



Caribbean/Gulf of Mexico Node
Physical Oceanography Division
Ocean Chemistry and Ecosystems Division

MCI 1-day: AOML Daily MCI 2021-05-02 12:00
Copernicus Keep netcdf thredds

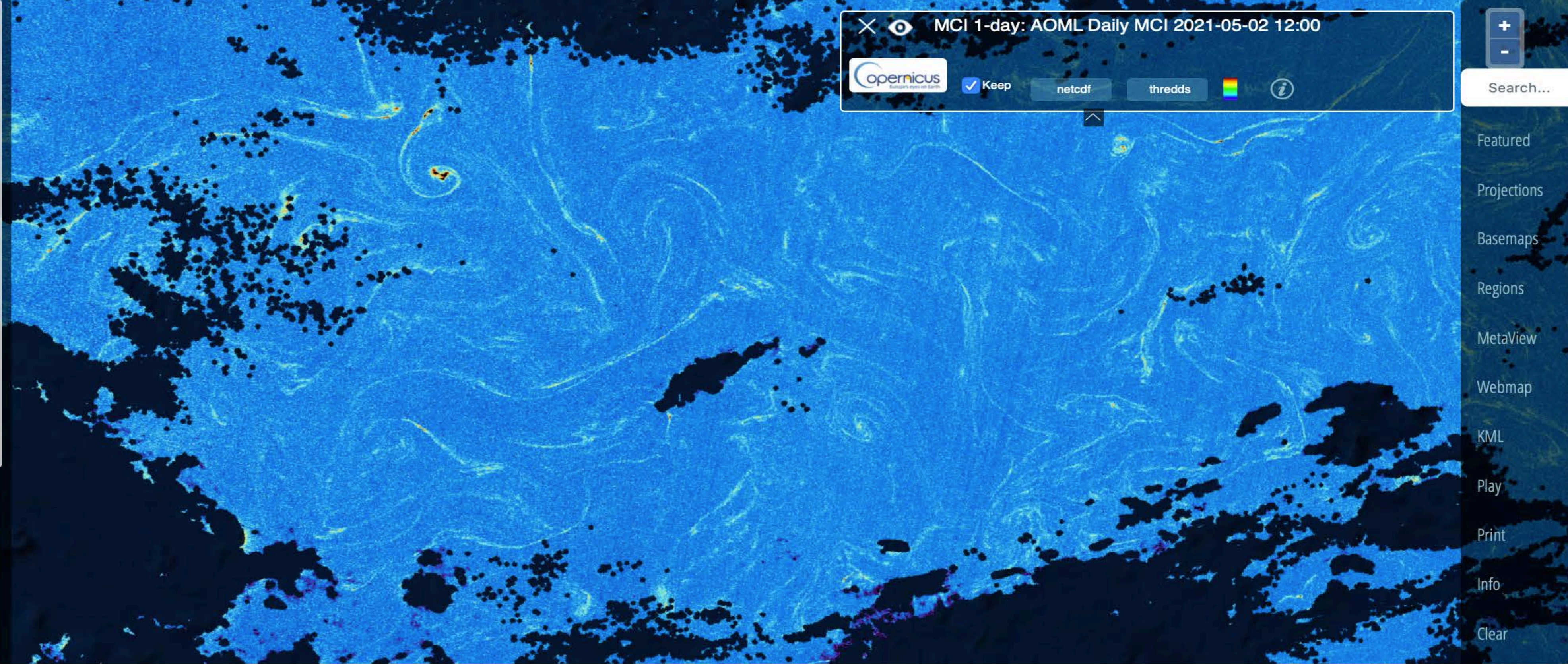
Search...

Satellite

- Regional Sea Surface Temperature >
- Global Sea Surface Temperature >
- Ocean Color - AOML >
- Ocean Color - CoastWatch >
- Ocean Color Tile Server - NOAA >
- GOES True Color >
- Sargassum >

MCI 1-day

none
 AOML Daily MCI

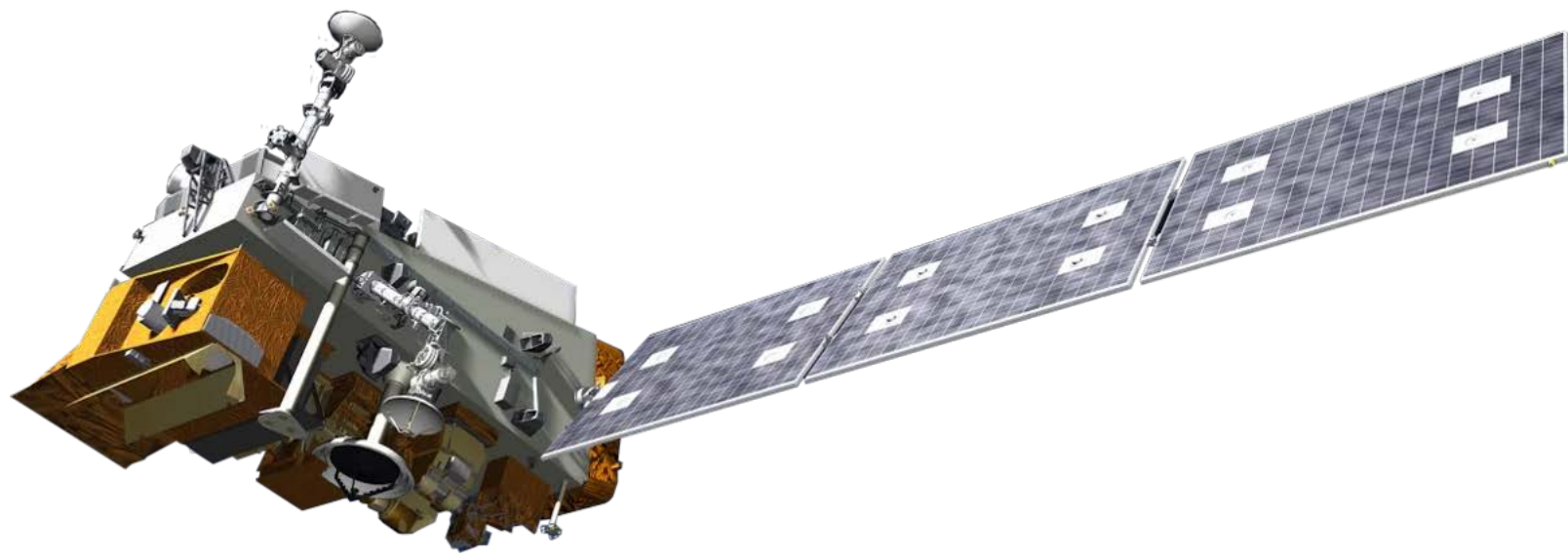


Featured
Projections
Basemaps
Regions
MetaView
Webmap
KML
Play
Print
Info
Clear

Caribbean and Gulf of Mexico Coast Atlantic Ocean Watch

Satellite Tracking of Sargassum in the Atlantic, Caribbean and Gulf of Mexico

Joaquin Trinanes Op. Manager, NOAA/AOML

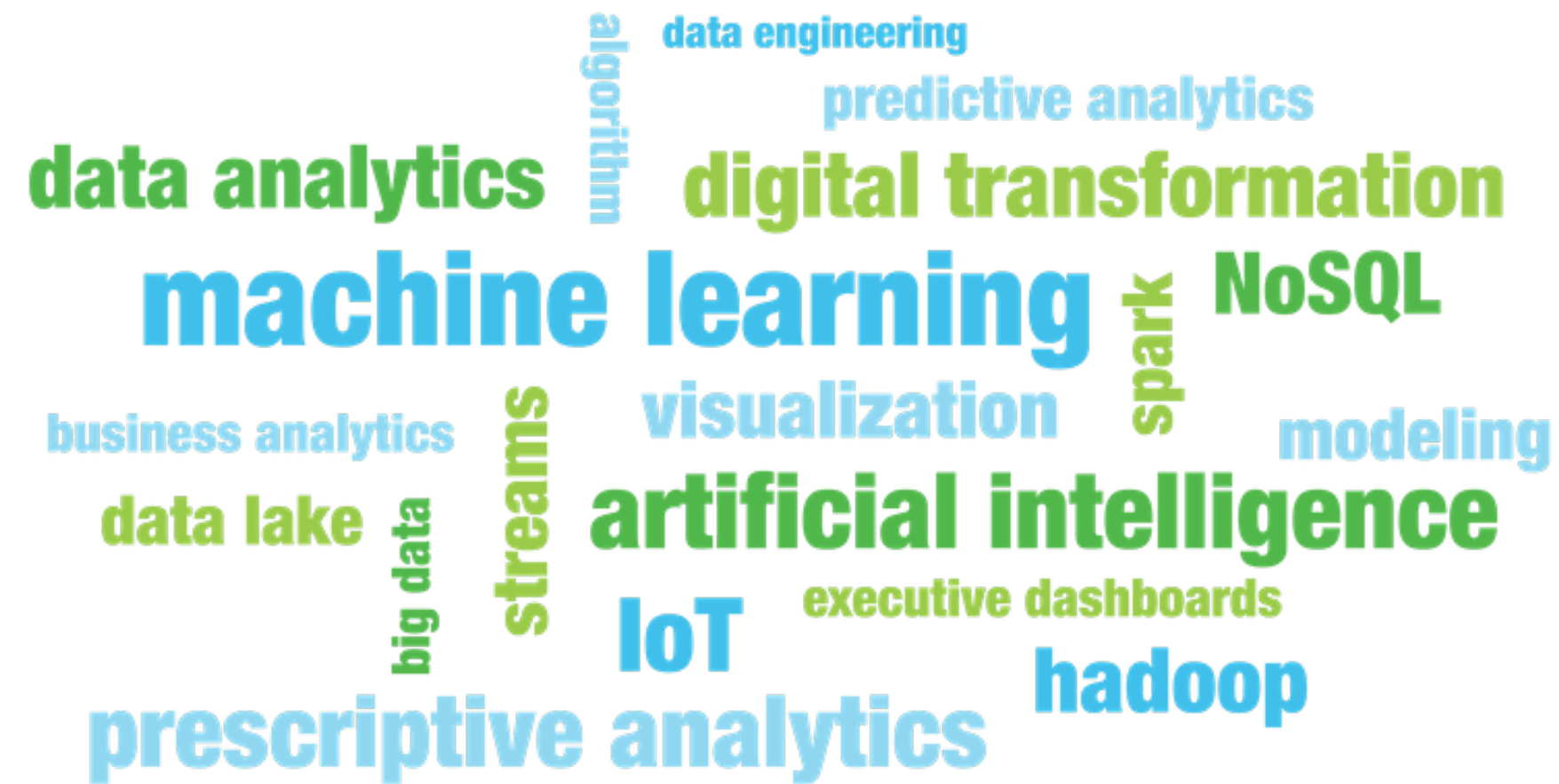


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- 01 CW/OW nodes at AOML
- 02 Applications. Unique Datasets
- 03 *Sargassum* products
- 04 Beyond satellite data
- 05 Data discovery, distribution, delivery
- 06 Current work

Partners:

- NOAA (Gustavo Goni, Rick Lumpkin, Veronica Lance, Emily Smail)
- USF (Chuanmin Hu, Mengqiu Wang)
- UM (Josefina Olascoaga, Javier Beron-Vera, Philippe Miron)
- LGL Ecological Research Associates (Nathan Putman)
- FIU (Lowell Andrew Iporac)
- CARICOOS (Julio Morell)



01 CW/OW nodes at AOML

Mission statement

NOAA CoastWatch/OceanWatch provides easy access for everyone to global and regional satellite data products for use in understanding, managing and protecting ocean and coastal resources and for assessing impacts of environmental change in ecosystems, weather, and climate

Managed by NOAA National Environmental Satellite Data and Information Service (NOAA/NESDIS)

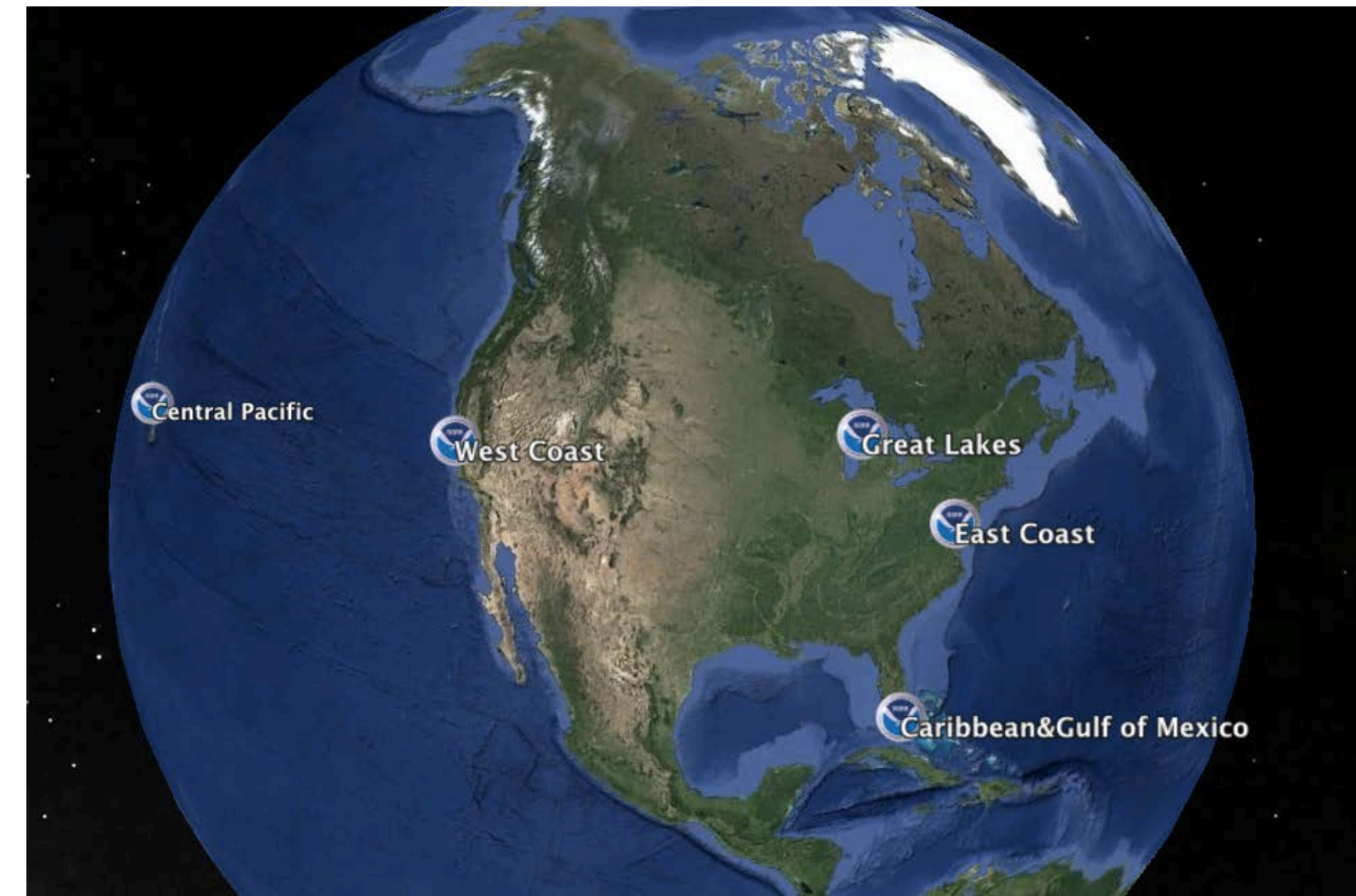
Two components: Central Operations and Regional Nodes.

Central Operations, operated within NOAA NESDIS, coordinates the processing, delivery, quality control and storage of data products.

Other NOAA line offices participate in the NOAA CoastWatch Program by hosting equipment and personnel.

Since 1999, AOML hosts the CW Caribbean and Gulf of Mexico regional node.

Main purpose: to serve NRT satellite-derived products for the Caribbean Sea and Gulf of Mexico



01 CW/OW nodes at AOML

OceanWatch is an extension of CW, focusing on expanded geographical boundaries, open ocean datasets and global coverage.

AOML hosts one of the 2 OW nodes: Atlantic OceanWatch

Data sharing and product development and distribution

Provide integrated data and tools to scientists and other stakeholders to better understand the physical, biological, and chemical ocean processes.

Scientific quality products and near-real time datasets needed to support climate, ocean, ecosystems, and weather studies.

Tools developed and implemented to deliver interoperable products through a service-oriented architecture, using international recognized standards for data and metadata.

Both CoastWatch and OceanWatch efforts run in parallel, with the latter focusing on a larger region of interest, primarily the Atlantic basin and global oceans.



01 CW/OW nodes at AOML

NOAA's Atlantic Oceanographic and Meteorological Laboratory

Hurricane, Climate, Coastal and Ocean Research



Advancing
Environmental
Modeling



Understanding the
Global Carbon Cycle



Improving Hurricane
Forecasts



Understanding the
Ocean's Role in
Climate & Weather



Maintaining Ocean
Observing Systems

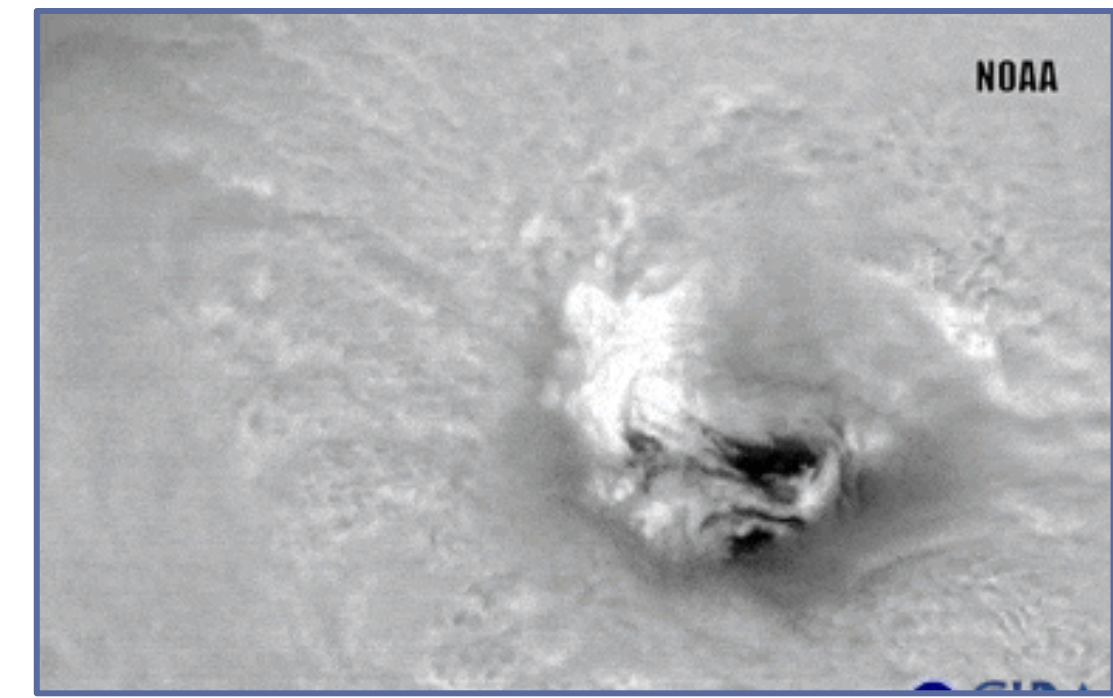


Identifying Solutions
for Coastal
Ecosystems

AOML is organized in 3 research divisions: Physical Oceanography (PhOD), Ocean Chemistry & Ecosystems (OCED) and Hurricane Research (HRD).



01 CW/OW nodes at AOML



Advantages

Synoptic view

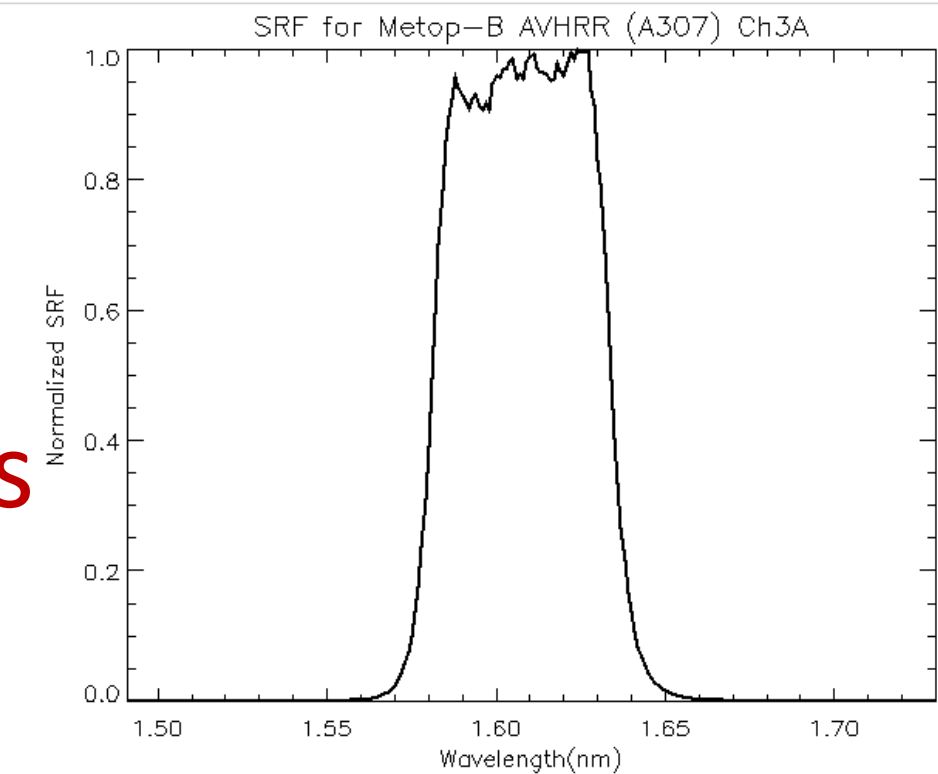
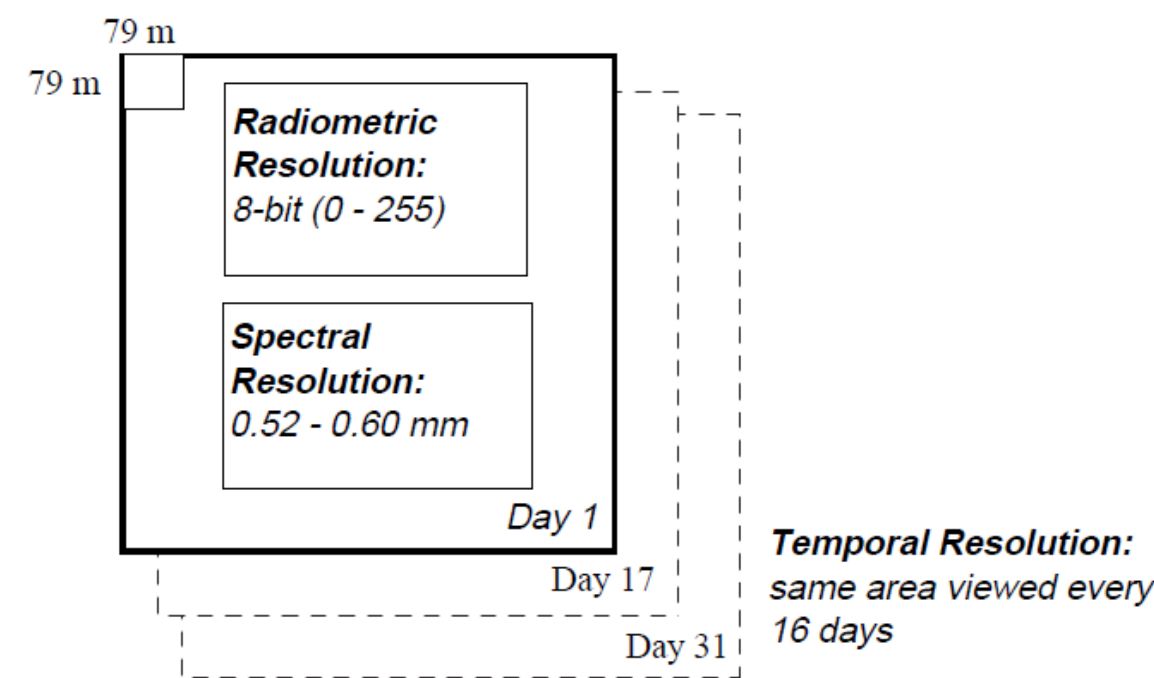
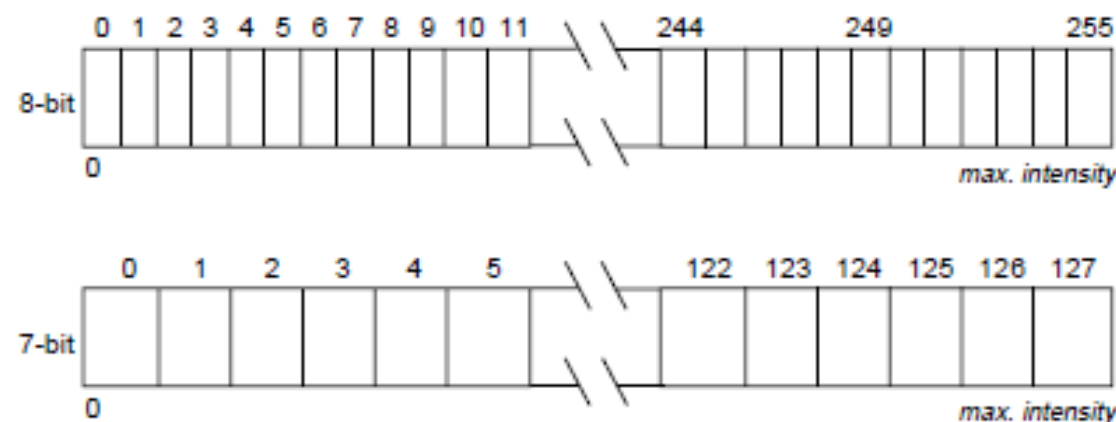
Short revisit times

Integration with GIS

Multispectral

Operational data availability

Different orbits, scales and resolutions



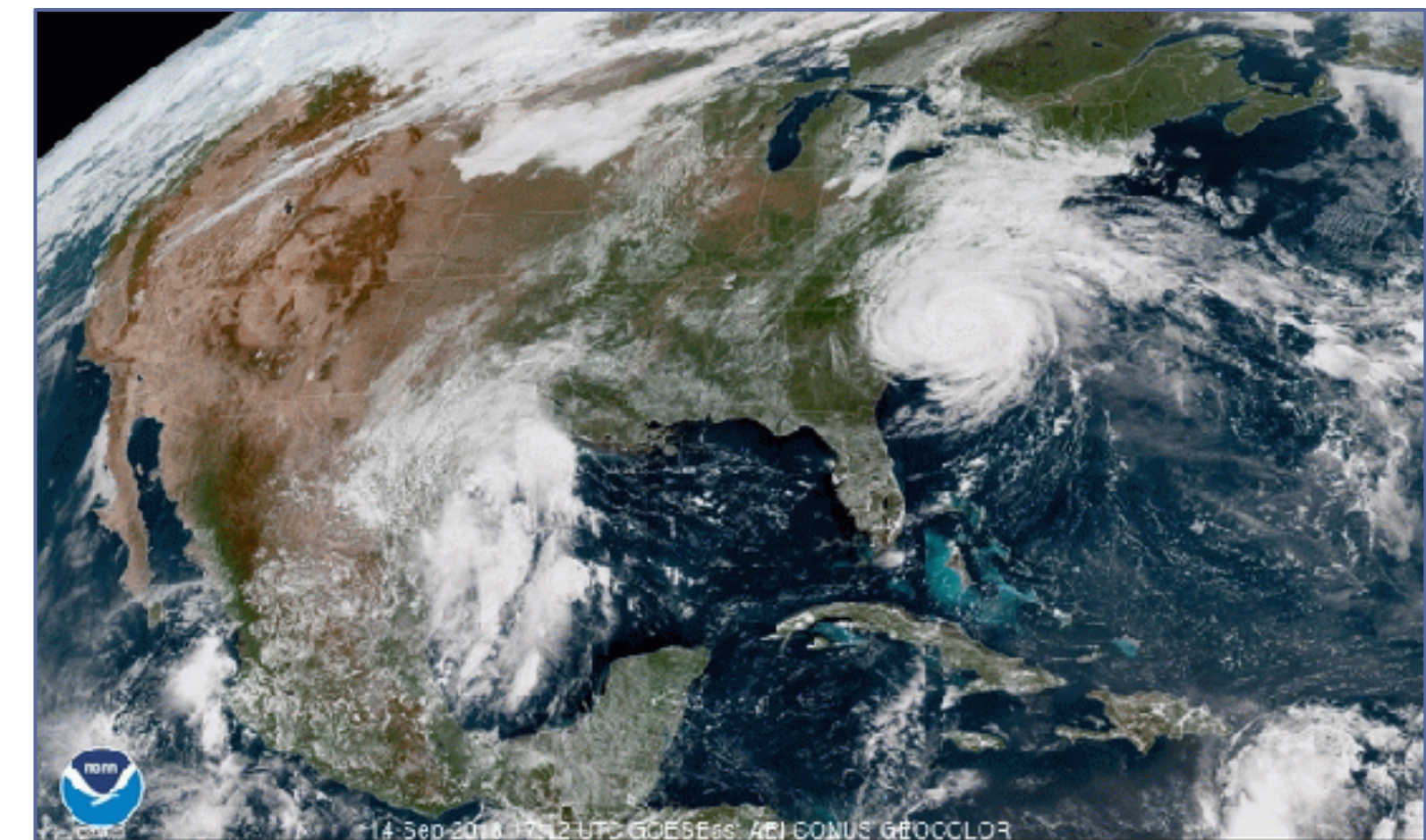
In line with CW objectives

Continuity: Promote follow-on sensors/Archival

Accessibility: OPeNDAP/THREDDS/ ERDDAP (Open&Free)

Quality: NRT Products

Utilization: Regional and global, multipurpose, ML, Big Data,...

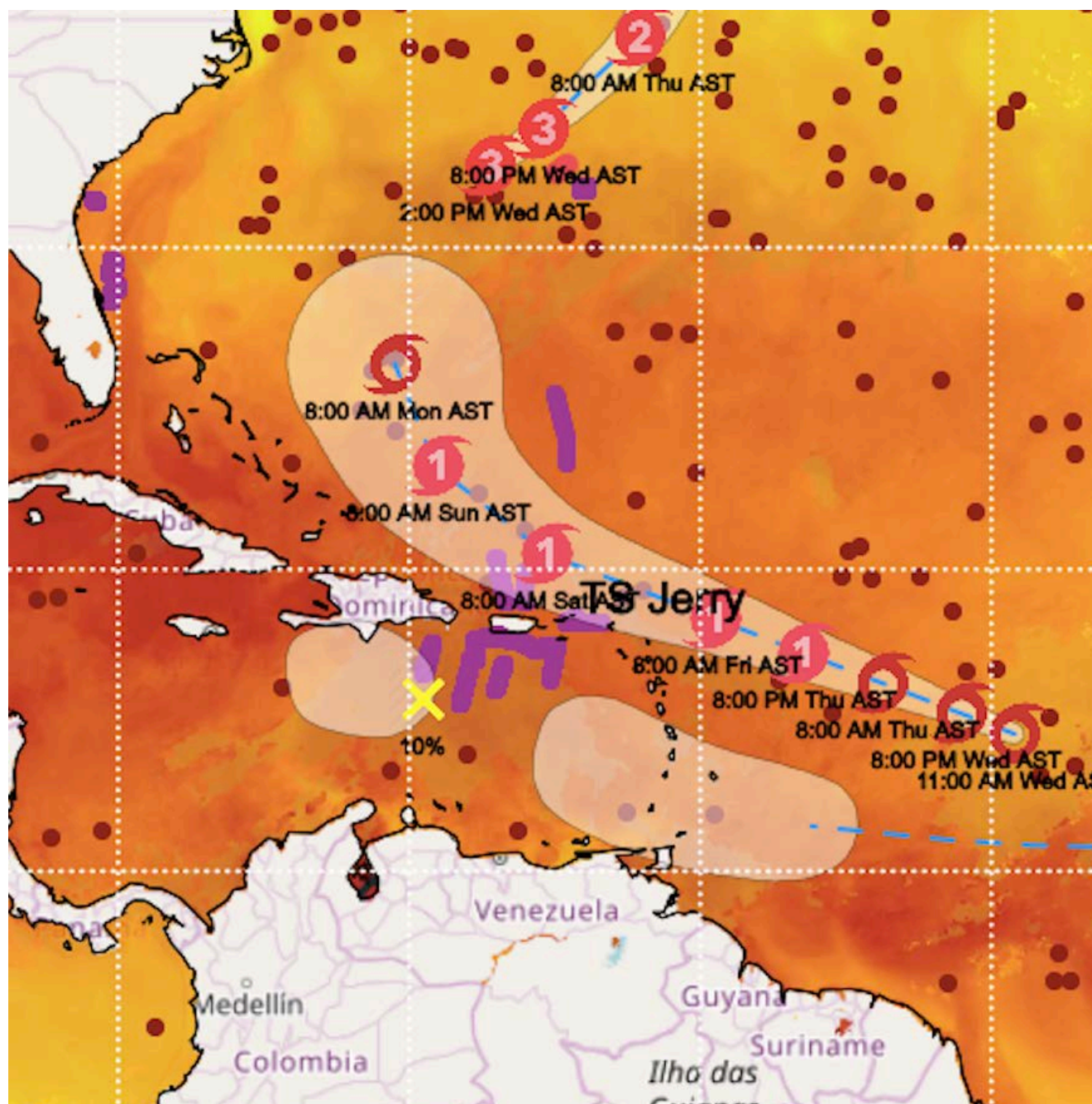


02 Applications

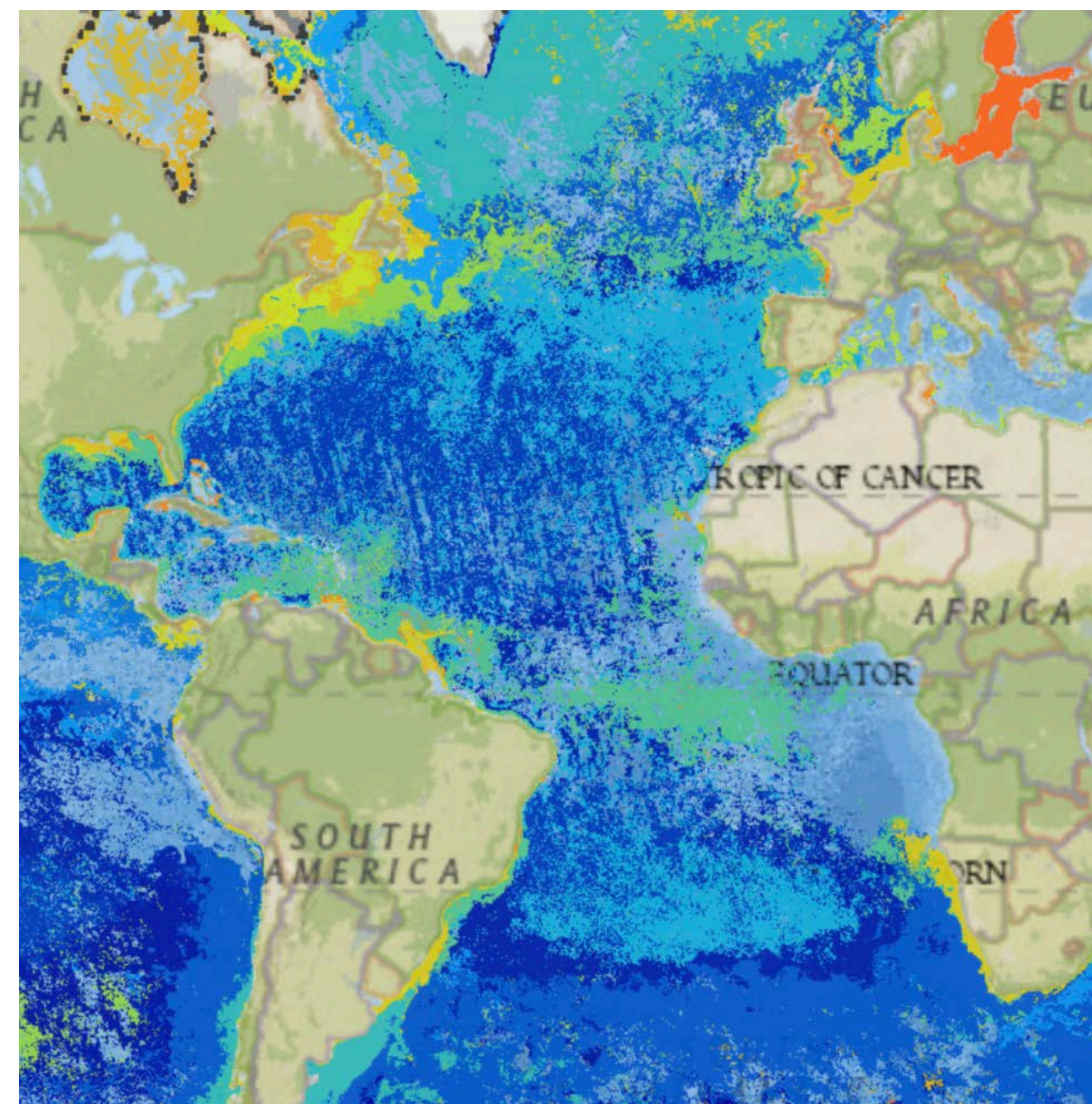
Applications: Fisheries, oil platforms, research cruise support, hurricane operations, public health, biogeographic research, omics, coastal environment, operational oceanography, *Sargassum* monitoring, glider operations, Argo/drifter deployments, carbon SOOP ship monitoring, ocean acidification, ocean debris, carbon fluxes



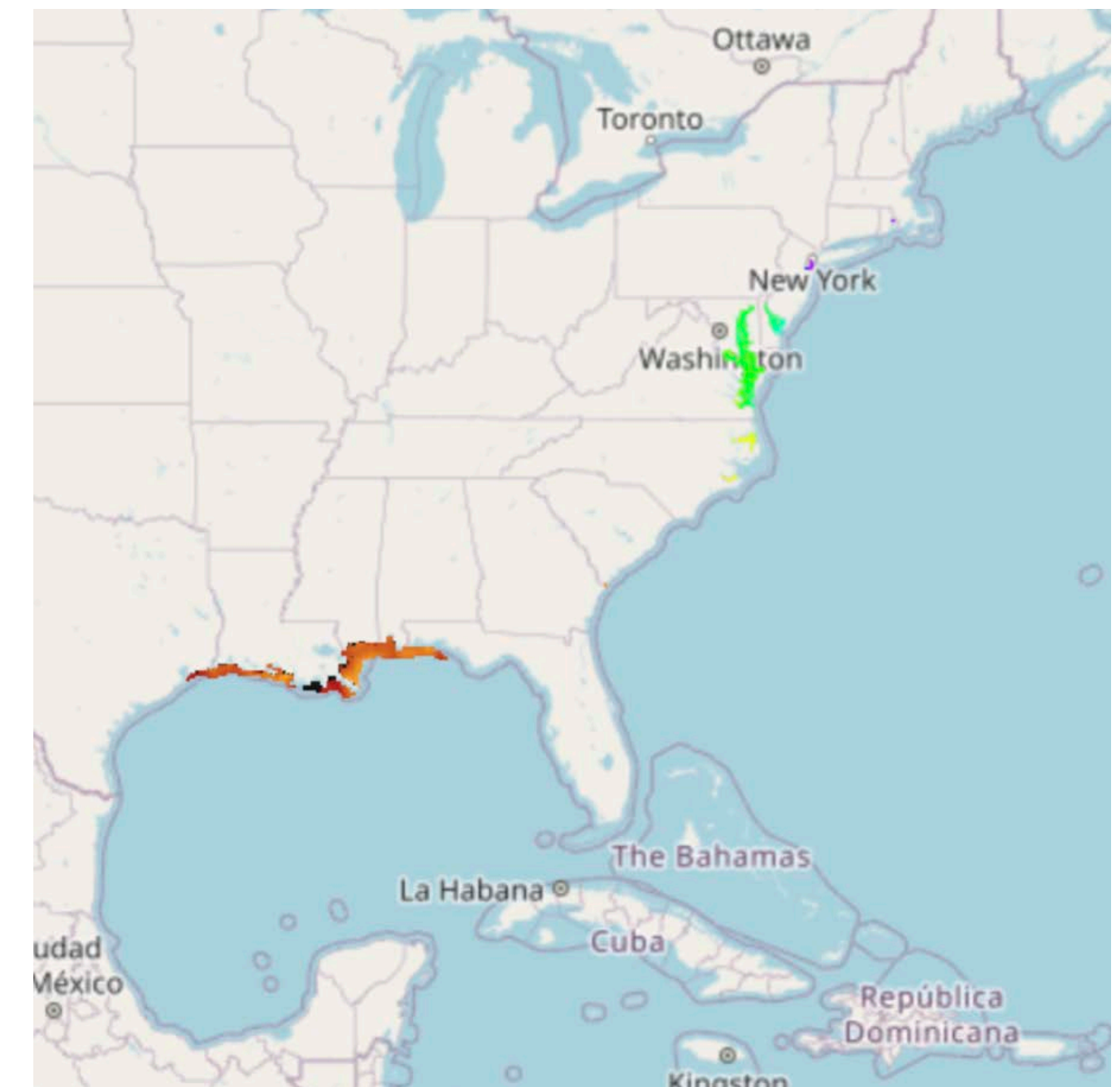
HurricaneViewer
OAR,HRD, NWS, NHC, NOS, NAVO



Seascapes
MBON, OSU, USF, NASA, UAF, IOOS, NMS



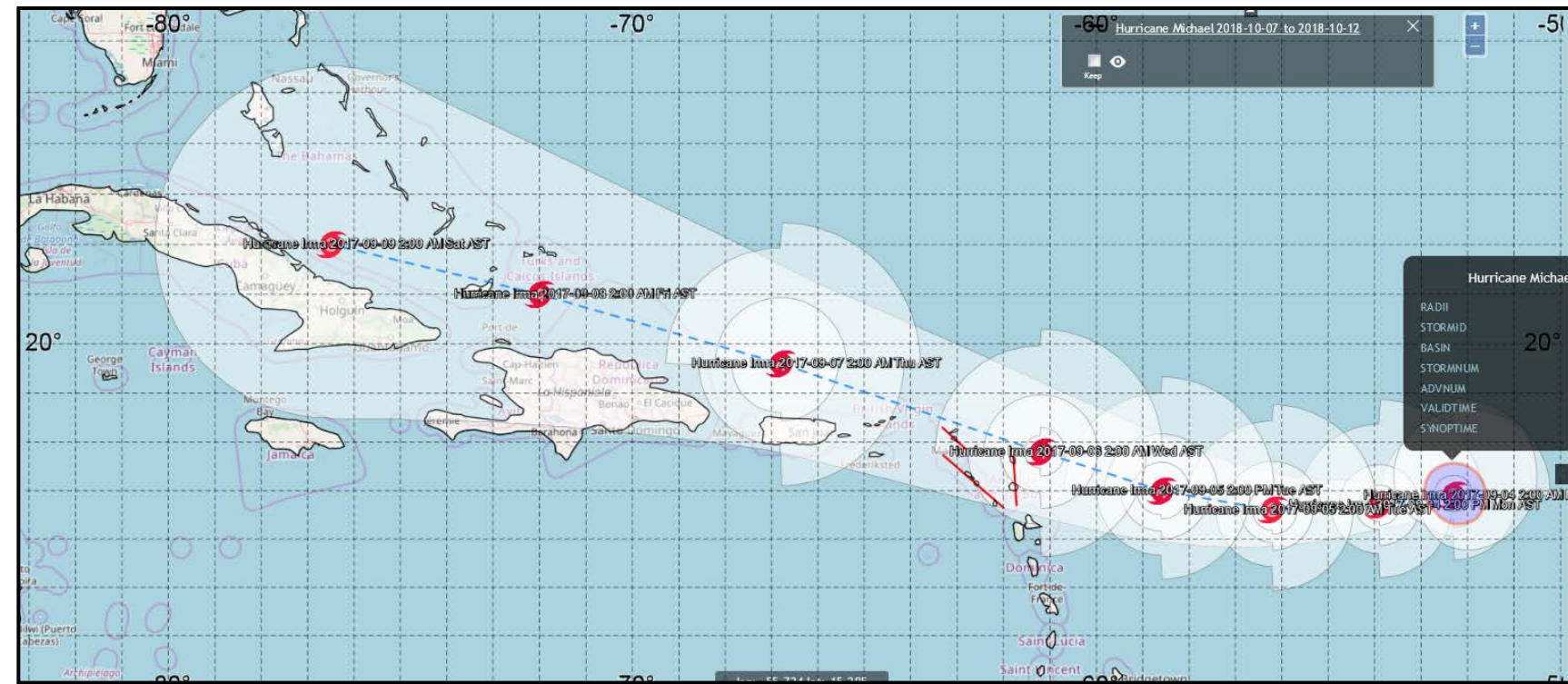
Vibrio Bacteria Suitability Index
ECDC, FAO



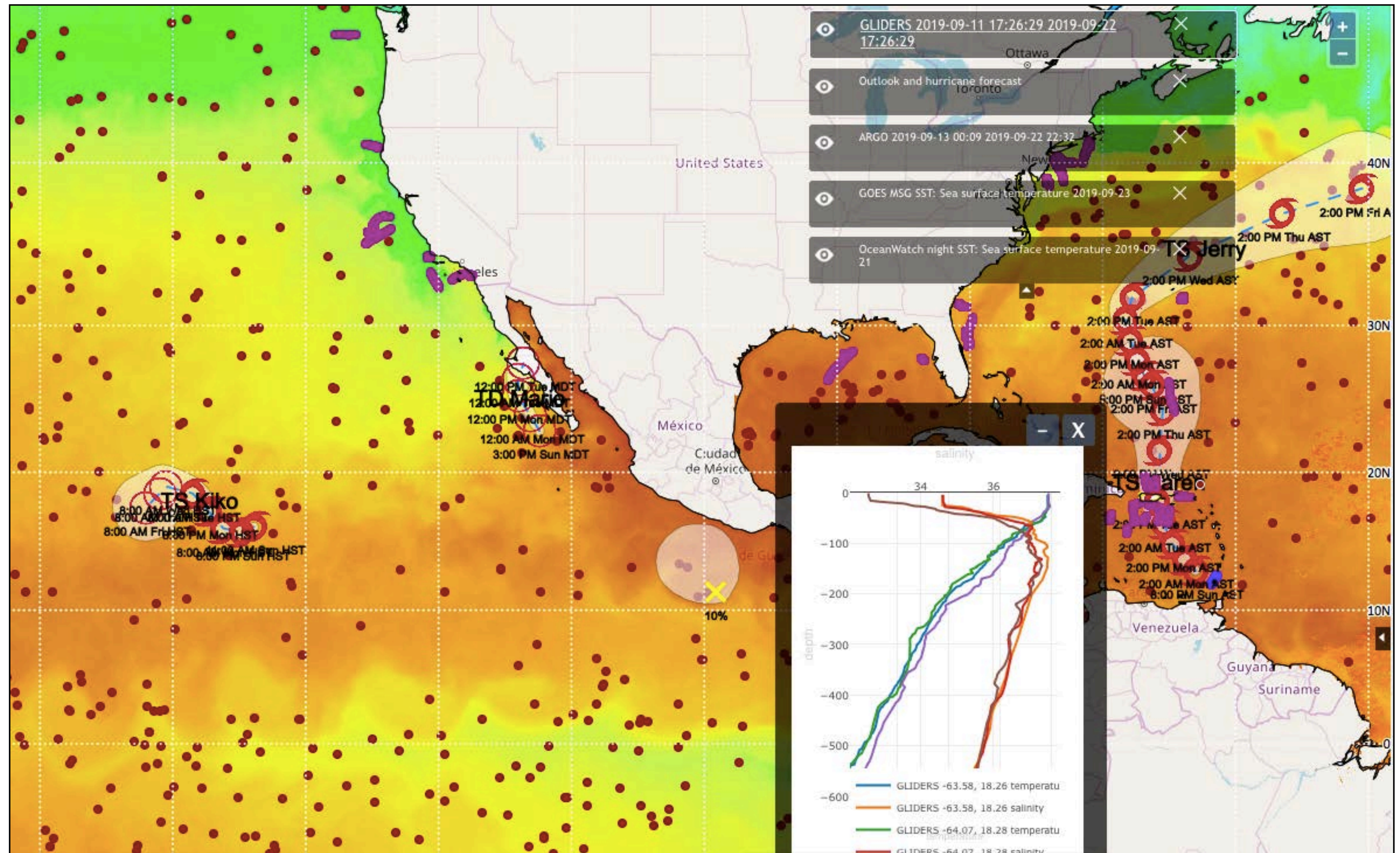
02 Applications

HOV

Goal: To support the Atlantic Hurricane Field Program.



It includes geoJSON with hurricane outlooks, forecasts and best track. In-situ data from gliders, XBTs, Argo and drifters. 30-day VIIRS cumulative chlor fields for detecting salinity-induced barrier layers.



02 Applications

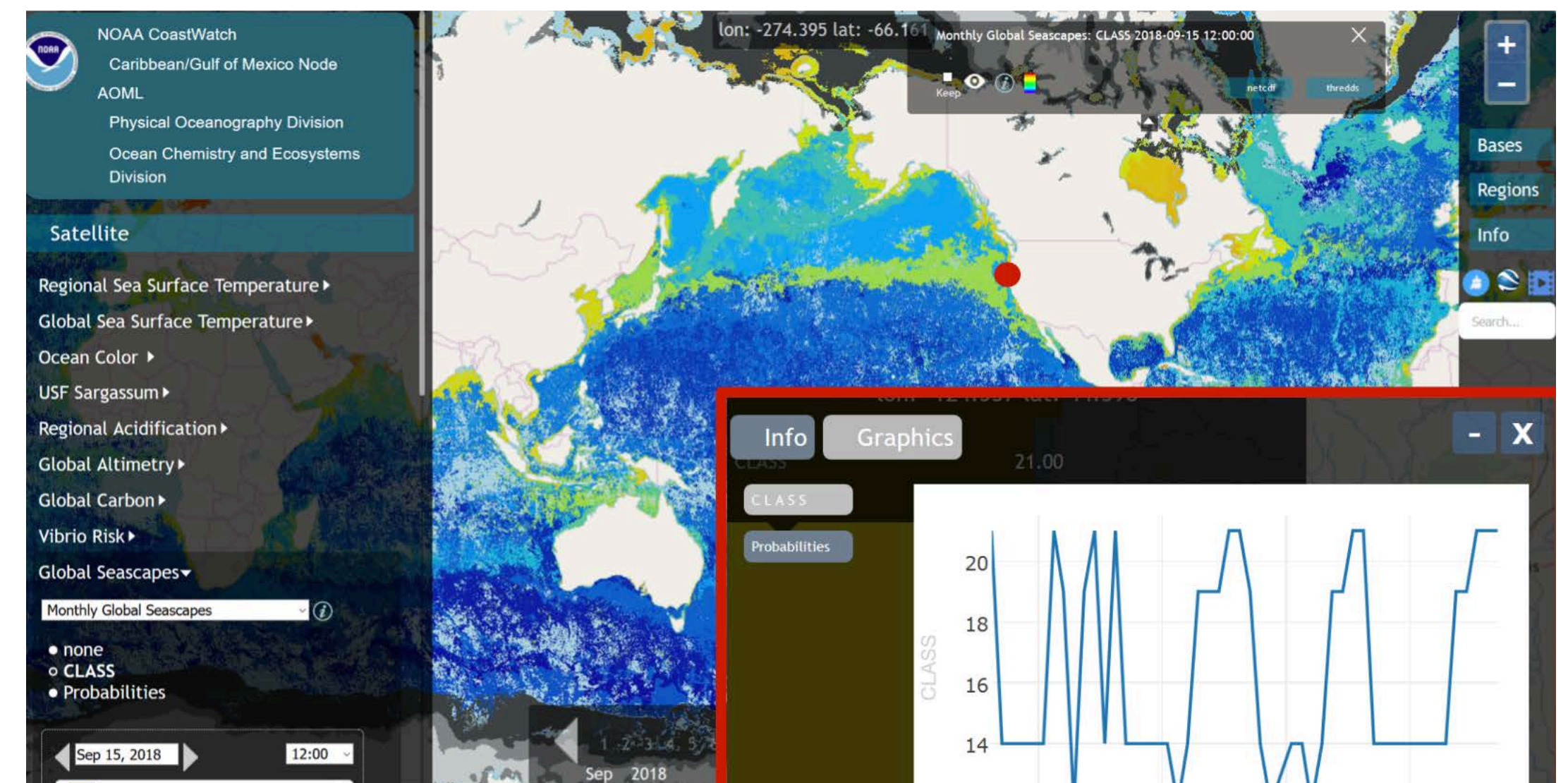
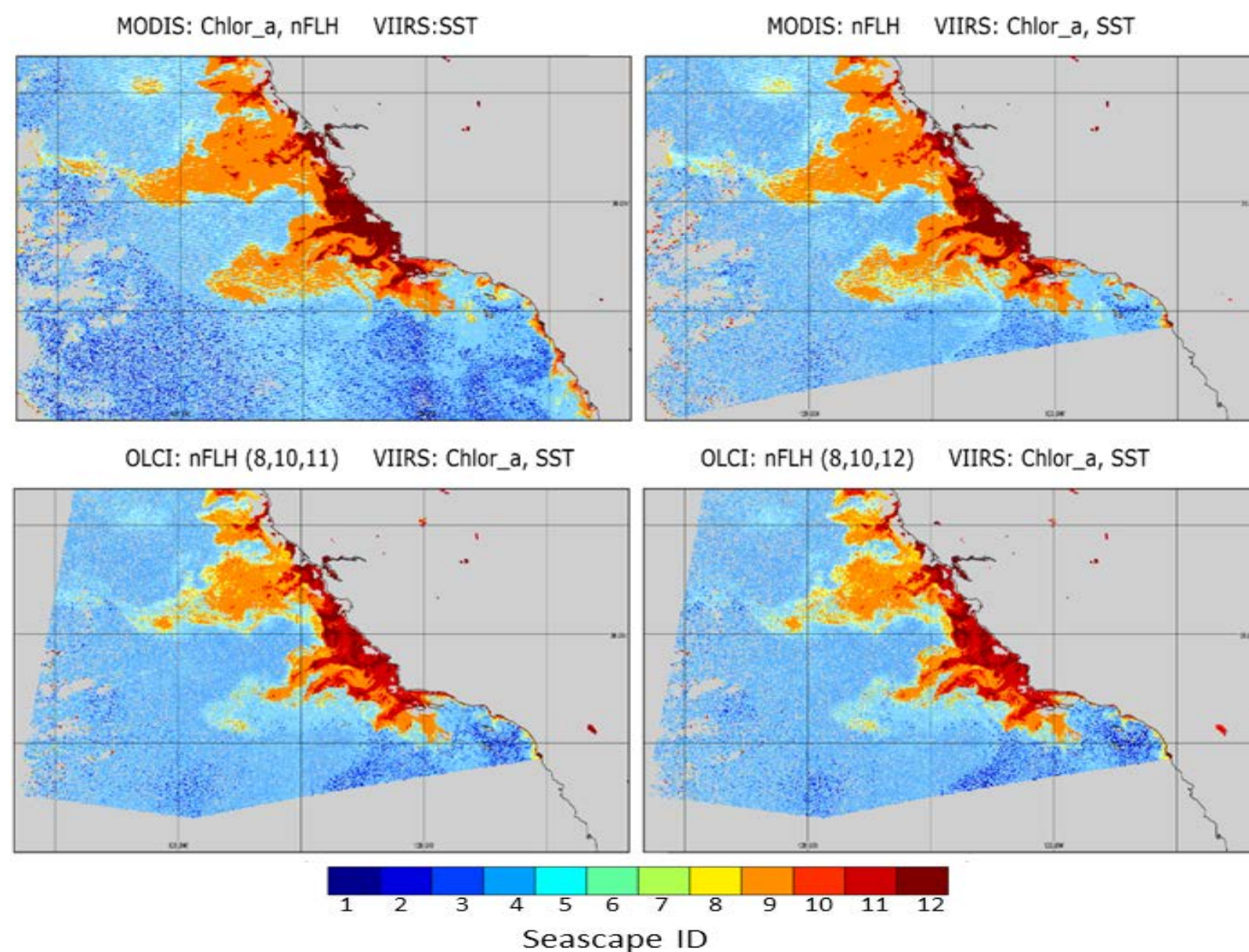
Seascapes

Goals: To identify spatially explicit water masses with particular biogeochemical features using model and satellite-derived measurements. To assess and predict the different planktonic and fisheries communities that reside within seascapes.

Seasonal and Interannual dynamics, classification uncertainty of habitats.

Moving toward real time cruise planning, feature tracking.
Provide end user indicators and metrics.

Questions: How well is the system characterized? How do we quantify atypical? Where do we need better/more in situ data to classify habitat?



02 Applications

Vibrio Model

McLaughlin JB et al. Outbreak of *Vibrio parahaemolyticus* gastroenteritis associated with Alaskan oysters. *N Engl J Med.* 2005; 353(14):1463-70

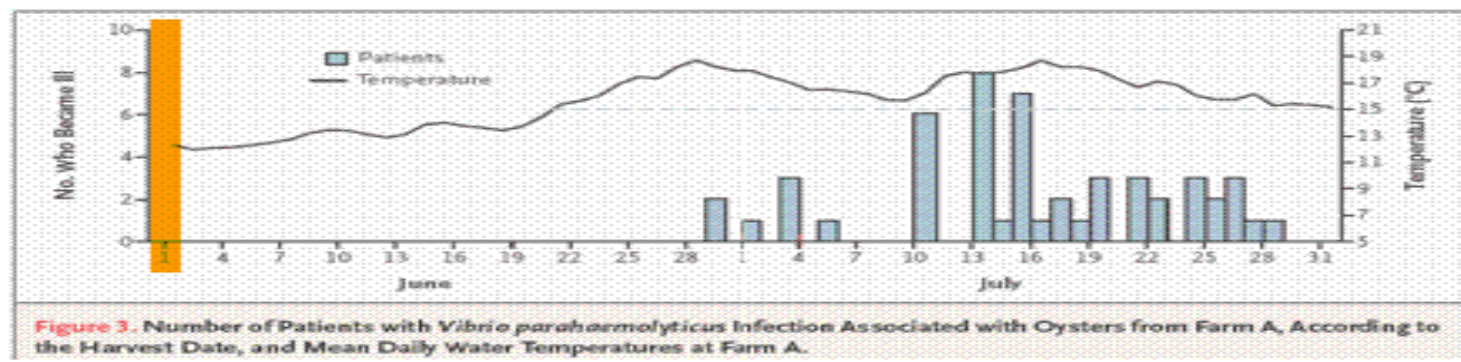
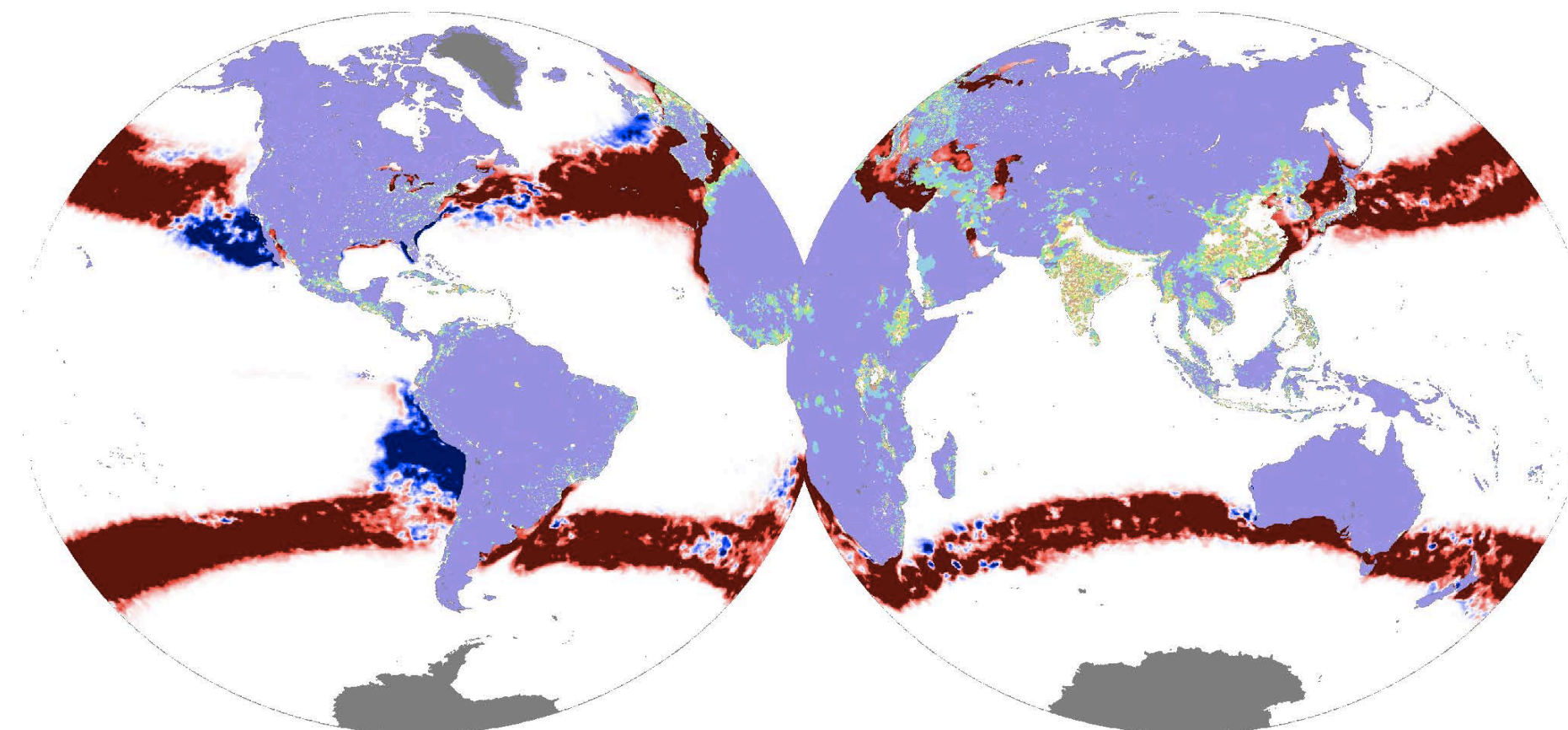
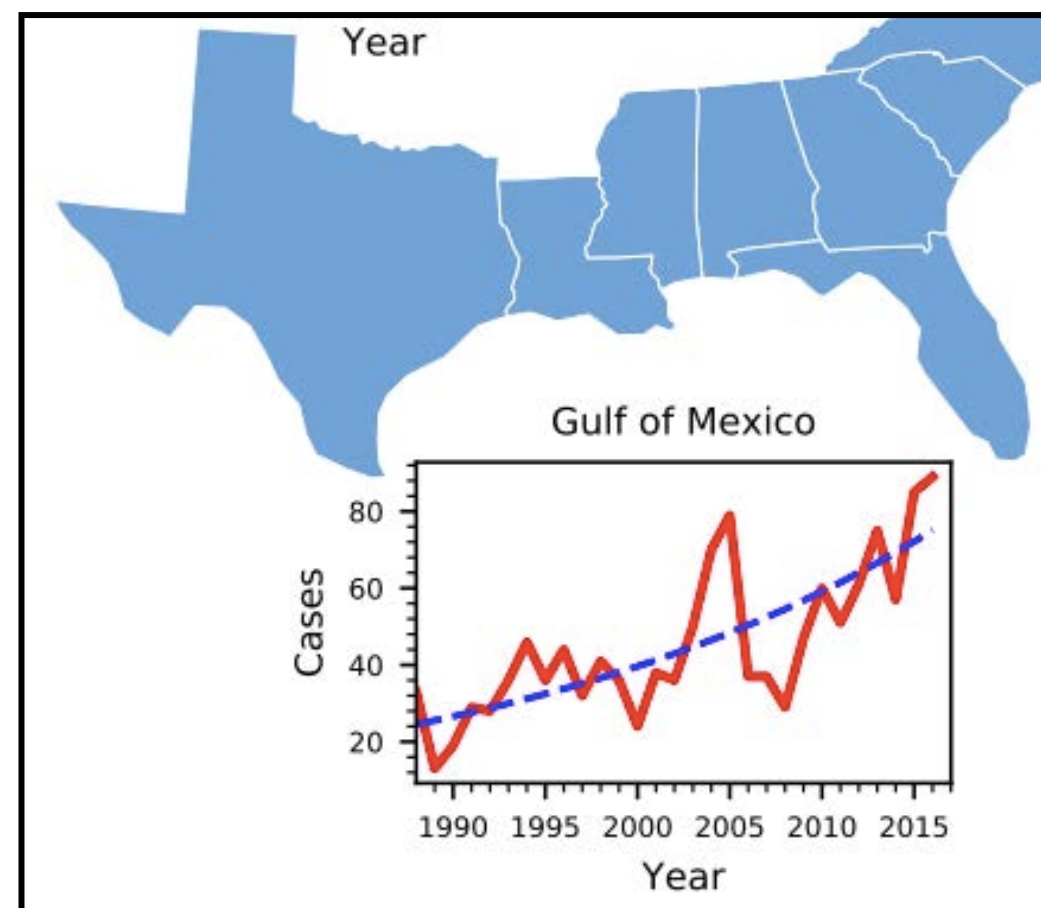
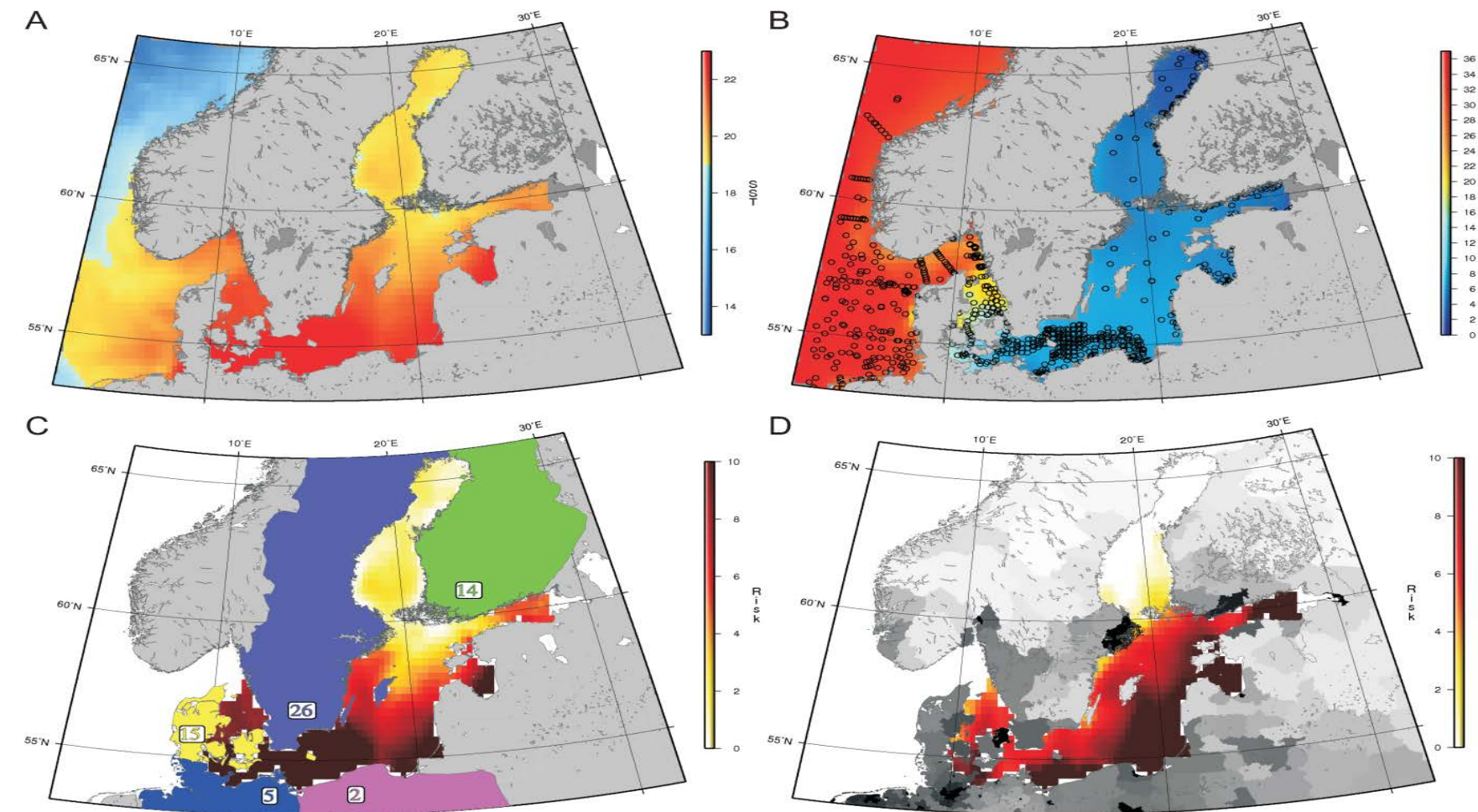
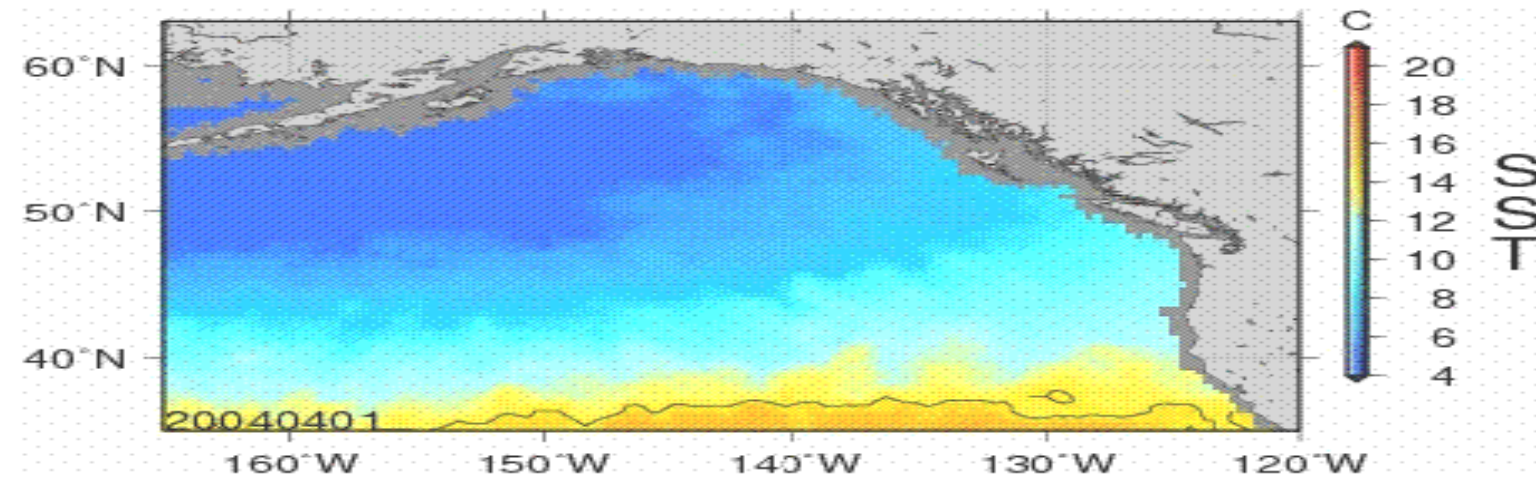


Figure 3. Number of Patients with *Vibrio parahaemolyticus* Infection Associated with Oysters from Farm A, According to the Harvest Date, and Mean Daily Water Temperatures at Farm A.



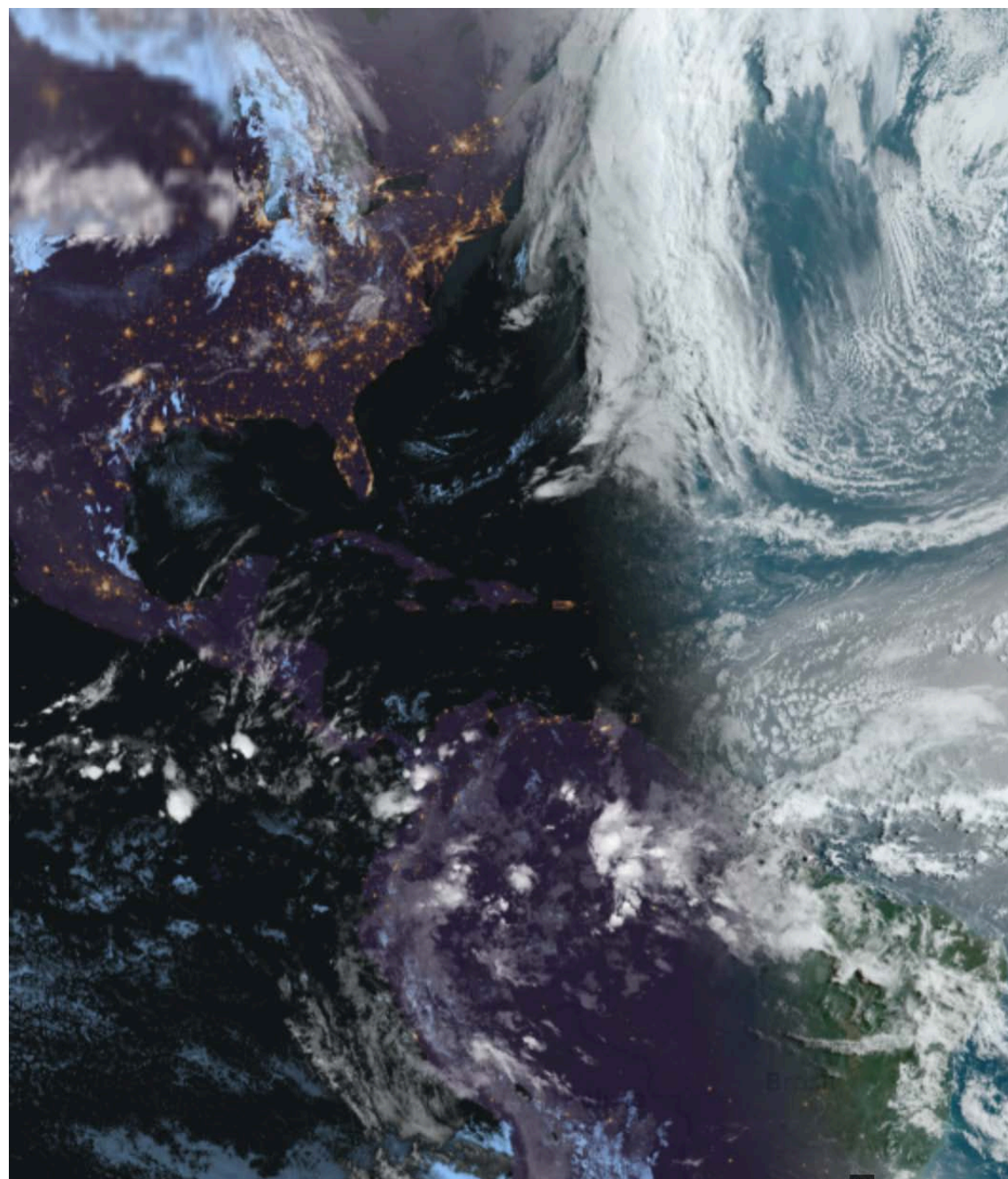
Number of Days
-100 -50 0 50 100

US NE is a hotspot for Vibrio risk

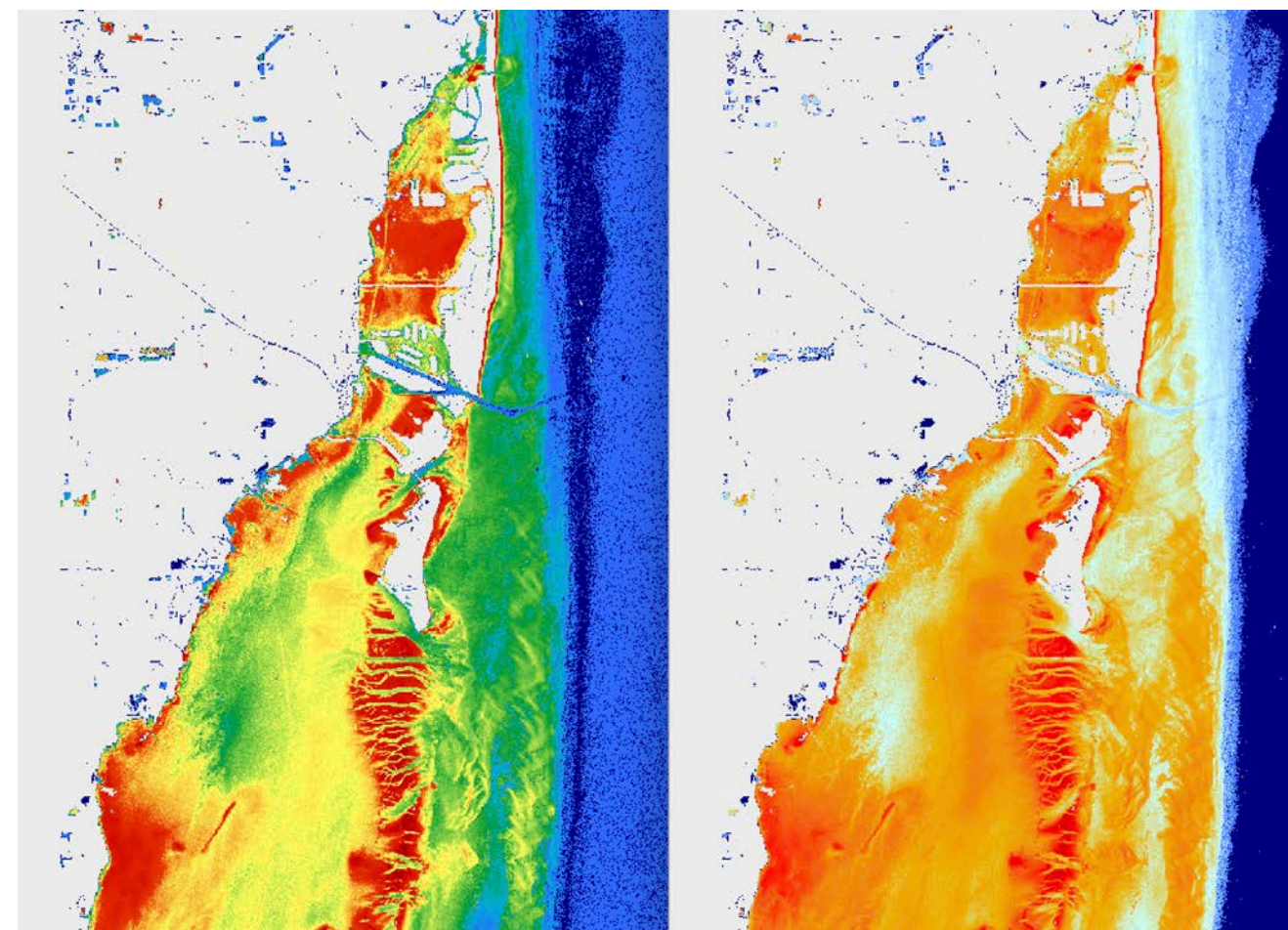
02 Unique datasets/novel products

Unique/novel products: GOES 16/17 truecolor, Caribbean OA, ocean geostrophic currents, monthly and seasonal carbon fluxes, Vibrio Suitability Index (daily, cumulative and short term forecast), blended SST+frontal boundaries, in-situ glider/Argo/drifter/XBT, RSS MW products, underway carbon SOOP, USF AFAI (daily, 3D and weekly) and MCI, Seascapes (8day and monthly), 30day cumulative VIIRS chlor_a, aggregated K490/Rrs667 GoM, AVHRR SST anomaly, in-situ sargassum, OSPO OHC, SIR, AOT

**GOES-16/17 Truecolor
(with CW Central)**

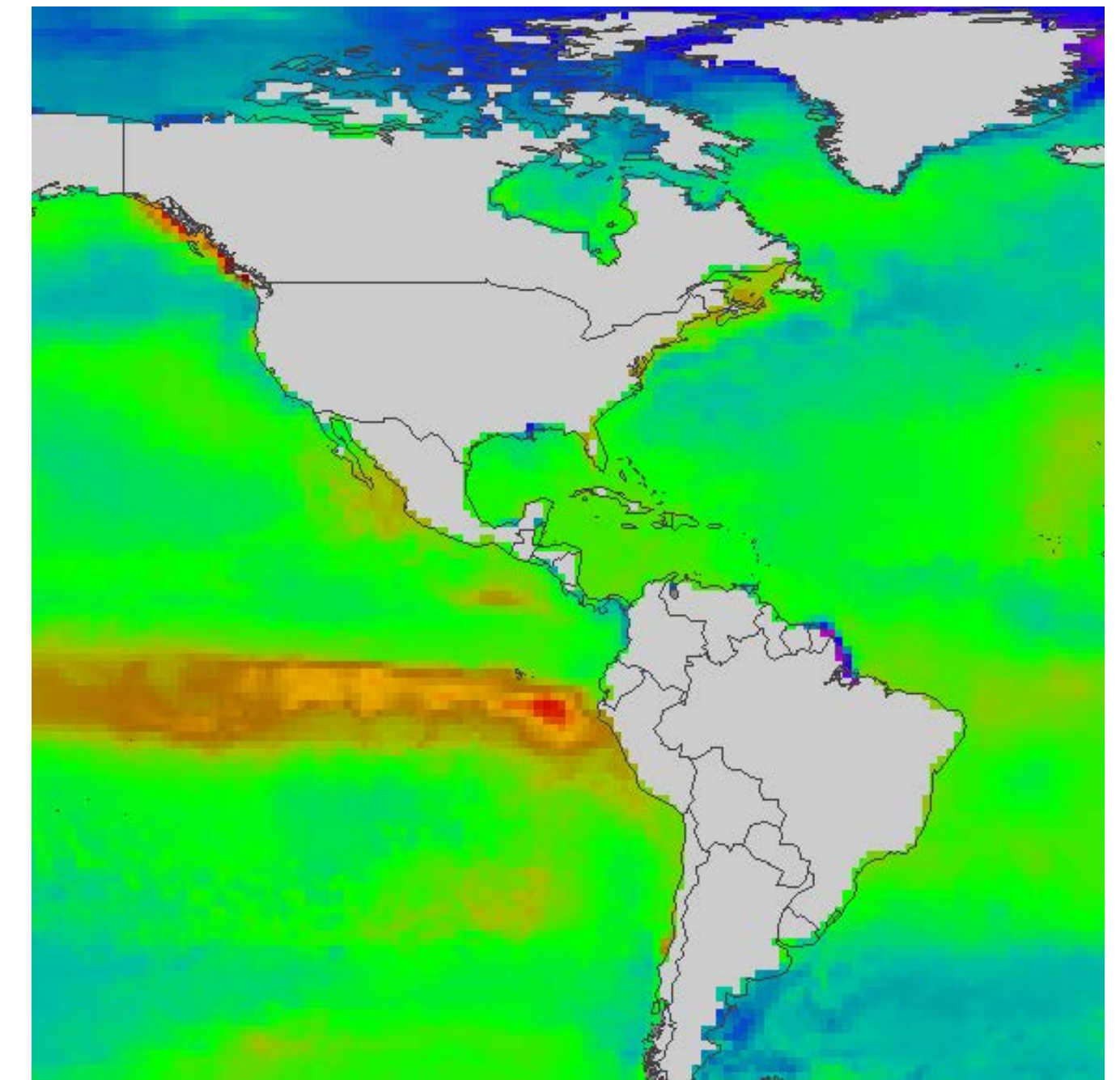


**S2 MSI
Urban Coastal Ecosystems**



IOPs, Chlor_a, TSM, yellow substance

**PCO₂/Carbon Fluxes
(R. Wanninkhof, NOAA/AOML/OCED)**



03 Pelagic *Sargassum*

Floating macroalgae that forms large rafts that function as a drifting ecosystem, providing valuable habitat for diverse marine organisms

Since 2011, massive amounts of pelagic *Sargassum* algae began washing ashore throughout the Caribbean Sea and Gulf of Mexico

Disrupts shipping, tourism, fishing, industry, and coastal ecosystems.

What we do? Monitor and track *Sargassum*. Trajectory modelling efforts. Operational.



03 *Sargassum* products

Introduction

During DeepWater Horizon oil spill, AOML and CW provided:

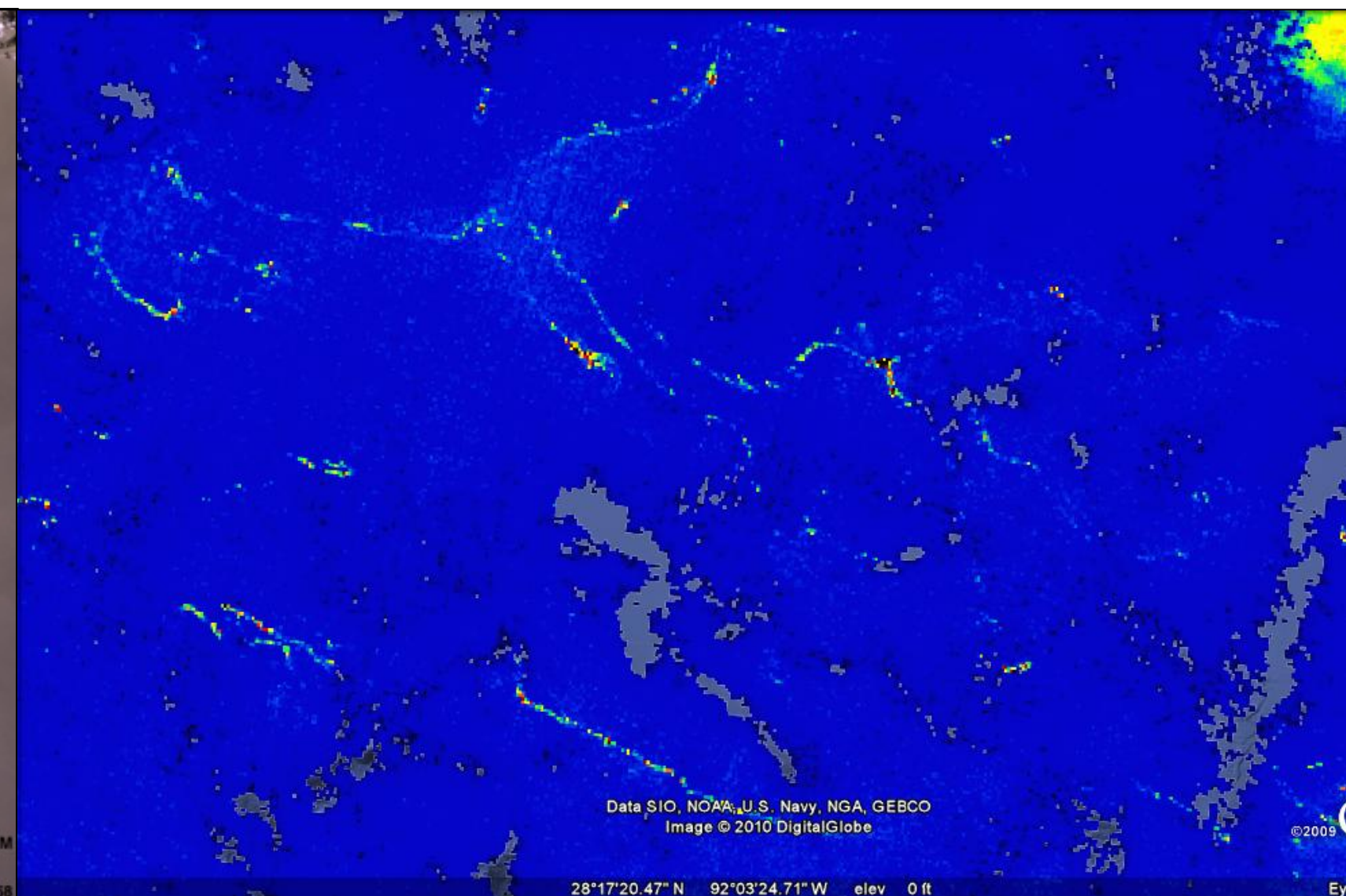
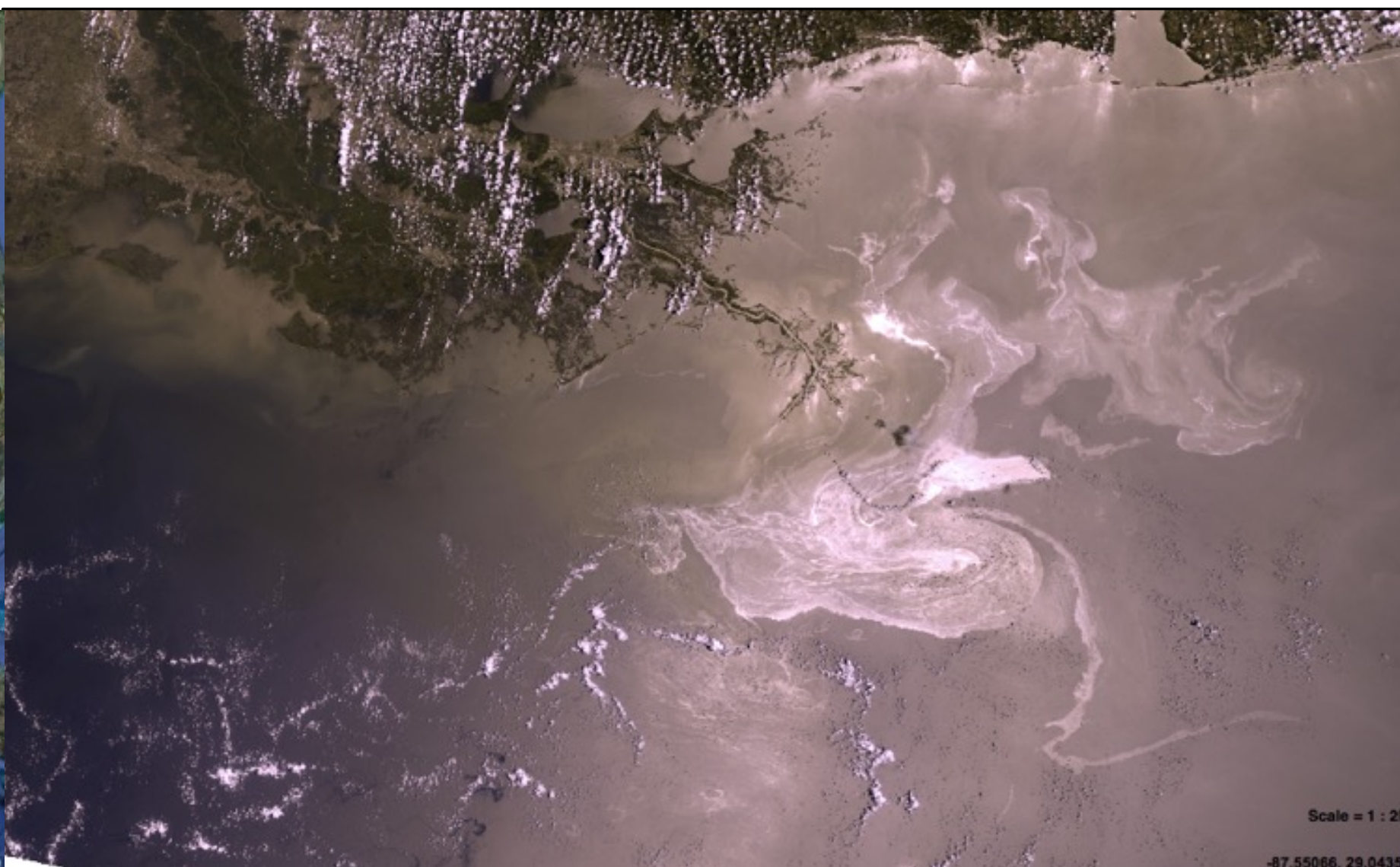
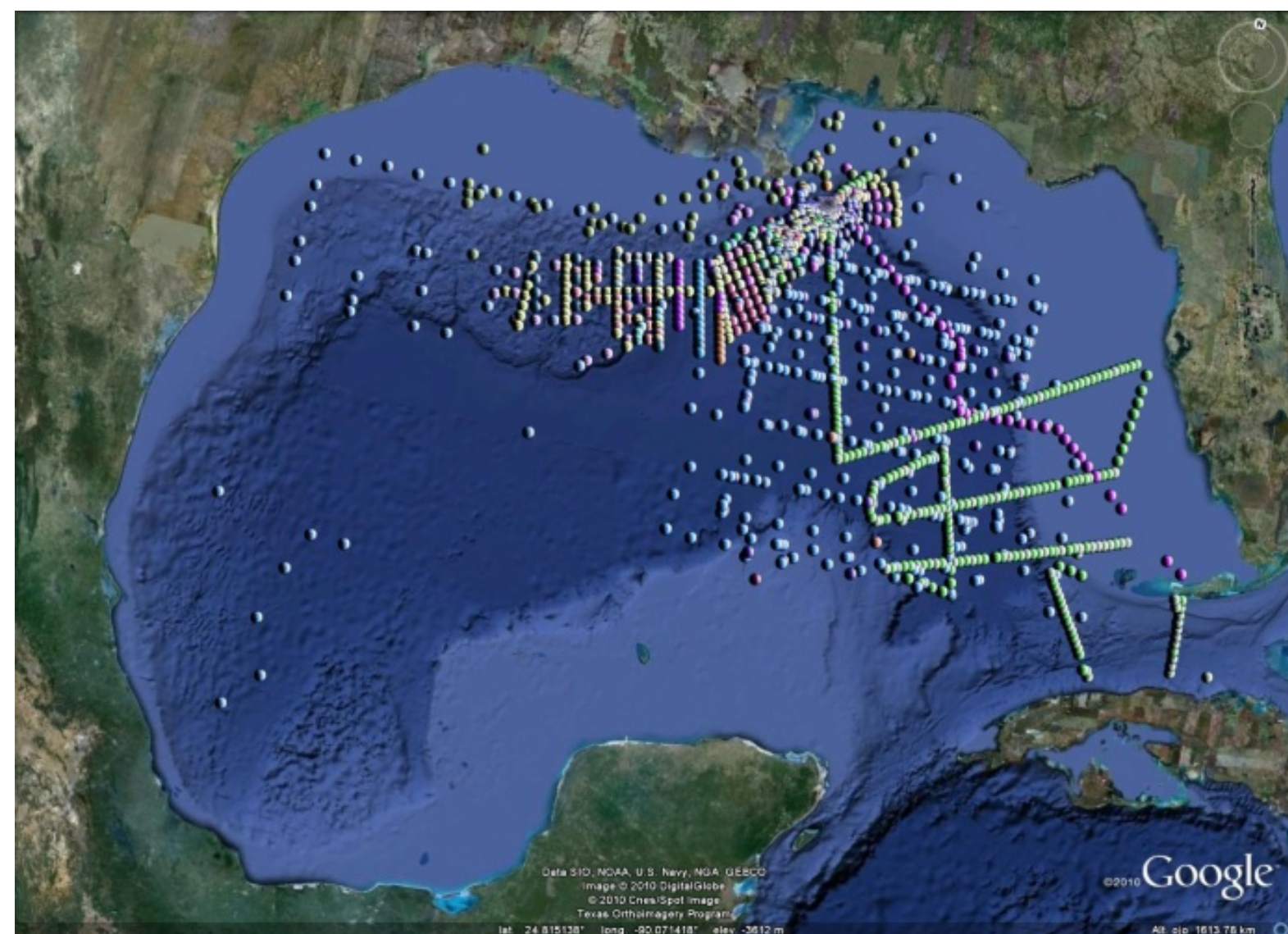
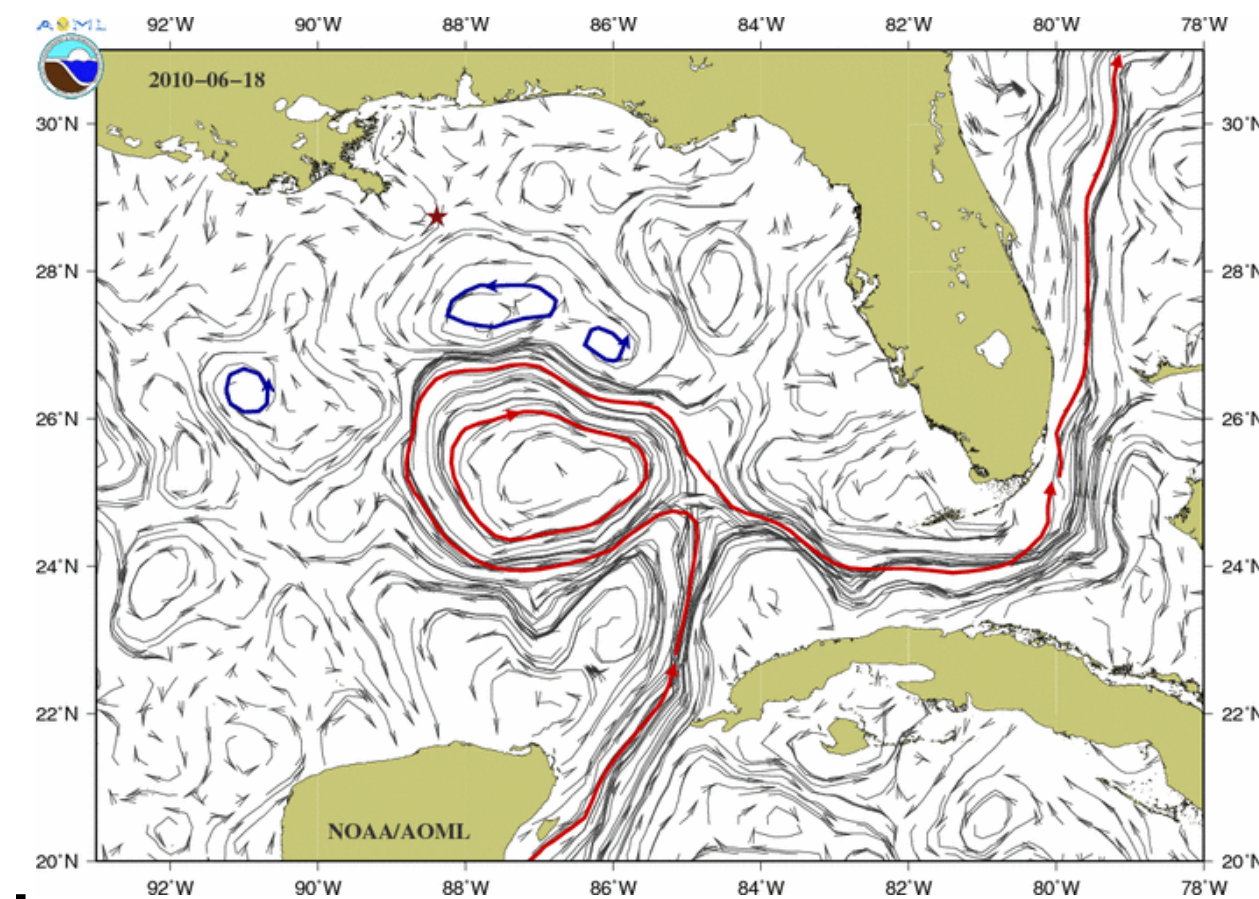
Data -> GTS

Daily updates of the location of oceanographic features in the Gulf of Mexico.

Sun-glint imagery from MERIS, MODIS and HRPT

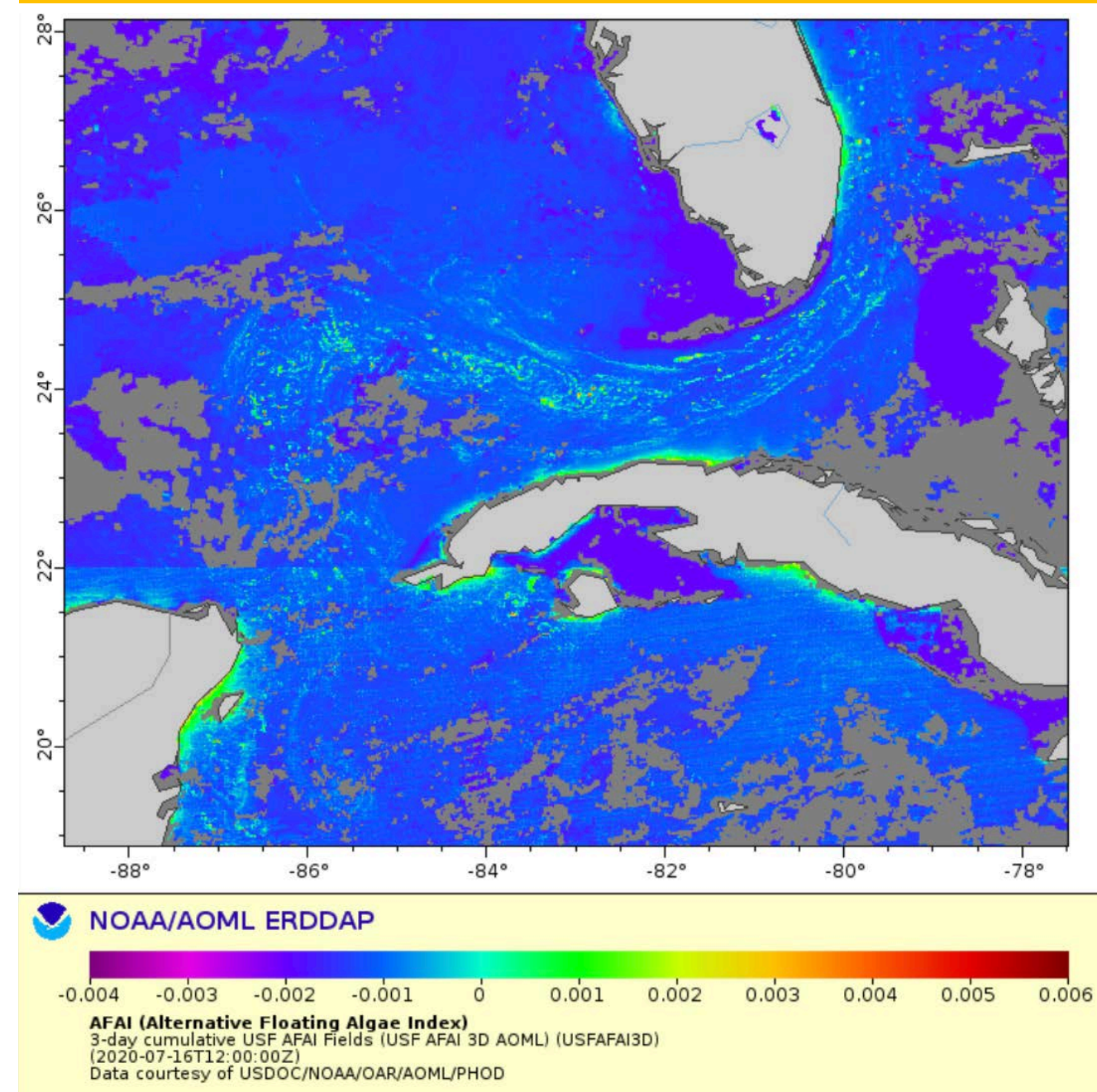
Issues: SAR false positives. Real oil?

MERIS MCI : $MCI = L709 - L681 - (709 - 681) * (L754 - L681) / (754 - 681)$. Source: Jim Gower

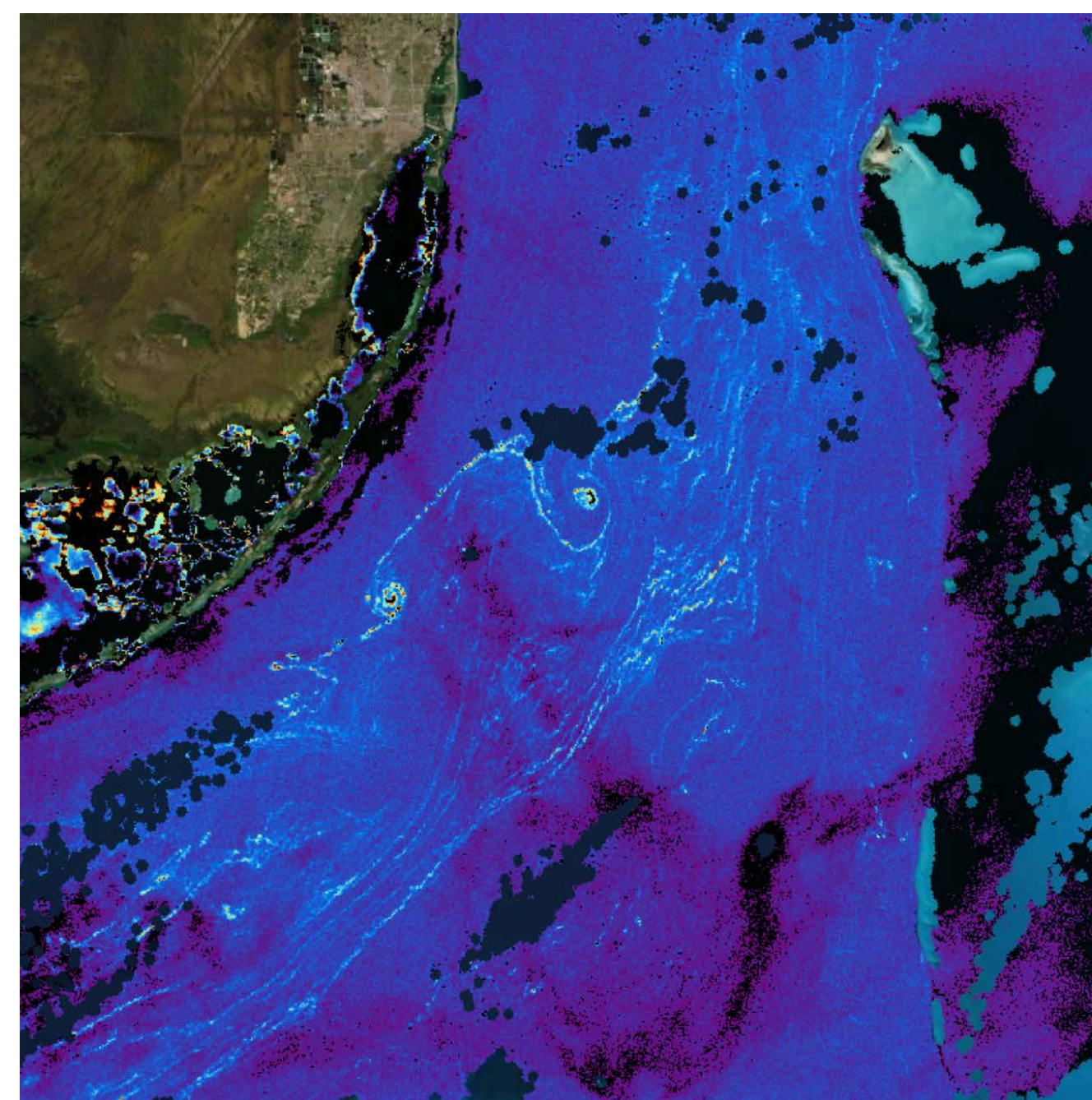


03 *Sargassum* products

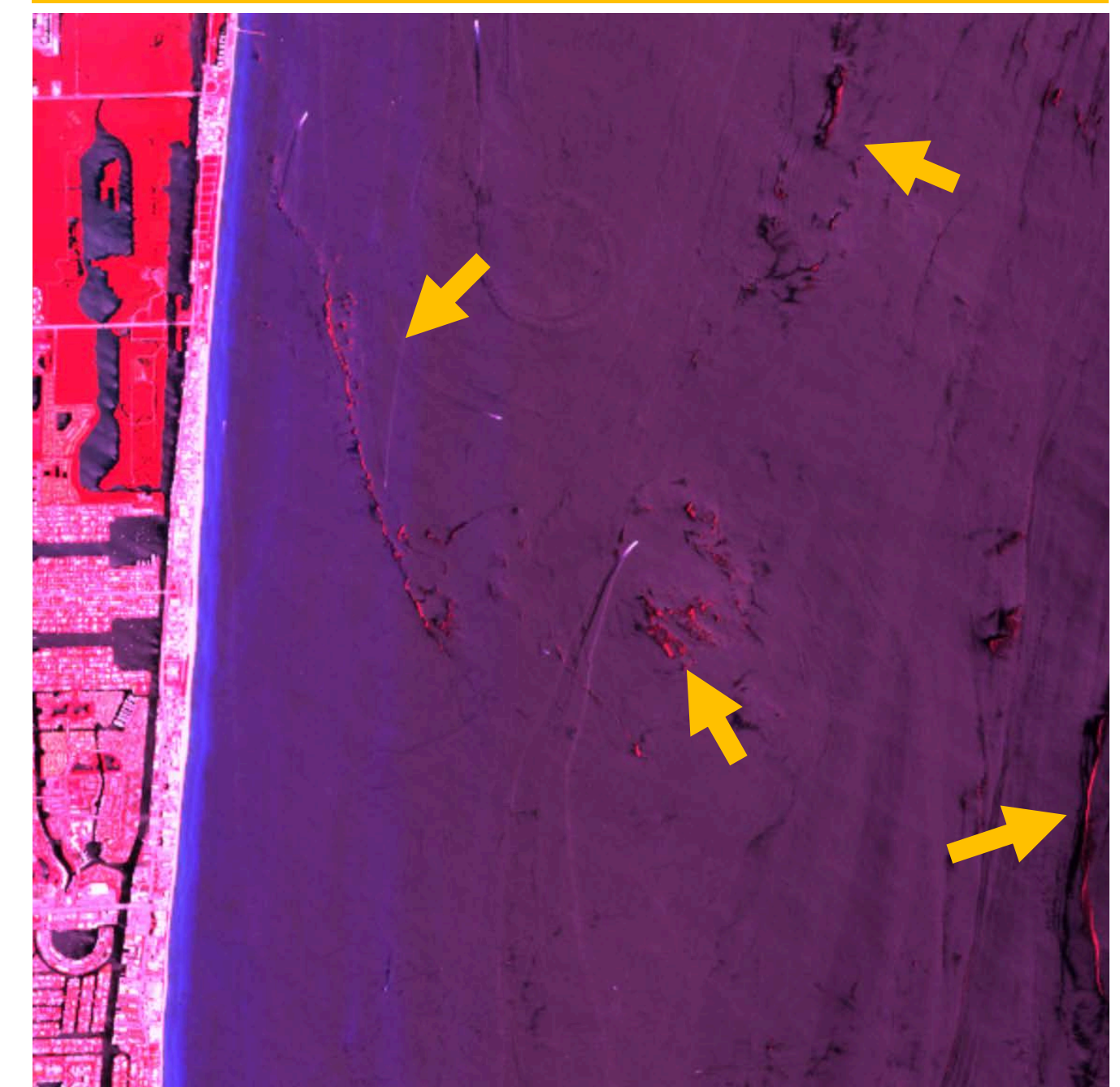
MODIS/VIIRS (source: C. Hu, USF)
Resolution: ~ 1km



OLCI data
Resolution: 300 m



MSI
Resolution: ~ 20m



Goals: NRT monitoring and tracking of pelagic *Sargassum* in the Tropical Atlantic, Caribbean Sea and Gulf of Mexico.

Revisit times: daily (MODIS , VIIRS), ~2 day (OLCI), ~5 day (MSI)

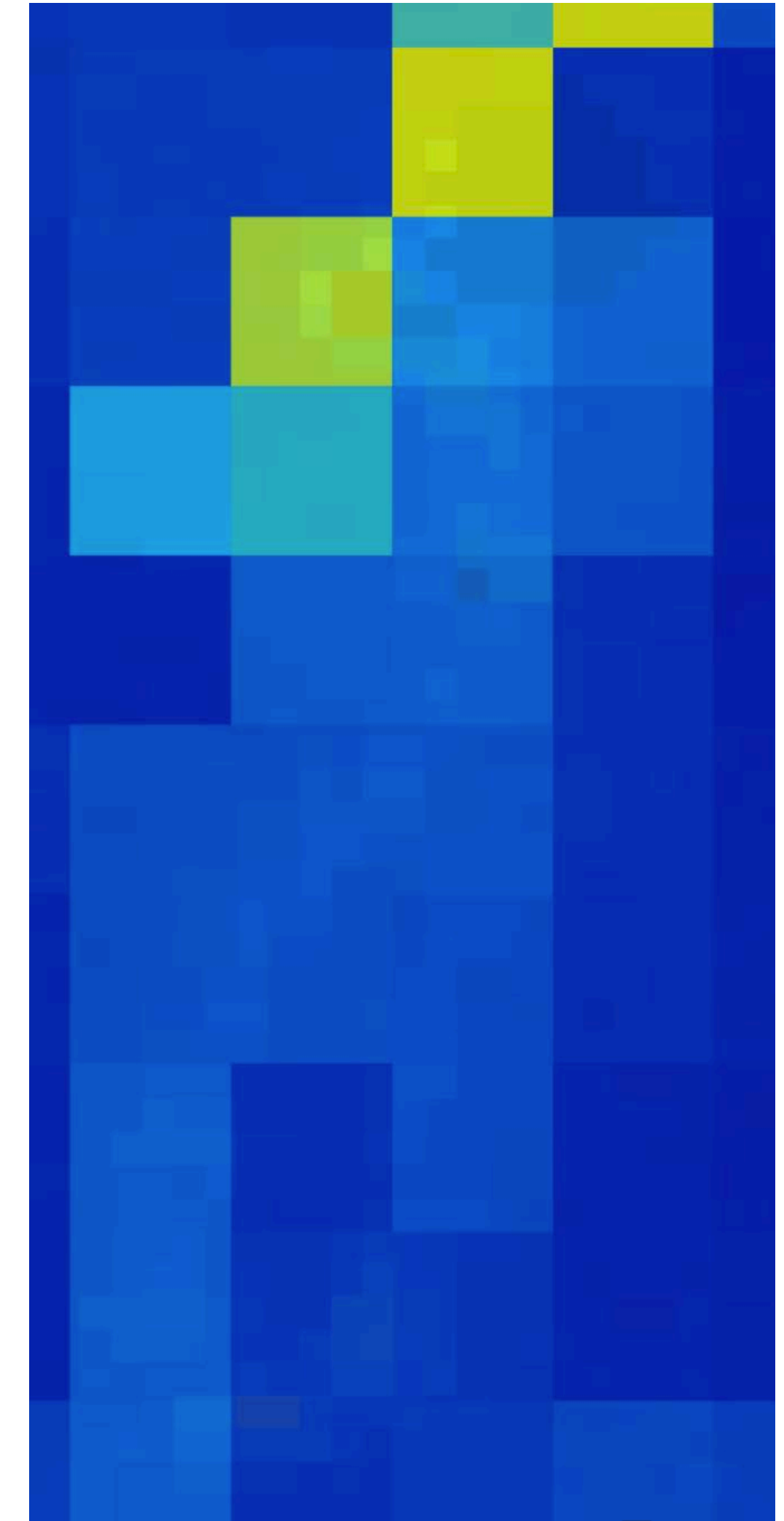
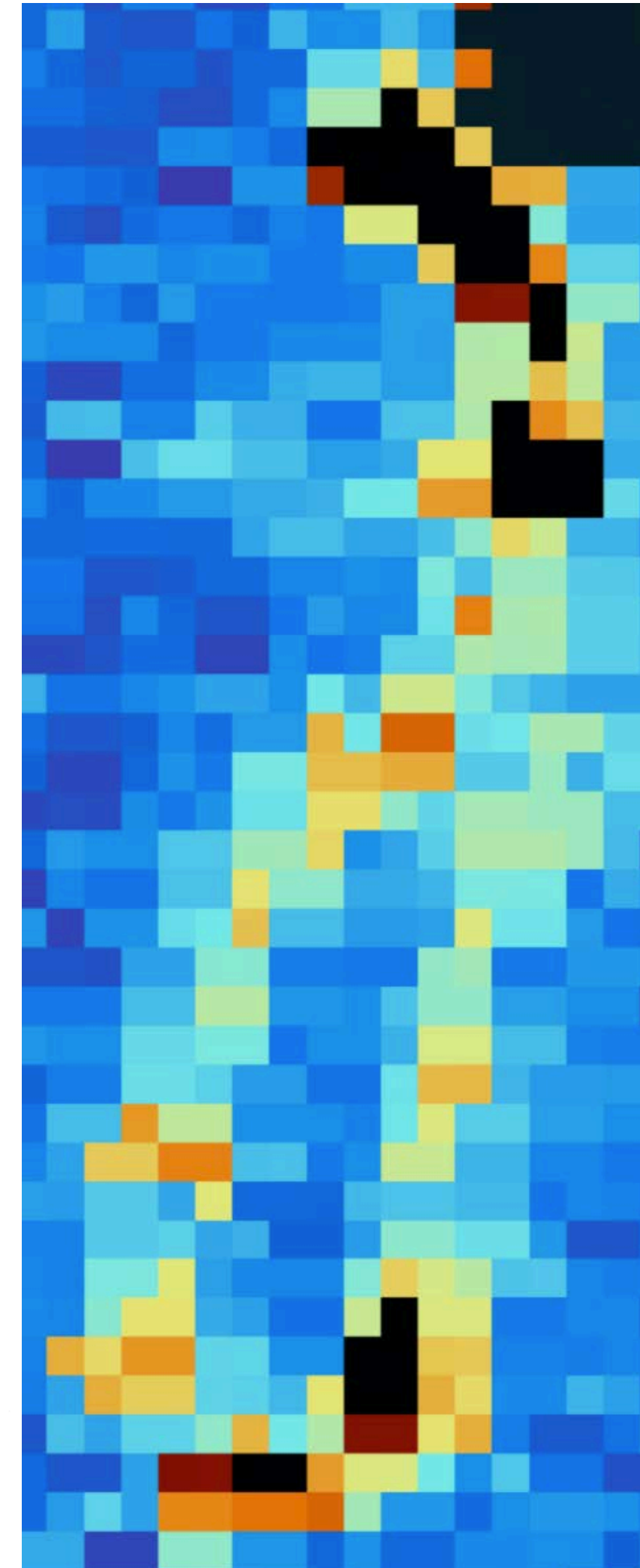
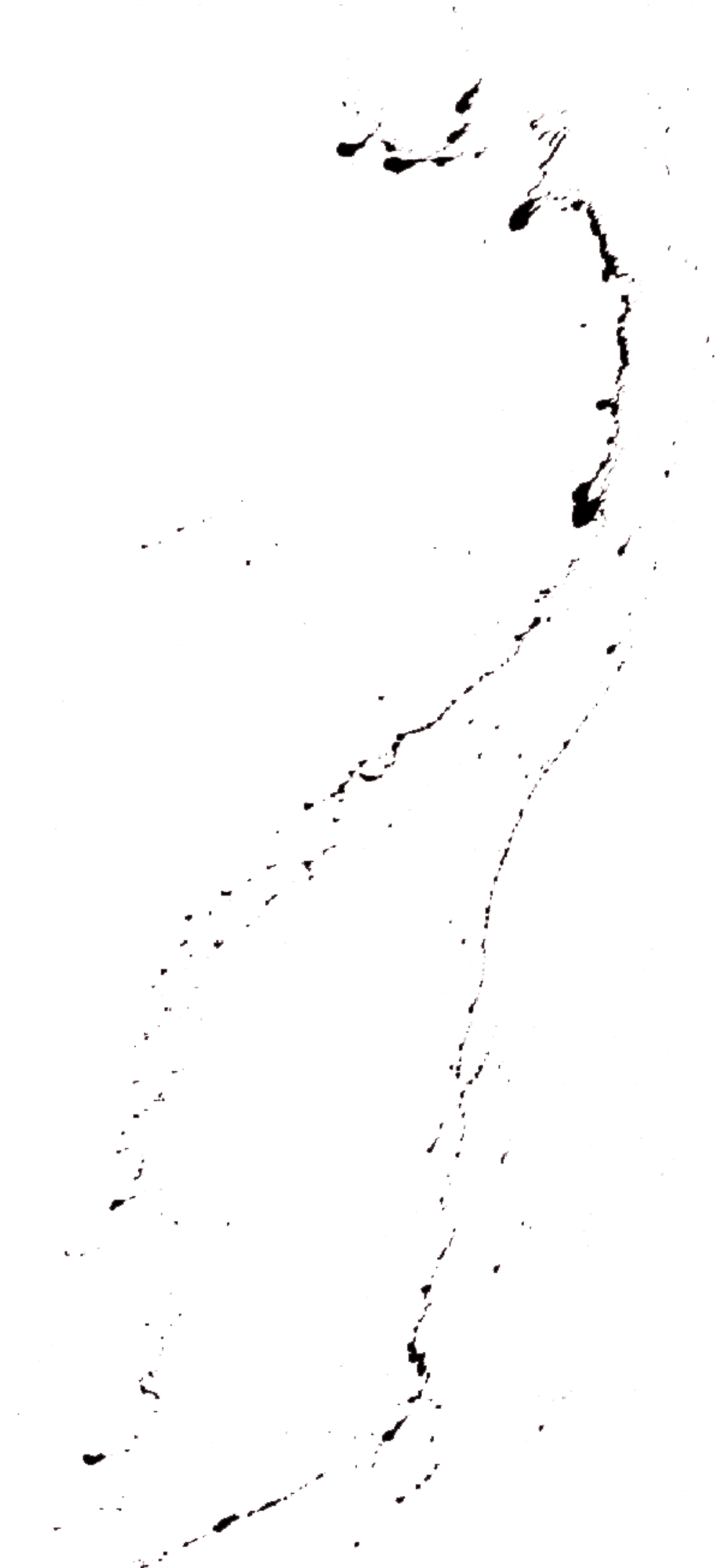
03 *Sargassum* products

Resolution:

20m -> 300m (ratio:15)

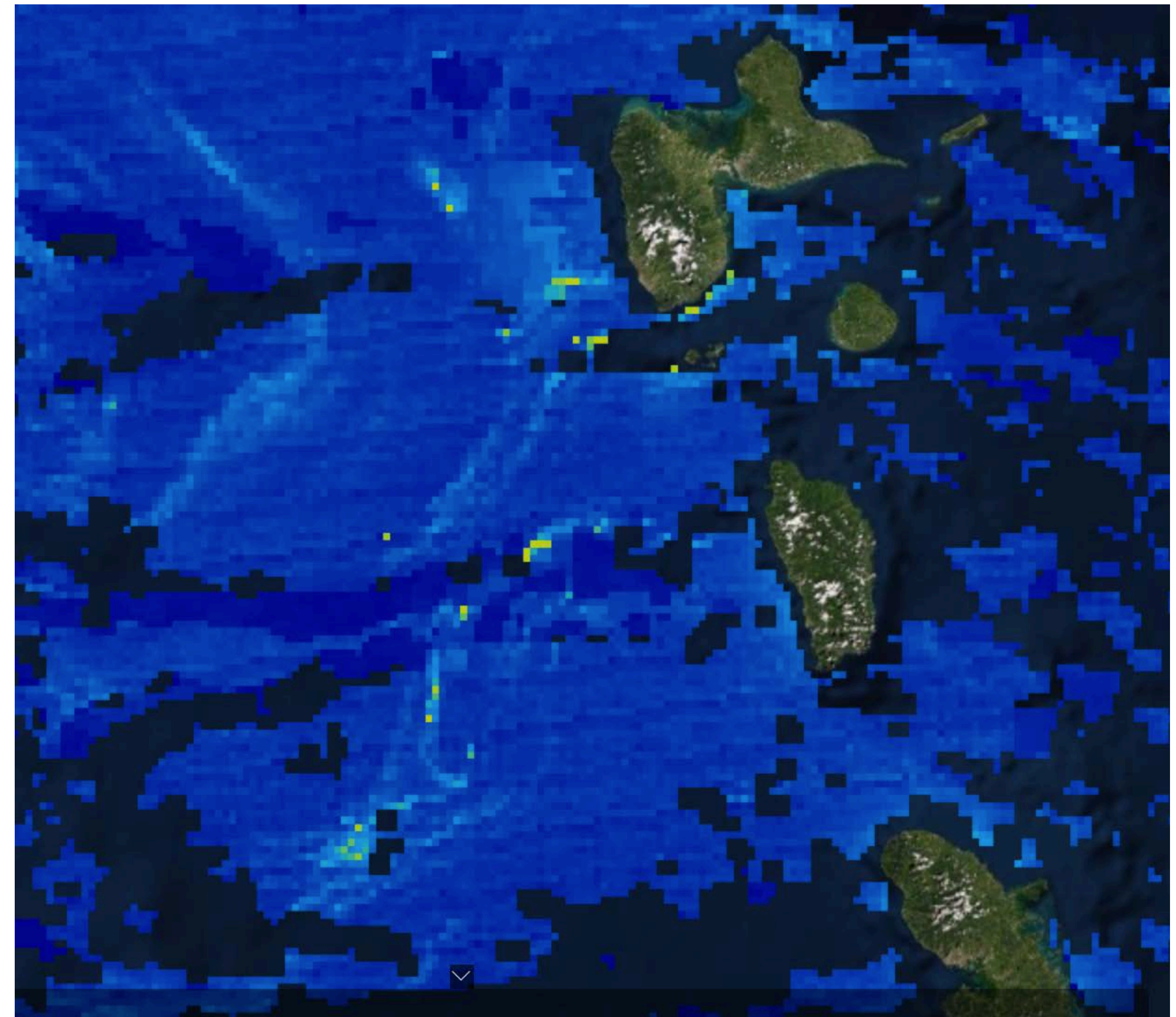
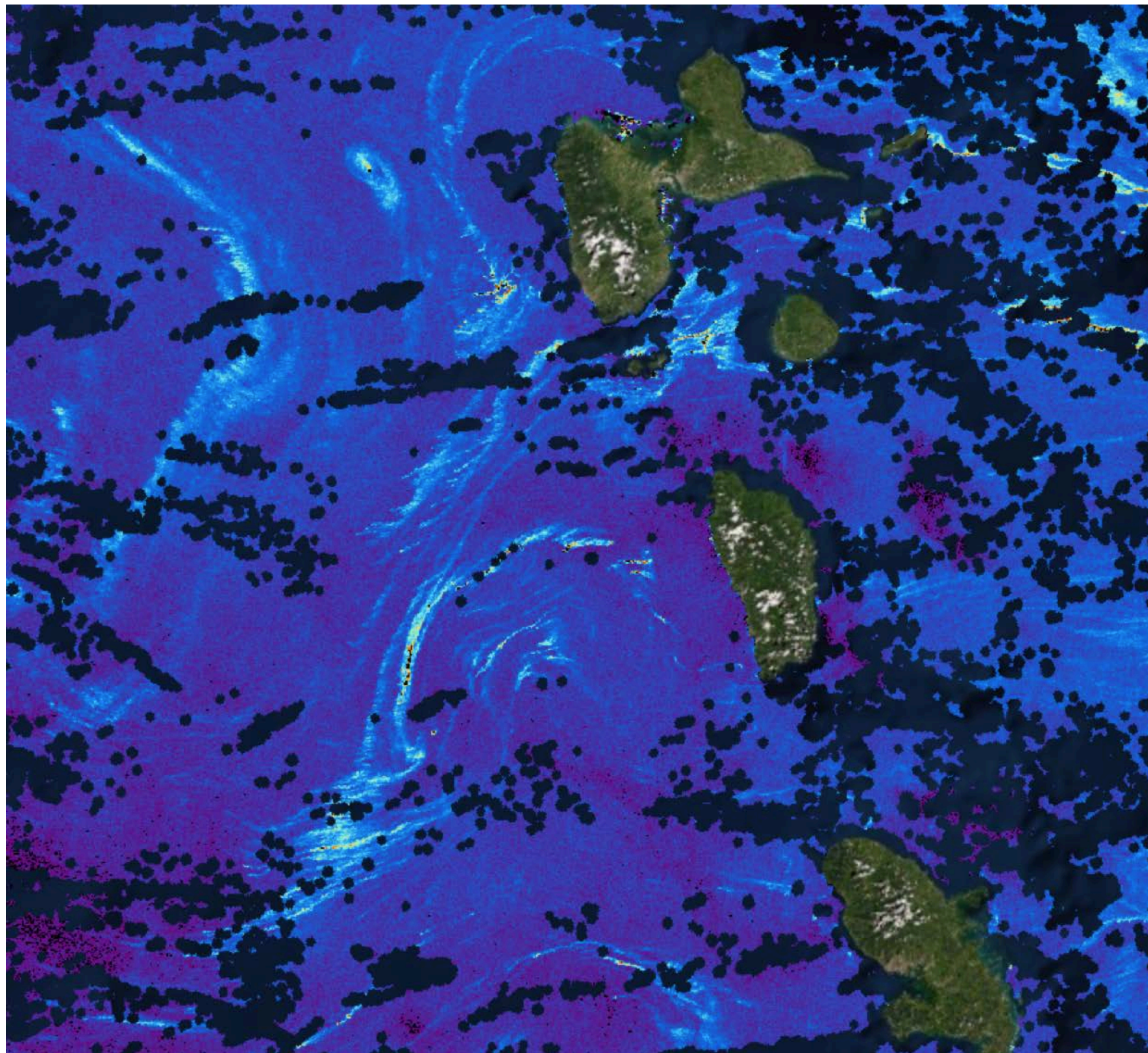
300m -> 1km (ratio:3.3)

MSI- Coastal areas

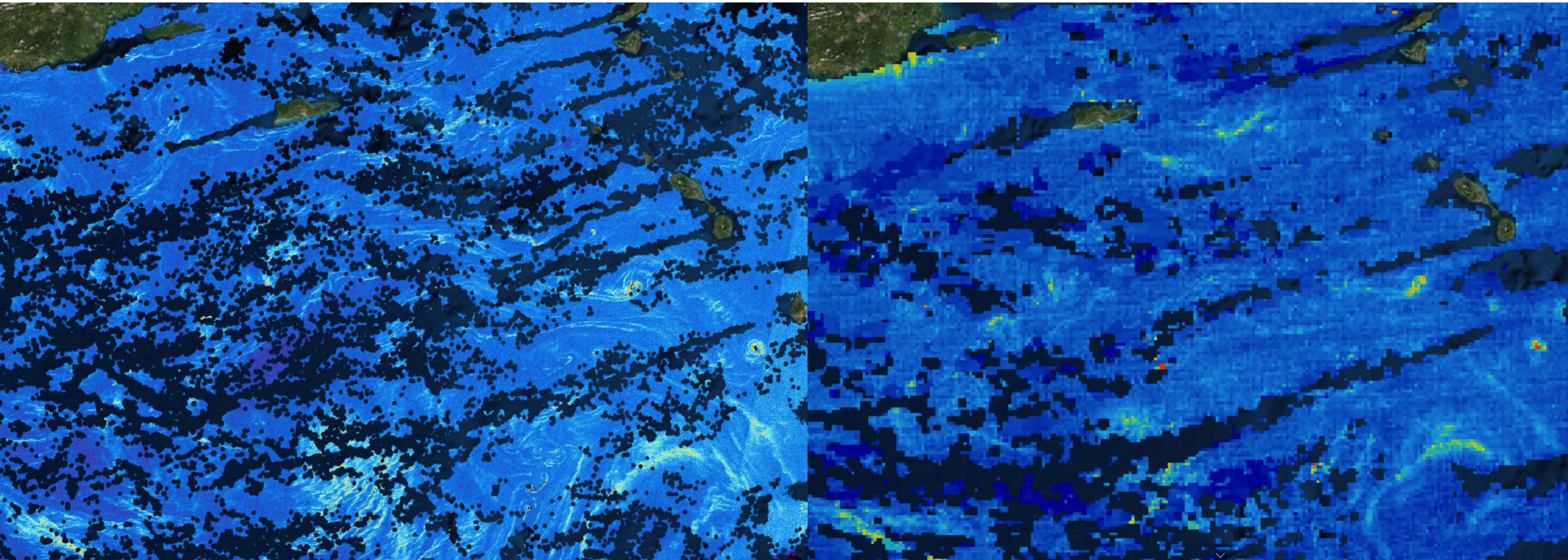


03 *Sargassum* products

Resolution:



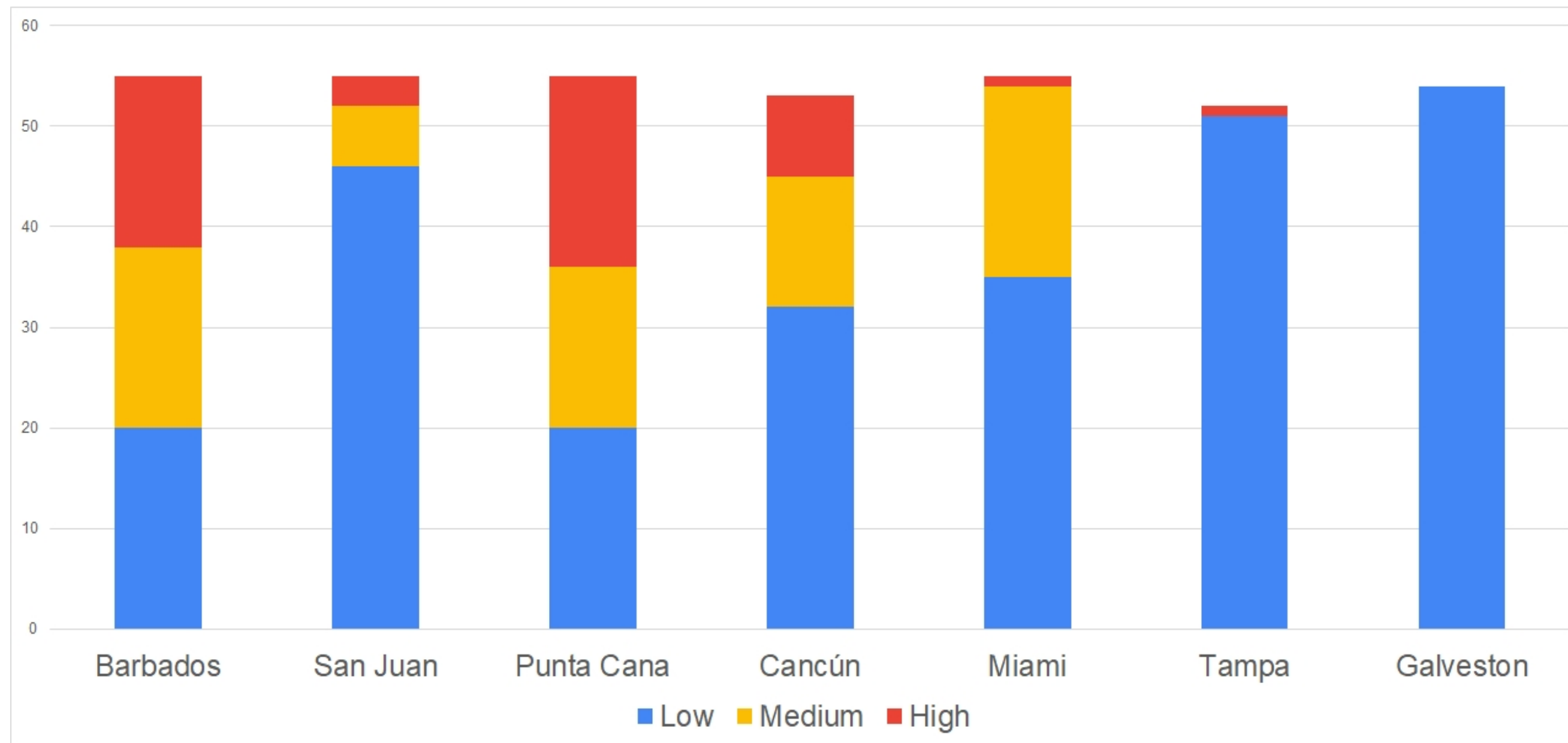
03 *Sargassum* products



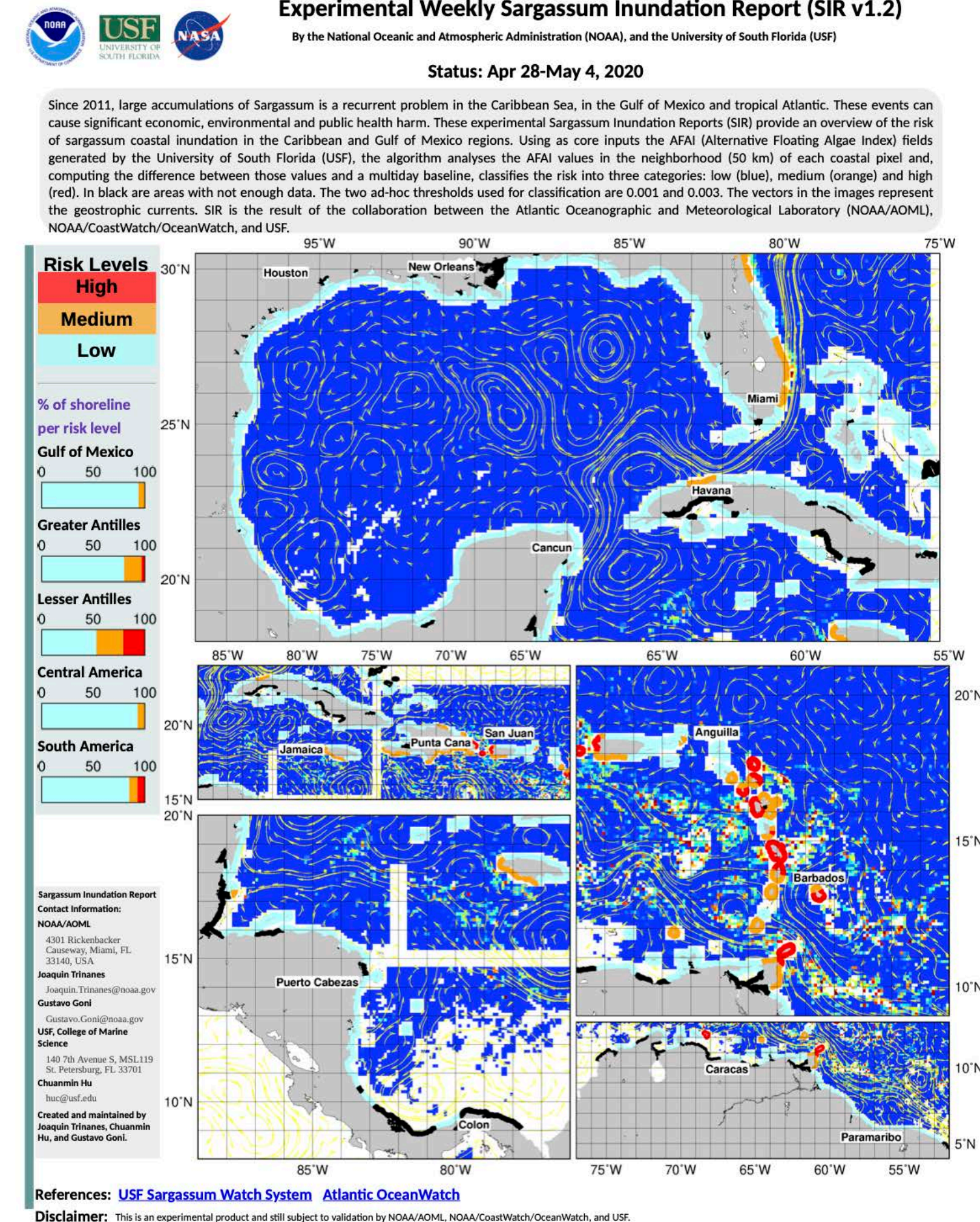
03 Sargassum products

SIR

Goals: To provide an overview of the risk of Sargassum coastal inundation in the Caribbean and Gulf of Mexico regions.



Joaquin Trinanes, N.F. Putman, G. Goni, C. Hu, M. Wang. **Monitoring pelagic Sargassum inundation potential for coastal communities.** *Journal of Operational Oceanography* Pub Date : 2021-03-18 , DOI: [10.1080/1755876x.2021.1902682](https://doi.org/10.1080/1755876x.2021.1902682)



04 Beyond satellite data

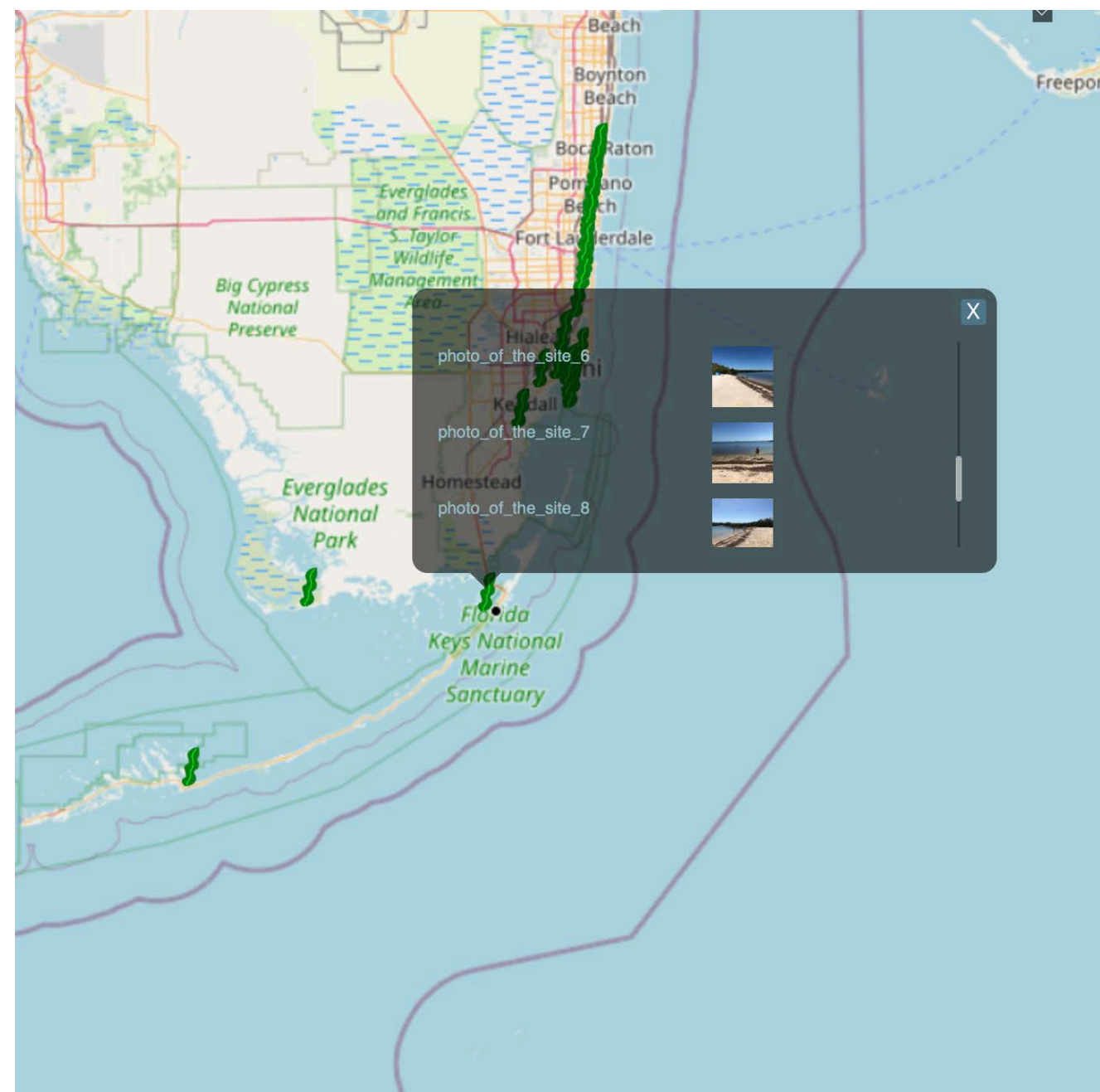
Models, analysis and overlays: OA, Fluxes, hurricane layers, EEZs, trajectories, genomics,

In-situ: Sargassum (Integration external repositories +ESRI Survey123 form). Argo, drifter, glider, XBT, CO₂ SOOP.

Machine Learning: Partial Pressure CO₂ in seawater, HABs, Sargassum detection.

Other: Visualization (Projections, basemaps, metaview, template, animations, palettes, multilayer).

Sargassum Observations In-situ Database



Survey123 Multidevice data collection






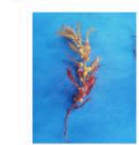









<input type="checkbox"/> Washed-up on the shore	<input type="checkbox"/> Floating along the shoreline	<input type="checkbox"/> Floating in bays, channels, harbors
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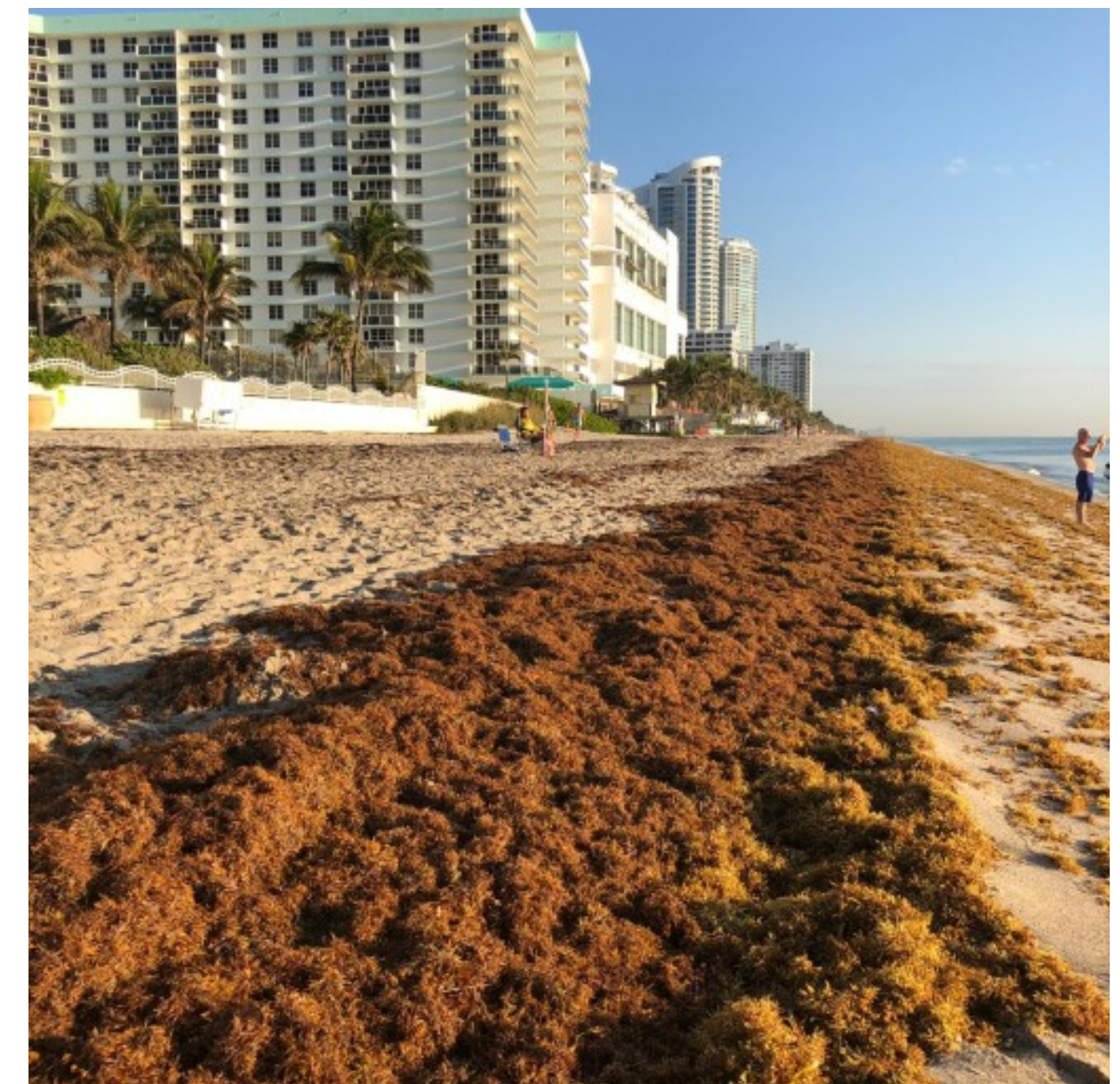
<input type="checkbox"/> Floating over reefs or seagrass	<input type="checkbox"/> Offshore
--	-----------------------------------

Sargassum Observed As

<input type="checkbox"/> Line(s) of Sargassum	<input type="checkbox"/> Mats/rafts	<input type="checkbox"/> Scattered clumps
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Species of Sargassum

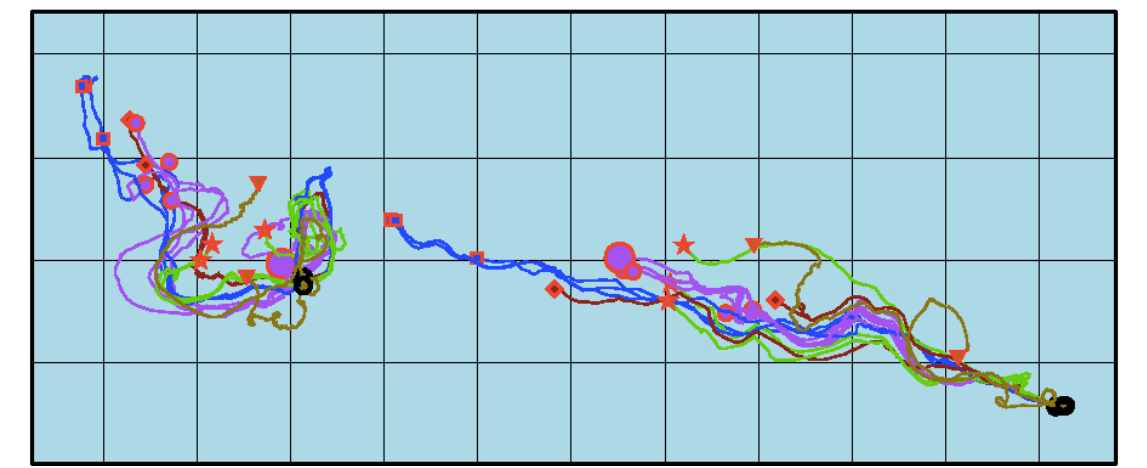
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04 Trajectory Modelling

Ocean Debris Tracking

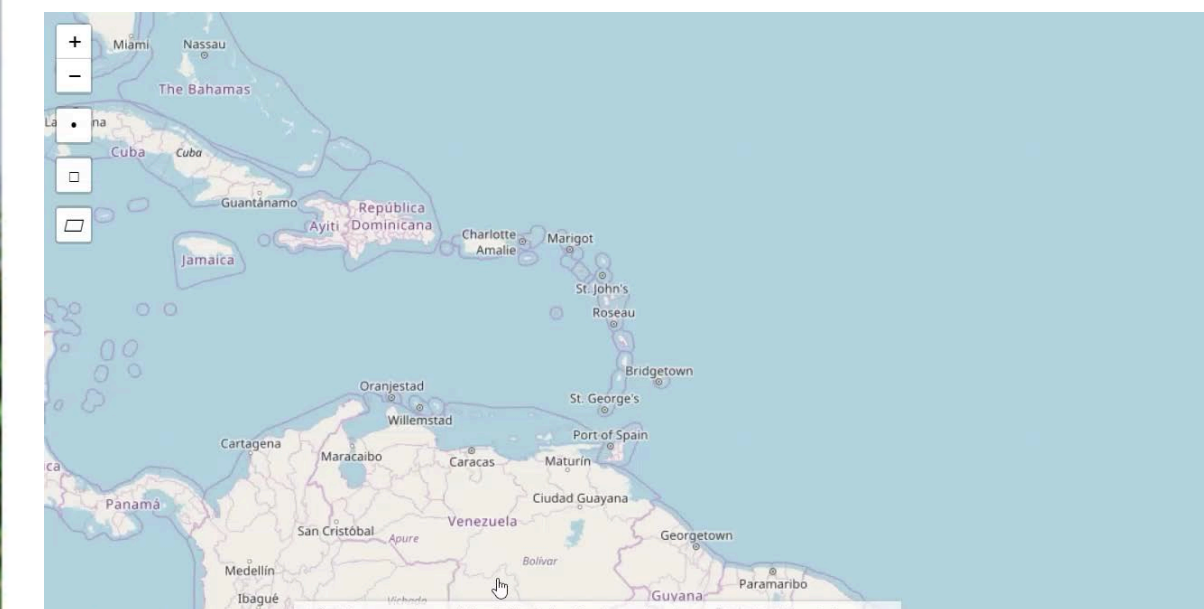
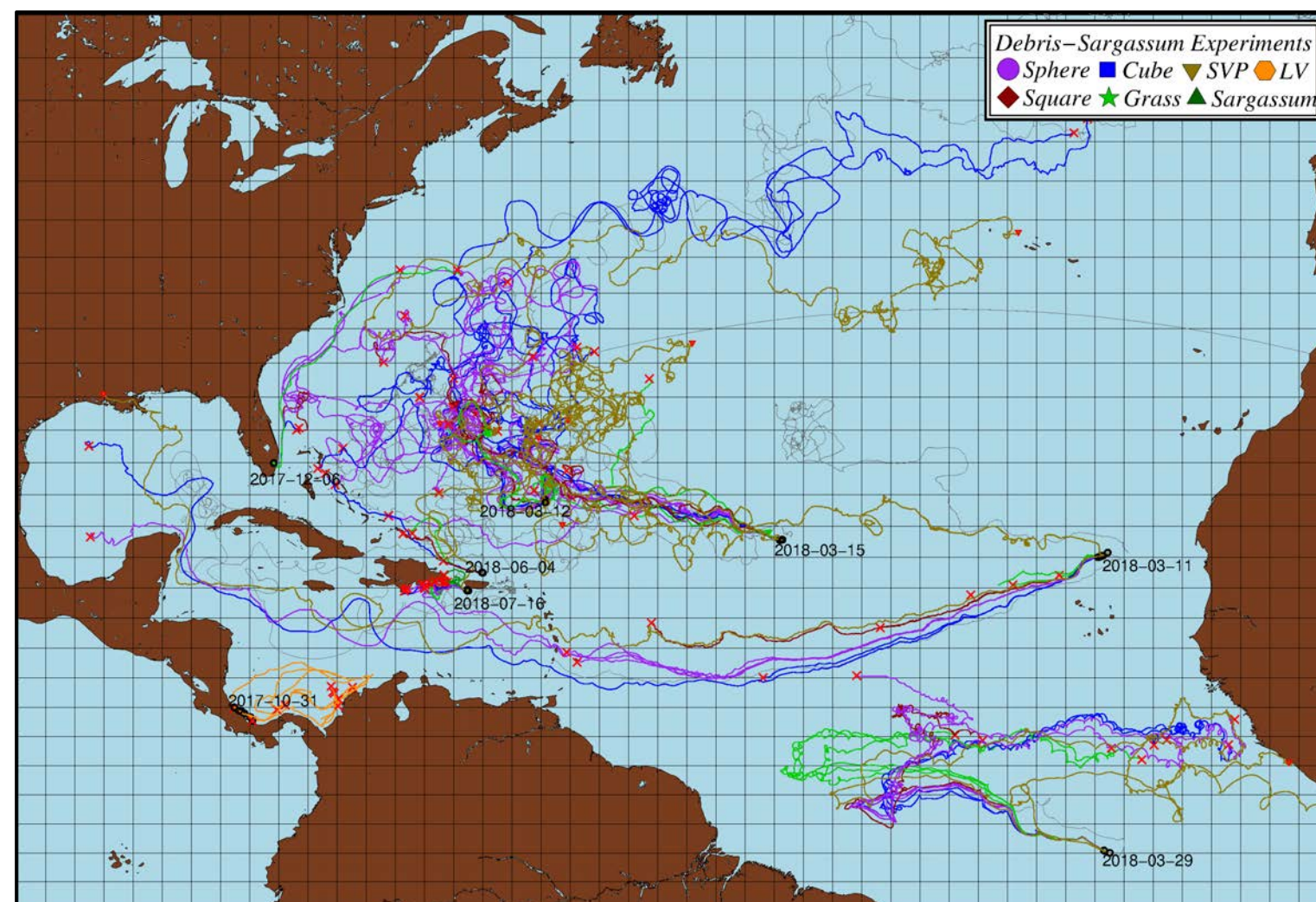
Goal: understand and assess impact of ocean dynamics and wind on sargassum (and debris in general)



Field experiments with GPS-tracked, undrogued buoys of varying shapes, simulating debris and Sargassum. This project will help us better understand the trajectories of floating debris, sargassum, and plankton including marine larva.

Putman, N.F., Lumpkin, R., Olascoaga, M.J., Trinanes, J. and Goni, G.J., 2020. Improving transport predictions of pelagic *Sargassum*. *Journal of Experimental Marine Biology and Ecology*, 529, p.151398.

Miron, P., Olascoaga, M. J., Beron-Vera, F. J., Putman, N. F., Triñanes, J., Lumpkin, R., and Goni, G. J., 2020. Clustering of Marine-Debris- and *Sargassum*-Like Drifters Explained by Inertial Particle Dynamics. *Geophysical Research L.*, 47(19), <https://doi.org/10.1029/2020GL089874>

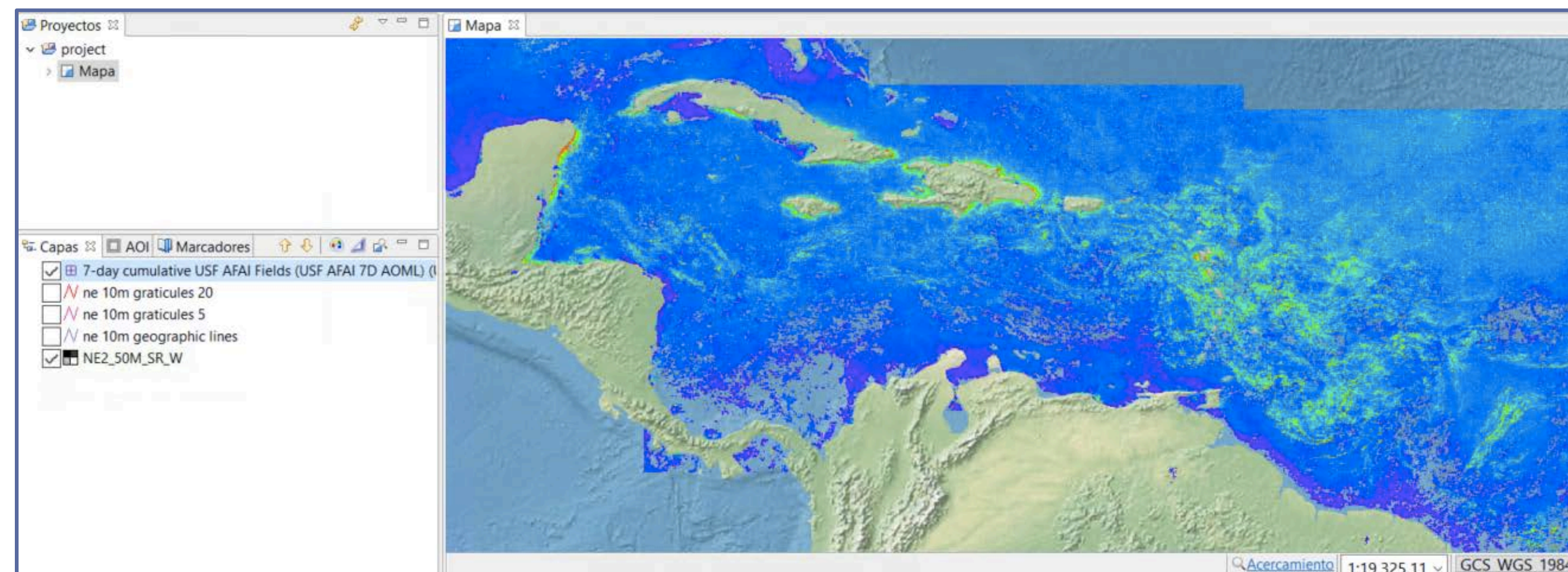


05 Data discovery, distribution, delivery

Interoperability: allows for information exchange. In our case, relies on open and machine independent standards (netCDF, CF, OPeNDAP, ...) and run within an operational framework.

Interoperability between web services that could run on different platforms, been implemented in different languages. Provide seamless and automatic connections between software applications.

Provide discovery and data&metadata retrievals (e.g. collocated with carbon measures) and backup



Clients: Matlab, Udig, Python
(Scientific.IO.NetCDF, pydap.client,
netCDF4,...), Octave, QGIS, ArcGIS, R,
Panoply, ...

Metadata is also data.

Important for Decision-support Systems

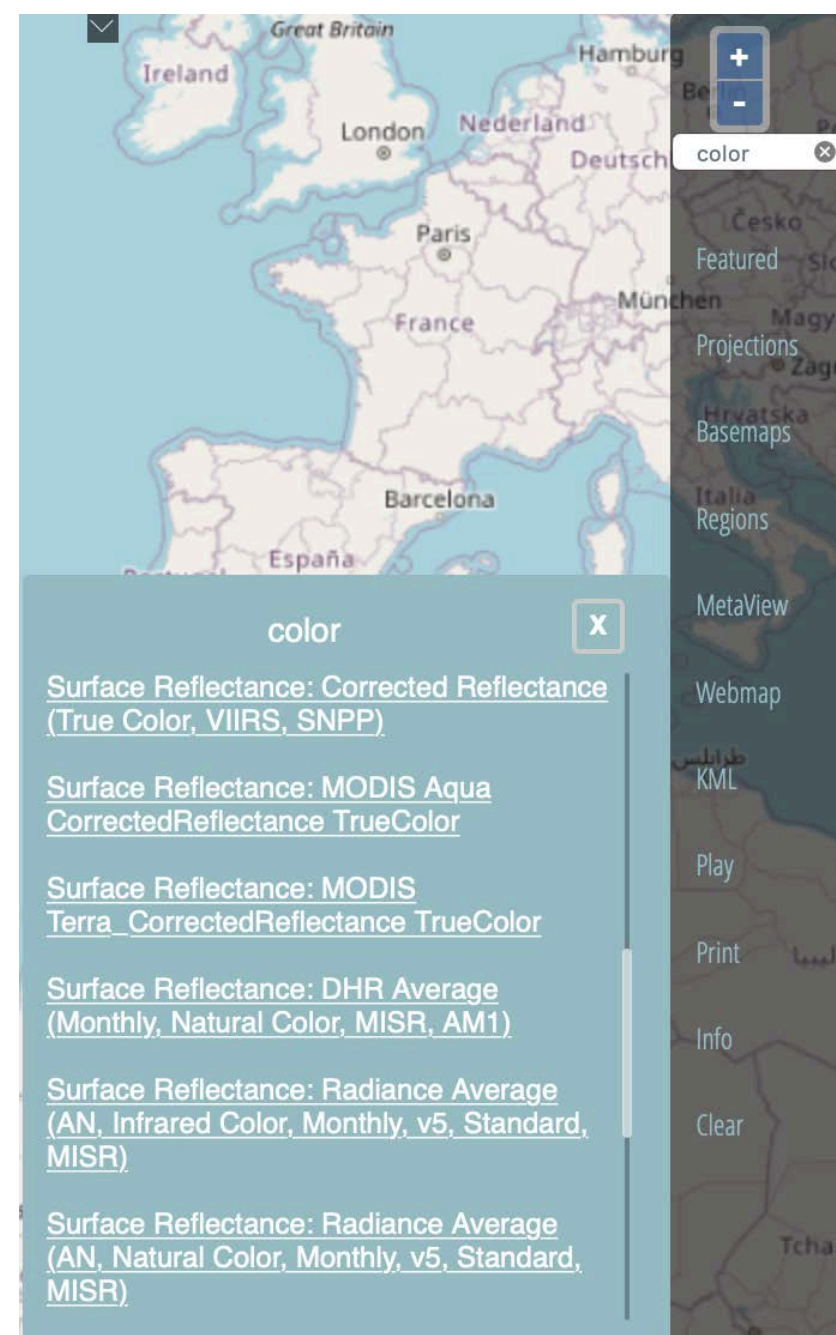
05 Data discovery, distribution, delivery

Data Discovery: Traditional TDS and ERDDAP capabilities. OV: enhanced with search capabilities and Webmap. Metadata available for evaluating data quality. Integrating OV with tool for searching in multiple ERDDAPs

Data Distribution: Interoperable tools.

Data Delivery: AOML OOS (GTS), reports, customized products (e.g. collocated with carbon measures) and backup

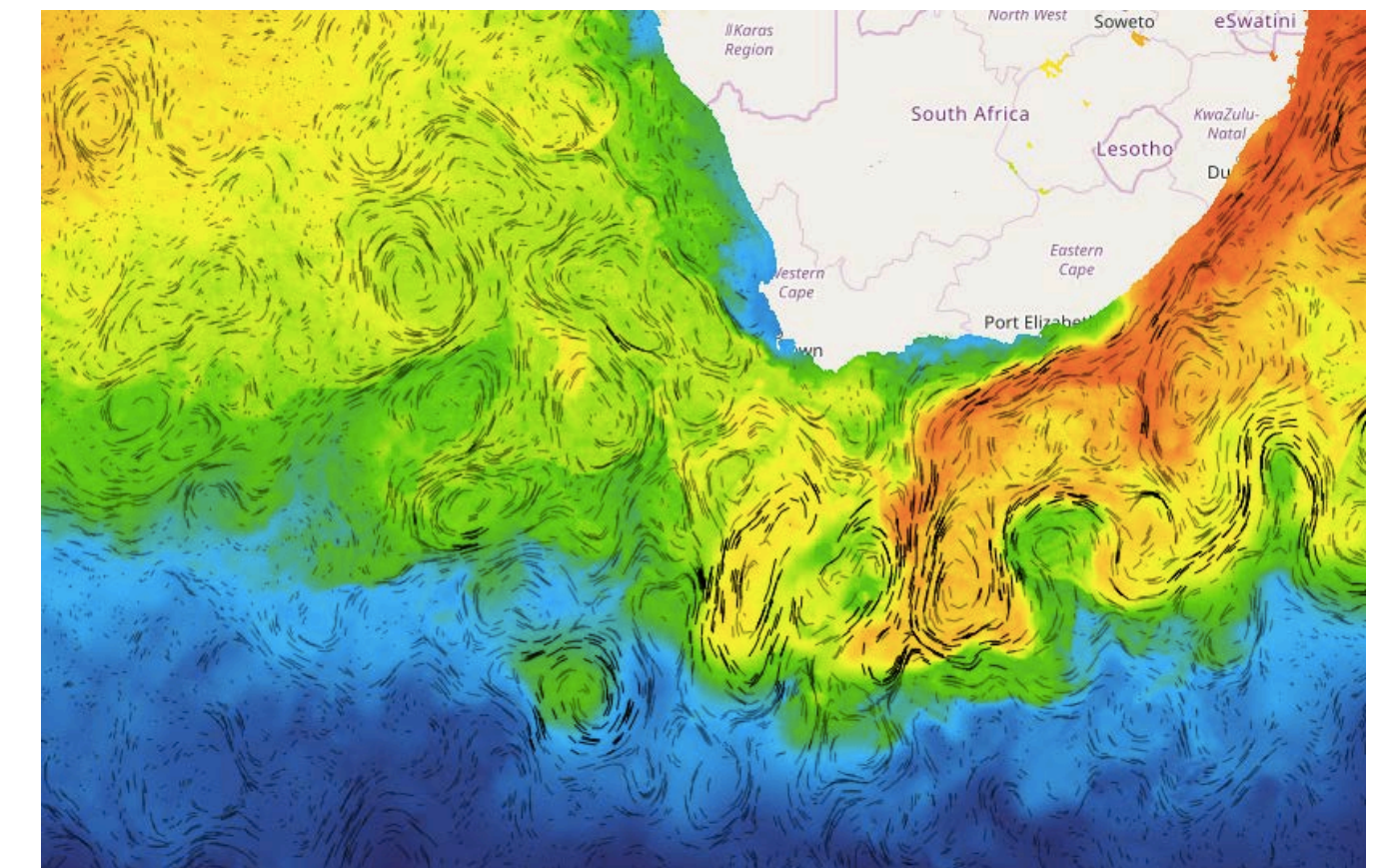
Data Discovery
Metadata search in ERDDAP/OV



Distribution
TDS/ERDDAP/OV/Tile Server

Tile Server
OCEANVIEWER
ERDDAP
TDS

Delivery
Customized products



05 Interoperable Environment

Caribbean/Gulf of Mexico Node
Physical Oceanography Division
Ocean Chemistry and Ecosystems Division

Satellite

- Regional Sea Surface Temperature
- Global Sea Surface Temperature
- Ocean Color - AOML
- Ocean Color - CoastWatch
- Ocean Color Tile Server - NOAA
- GOES True Color
- Sargassum
 - MCI 1-day
 - none
 - AOML Daily MCI

Jan 18, 2021 12:00

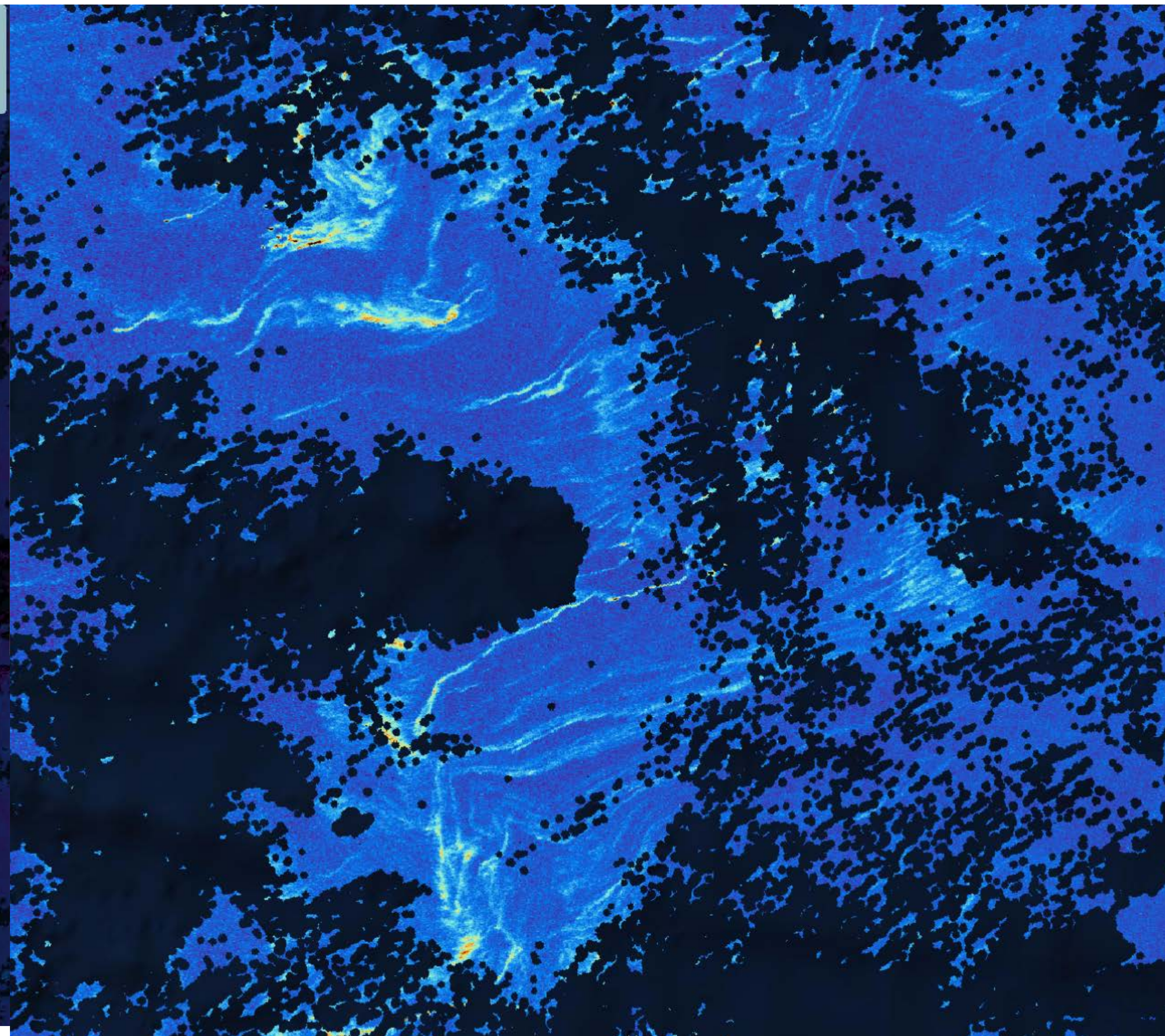
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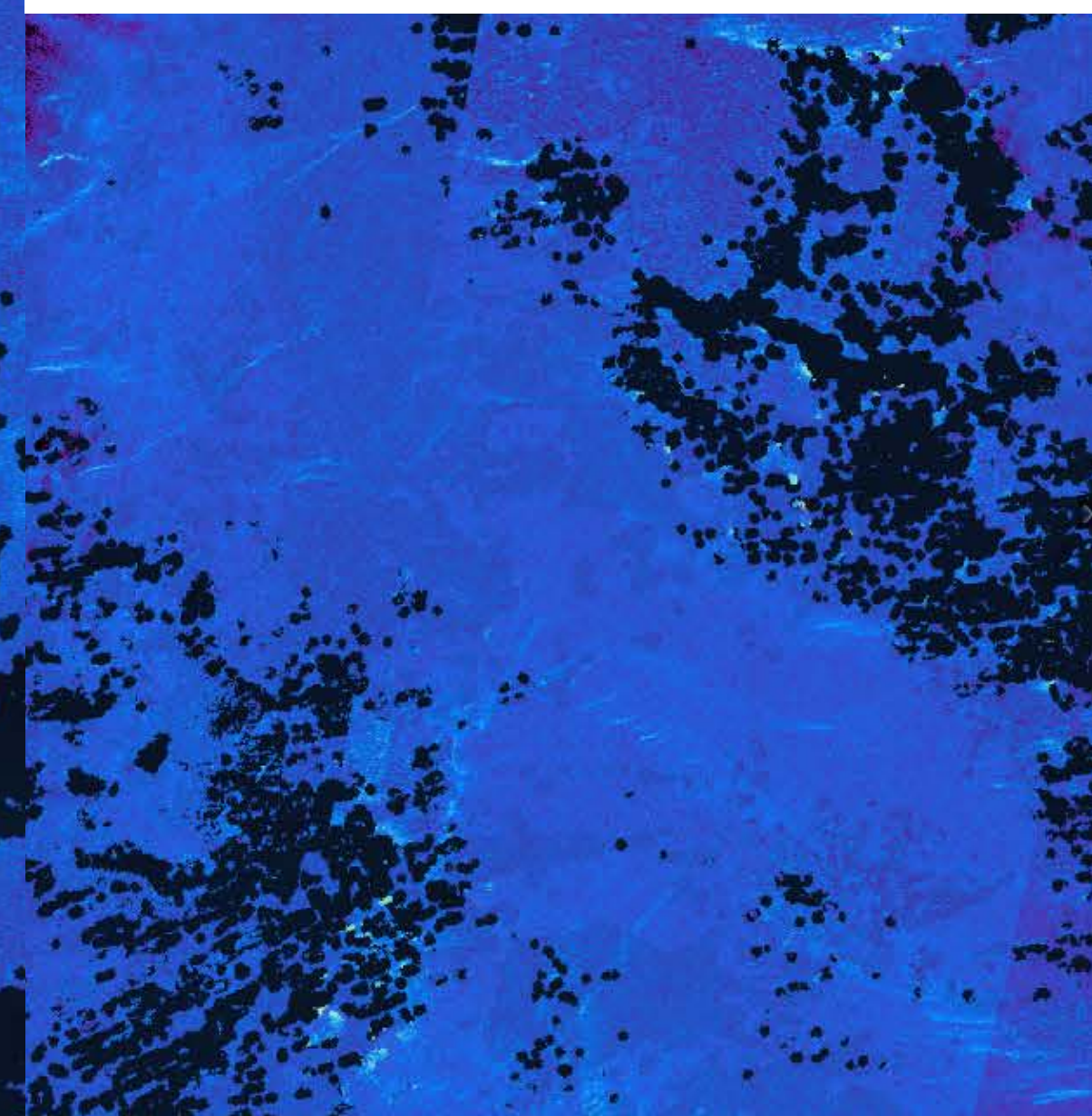
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opacity: cache:

- Regional Acidification
- Global Altimetry
- Global Carbon
- Vibrio Risk
- Global Seascapes
- Weather
- Hurricanes



Tile Server
OCEANVIEWER
ERDDAP
TDS



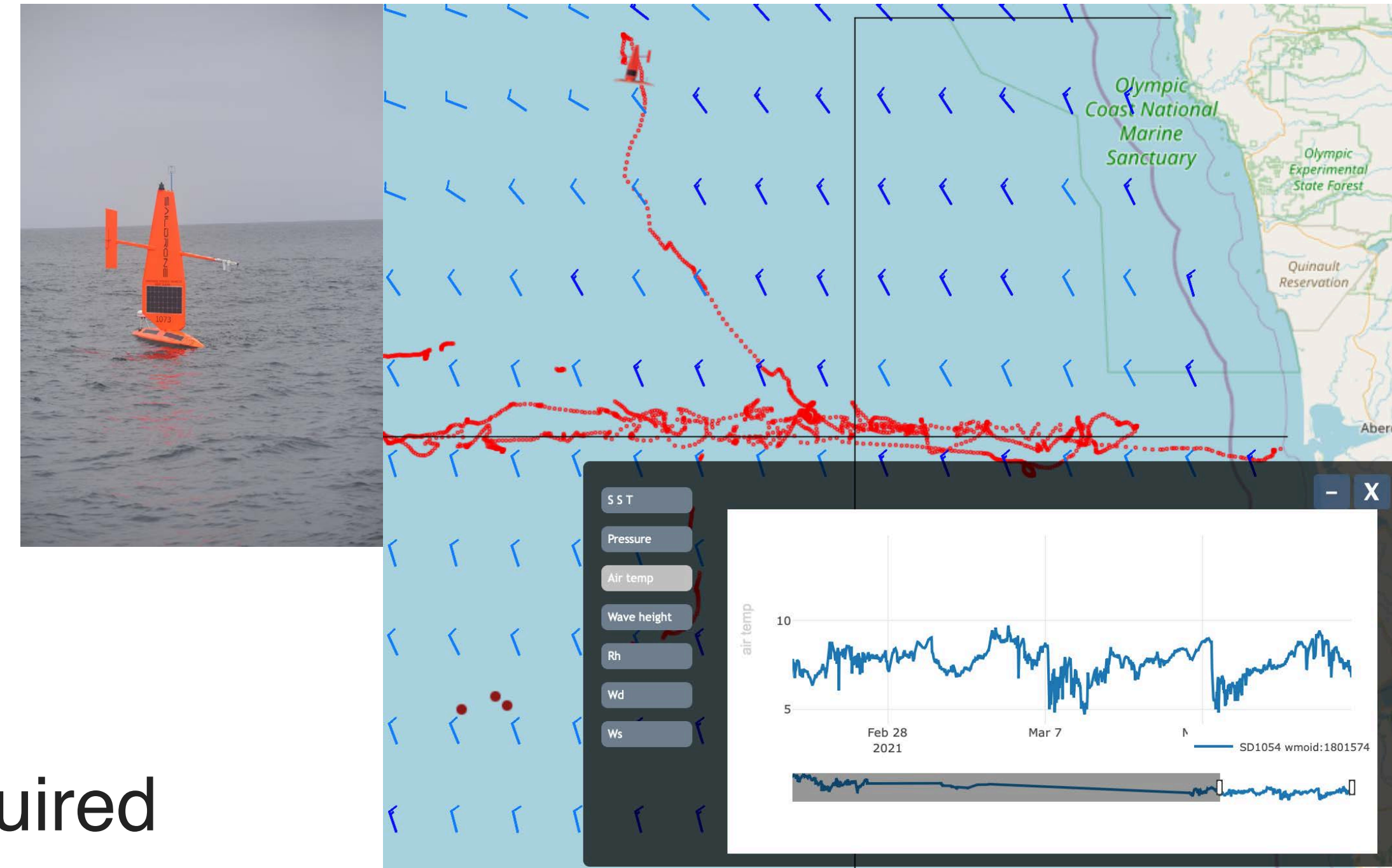
06 Current work

Integrating Sargassum products into HOV

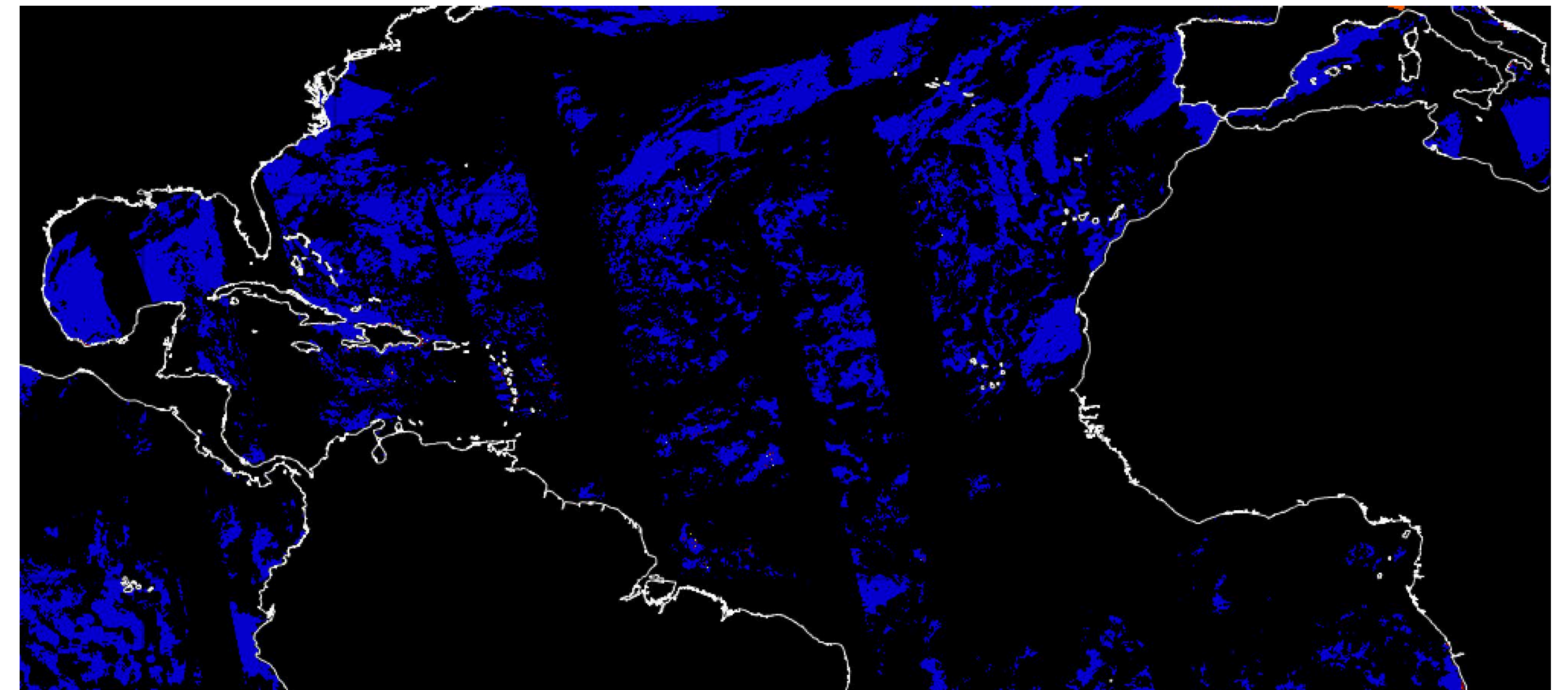
Saildrone operations

Migrating AFAI VIIRS and MODIS products to CW environment (~80% completed)

Increased spatial coverage but additional tuning required



ML- Sargassum detection (RF, ANNs)



06 Current work

Improve *Sargassum* Inundation risk model

Trajectory modelling (in general, not only for *Sargassum*). Field experiments.

Better coverage in the coastal zone:

- Ground truth (e.g. citizen science projects, beach management agencies)

- Winds

- Currents (e.g. HF radars)

- Waves

- Satellites

Enhance local and regional engagement.

Integrate RS datasets and generating vector products

Adapt data distribution and visualization interfaces

Op. Manager

Joaquin.Trinanes@noaa.gov



Atlantic OceanWatch OceanViewer

<https://cwcgom.aoml.noaa.gov>

Caribbean and Gulf of Mexico node

<https://cwcaribbean.aoml.noaa.gov>

Hurricane OceanViewer

https://cwcgom.aoml.noaa.gov/index_HOV.html

Sargassum Inundation Reports

https://www.aoml.noaa.gov/phod/sargassum_inundation_report/

Survey123

https://cwcgom.aoml.noaa.gov/survey123_sargassum.html

TDS

<https://cwcgom.aoml.noaa.gov/thredds/>

<https://oceanwatch.aoml.noaa.gov/thredds/>

ERDDAPs

<https://cwcgom.aoml.noaa.gov/erddap/>

<https://oceanwatch.aoml.noaa.gov/erddap/>