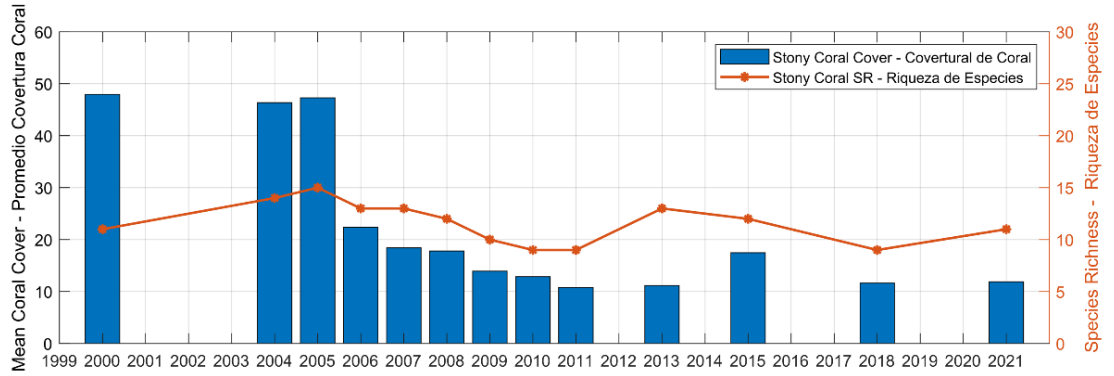


USER-ORIENTED DATA PRODUCTS
ENVIRONMENTAL AND BIODIVERSITY DATA PRODUCT

- CARICOOS aims to support decision-making in management activities by providing access to environmental and biodiversity data products in the U.S. Caribbean region; a way to assess the status and trends of natural coastal barriers.
- Datasets were extracted from NOAA habitat maps, environmental stressors (DWH and KD490) from remote sensing, and biological indicators (coral cover and species richness) from in-situ coral reef monitoring stations







RESPONSIVE STAKEHOLDER-DRIVEN OBSERVING SYSTEM

Image Source: Fact Sheet: Building Climate-Ready Fisheries and Fishing Communities
https://www.nrdc.org/resources/building-climate-ready-fisheries-fishing-communities
Illustrations by Christina Chung

- CARICOOS collects high-quality standardized observations of essential climate and ocean variables.
- High-quality data provide the basis for decisions that affect weather, marine environment, fish stocks, climate, commerce, and security.
- Maintaining healthy ecosystems and promoting safe and efficient marine operations requires knowledge of the ocean environment. Gliders, saildrones, and autonomous technologies for ocean observations provide opportunities to measure and monitor the ocean conditions in a manner that minimizes competition for ship time and provides a continuous, three-dimensional, near real-time representation of the ocean.

CARICOOS

THANK YOU!