



NESDIS - Ocean Data Initiatives and the Future of NOAA Observing Systems

National Environmental Satellite,
Data, and Information Service

01/30/2024

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and Information Services



NOAA Priorities

Science, Service, and Stewardship



CLIMATE

Establish that NOAA is **the authoritative source** for climate products and services that can be applied to a diverse range of missions.



BALANCE

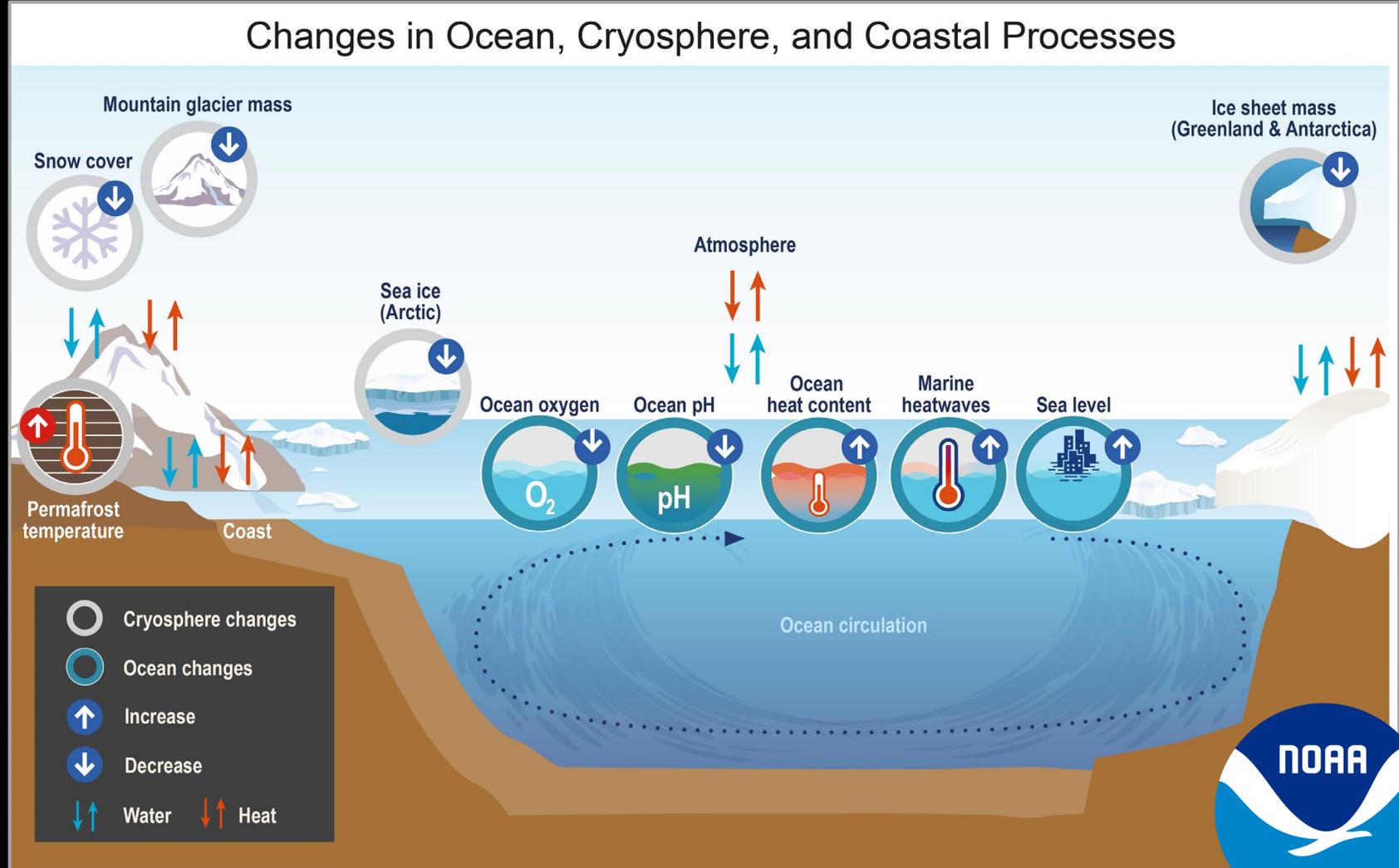
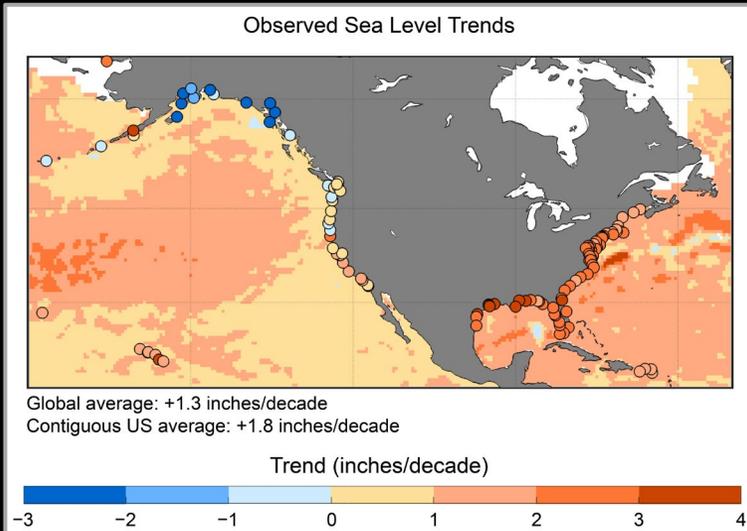
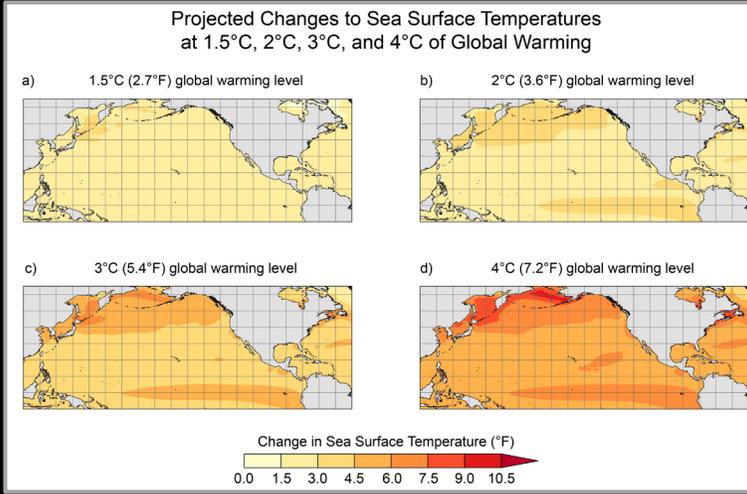
Advance NOAA's complementary work on **environmental stewardship and economic development** with a particular focus on the New Blue Economy.



EQUITY

Exhibit equity in how NOAA builds and provides services. Promote diversity, equity, inclusion, and accessibility in the workforce. Provide **equitable access to NOAA products and services**.

USGCRP Fifth National Climate Assessment – NCA5 Highlights the Urgency of Our Mission



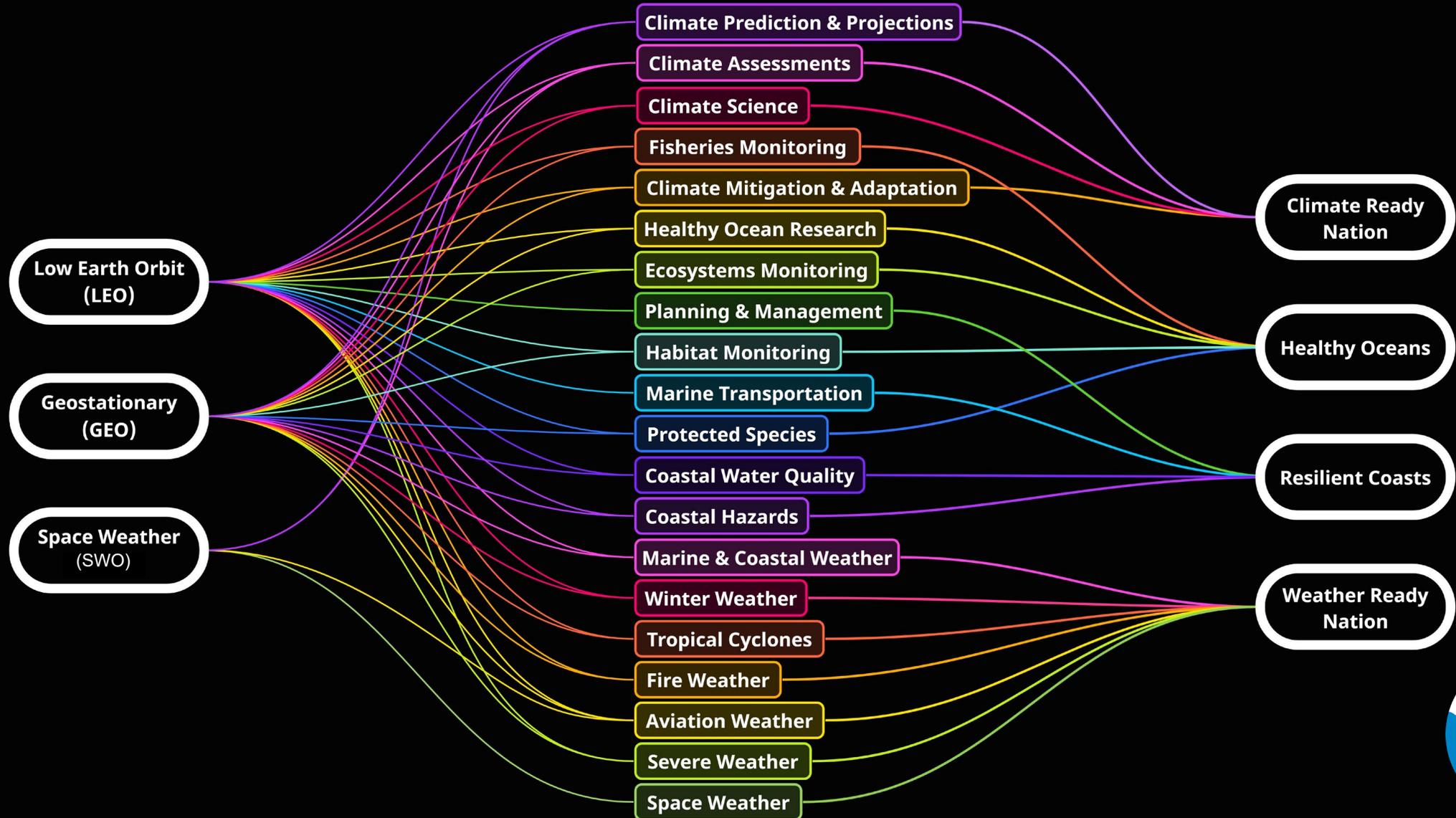
NOAA's data collection and observational capabilities have never been more critical or in demand.



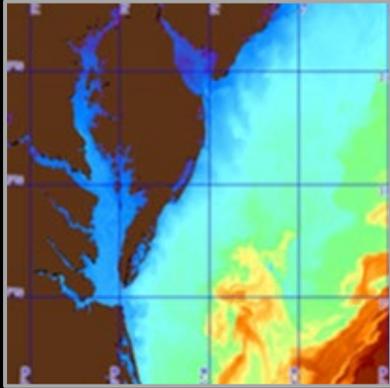
**How do we build, grow,
and connect these systems
to meet the moment?**



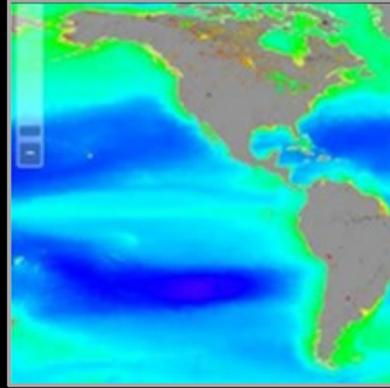
NESDIS Missions Enable the Full Spectrum of Climate Resilience, Ecosystem Awareness, and Adaptation



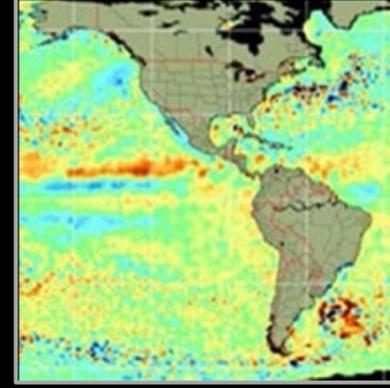
Current Essential Ocean Satellite Measurements



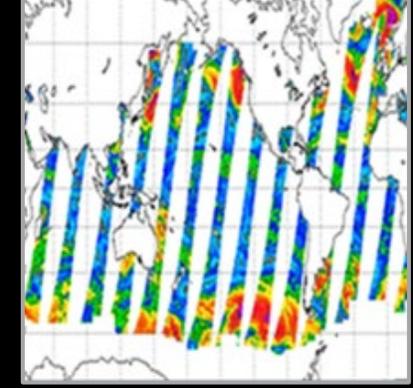
Temperature



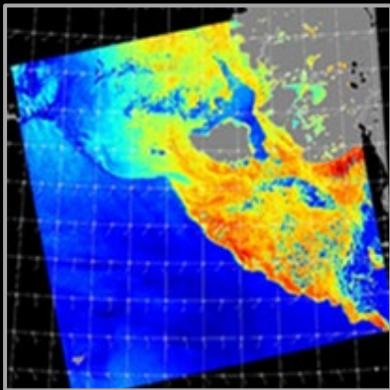
Ocean Color



Altimetry



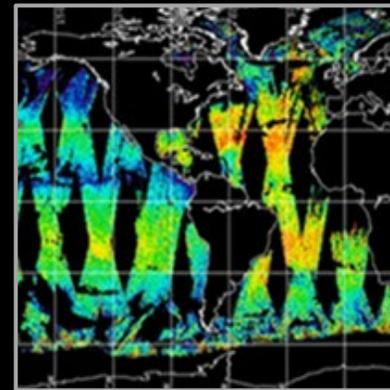
Ocean Vector
Winds



Synthetic
Aperture Radar



Sea Ice



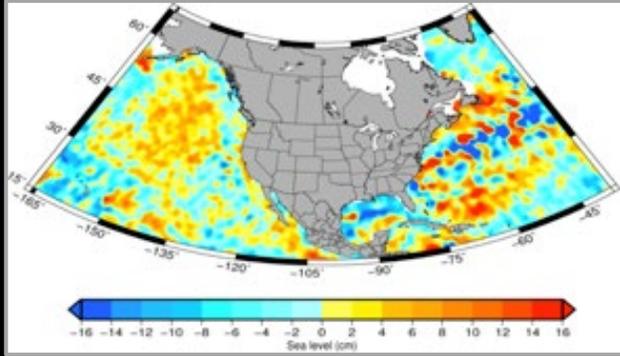
Salinity



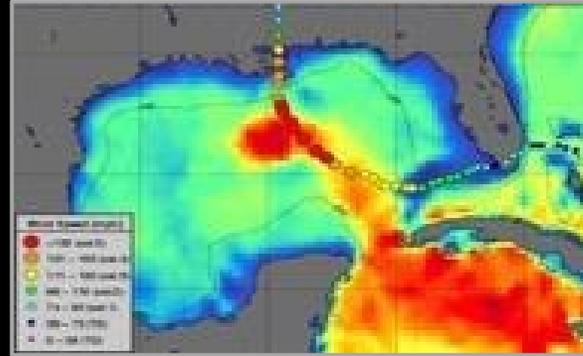
Imagery

Selected NESDIS Satellite Ocean Product Uses

Operational ocean modeling
(NWS, NOS, JPL, USN)



Hurricane Intensity
Forecasting (NHC)



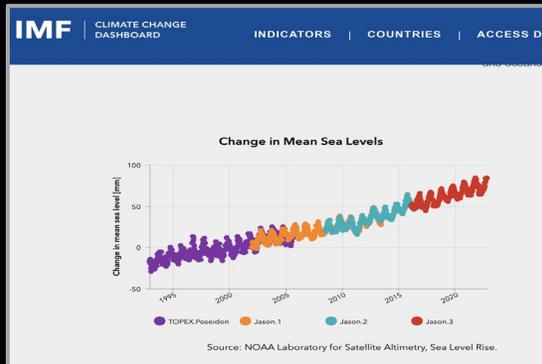
Fisheries Management
(NMFS)



High Wave Forecasting
(NWS)



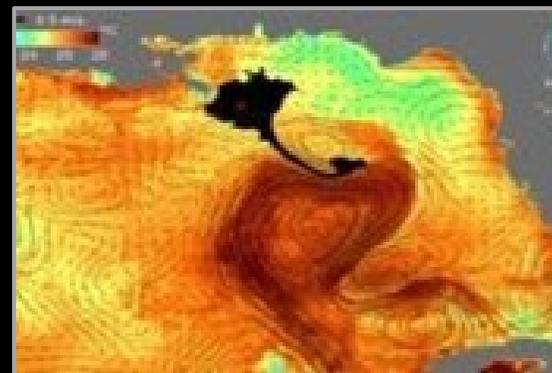
Climate indicators (State of
the Climate, EPA, IMF)



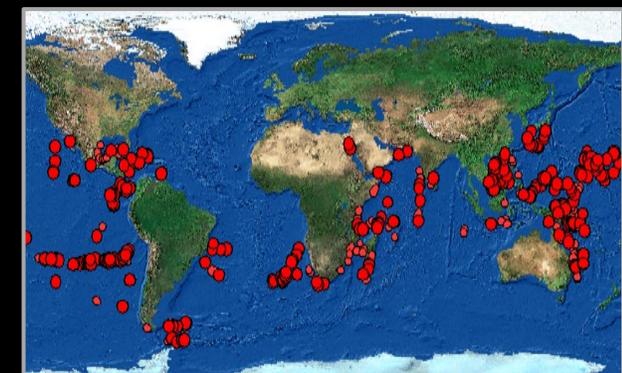
Search & Rescue
(Coast Guard)

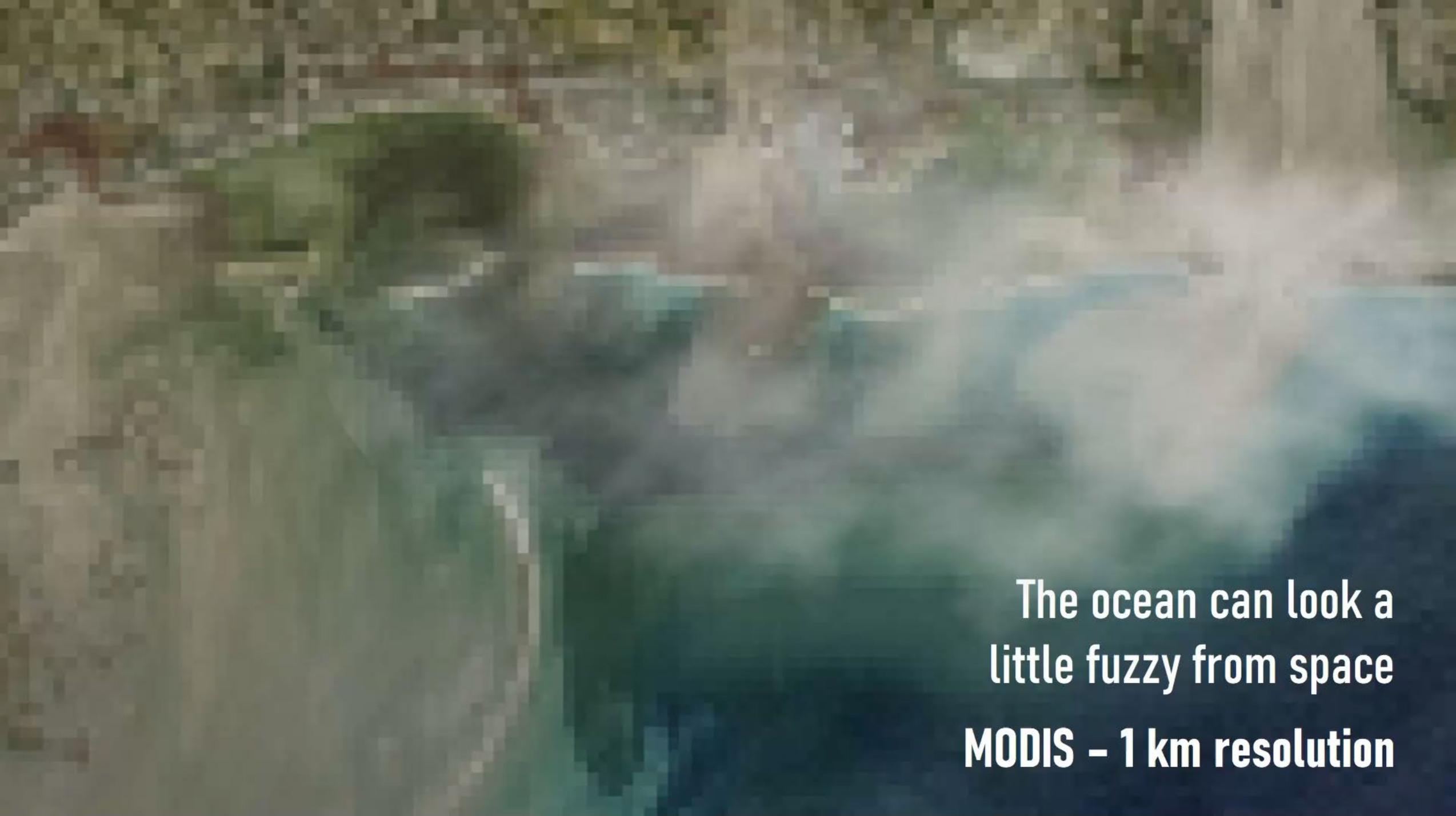


Oil Spill Monitoring
(NOS)



Navigation
(Navy)





The ocean can look a
little fuzzy from space
MODIS – 1 km resolution

GeoXO Constellation



GEO-West

Visible/Infrared Imager
Lightning Mapper
Ocean Color



GEO-Central

Hyperspectral Infrared Sounder
Atmospheric Composition
Partner Payload



GEO-East

Visible/Infrared Imager
Lightning Mapper
Ocean Color



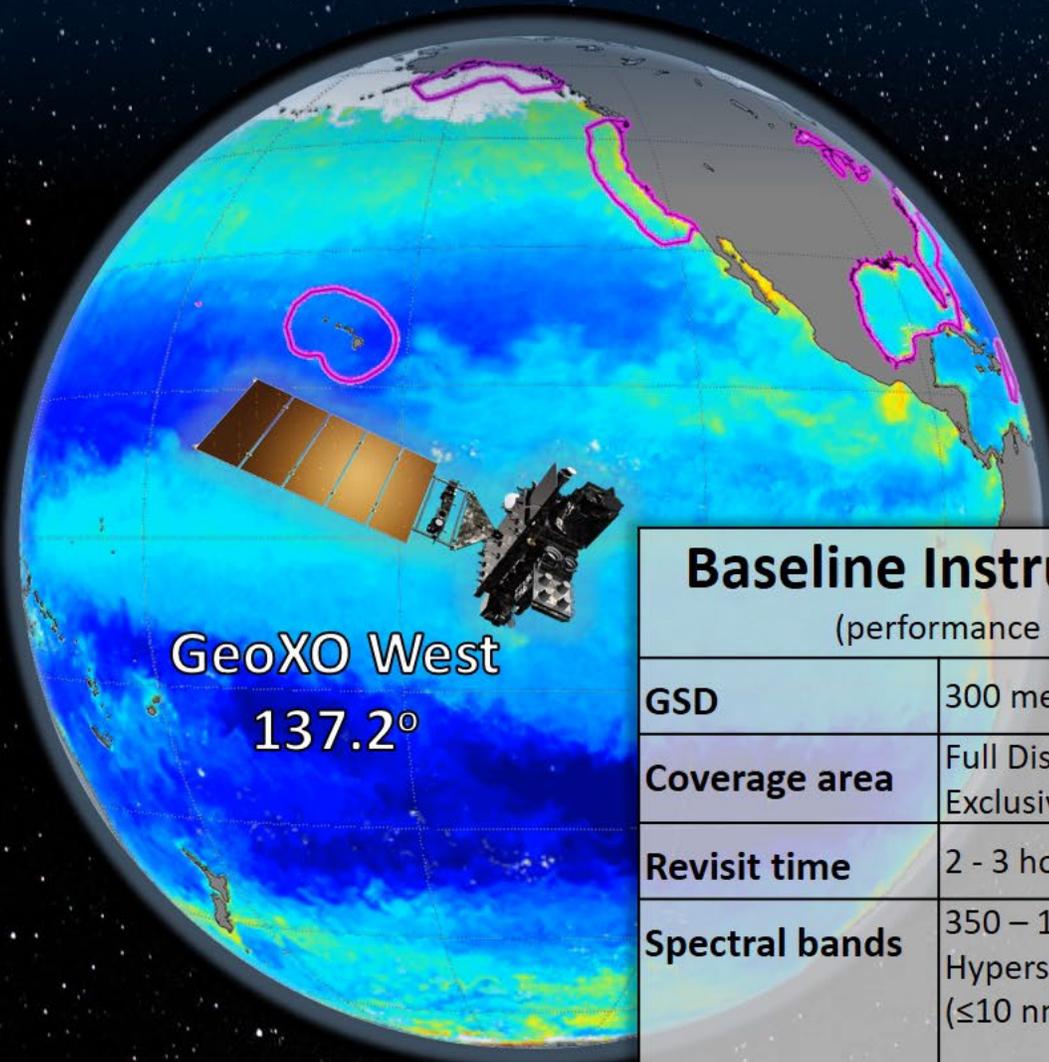
NOAA Satellite Operations
Facility, Suitland MD
Command and Data Acq.
Station Wallops VA



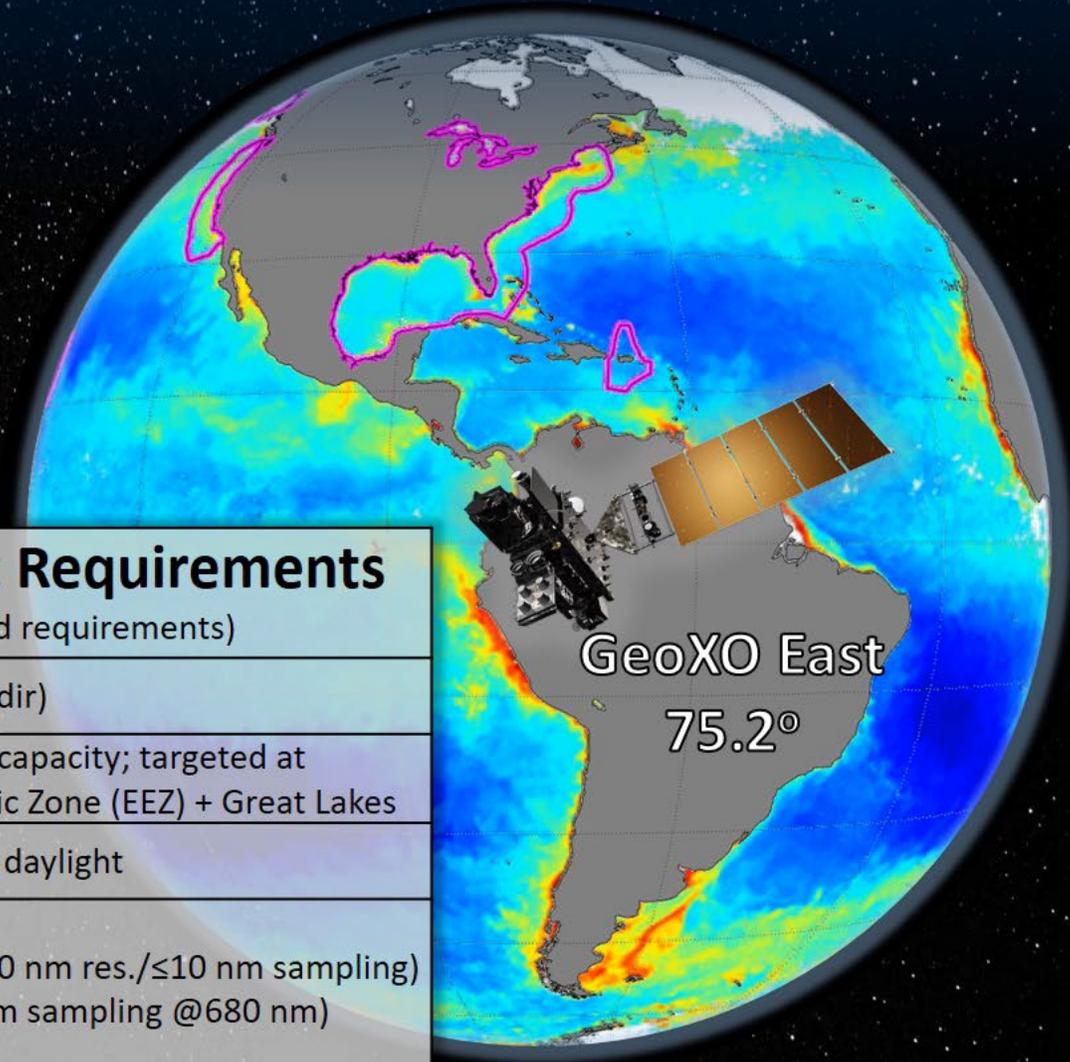
Consolidated
Back-Up,
Fairmont WV



OCX – next gen ocean color sensors aboard GeoXO



GeoXO West
137.2°



GeoXO East
75.2°

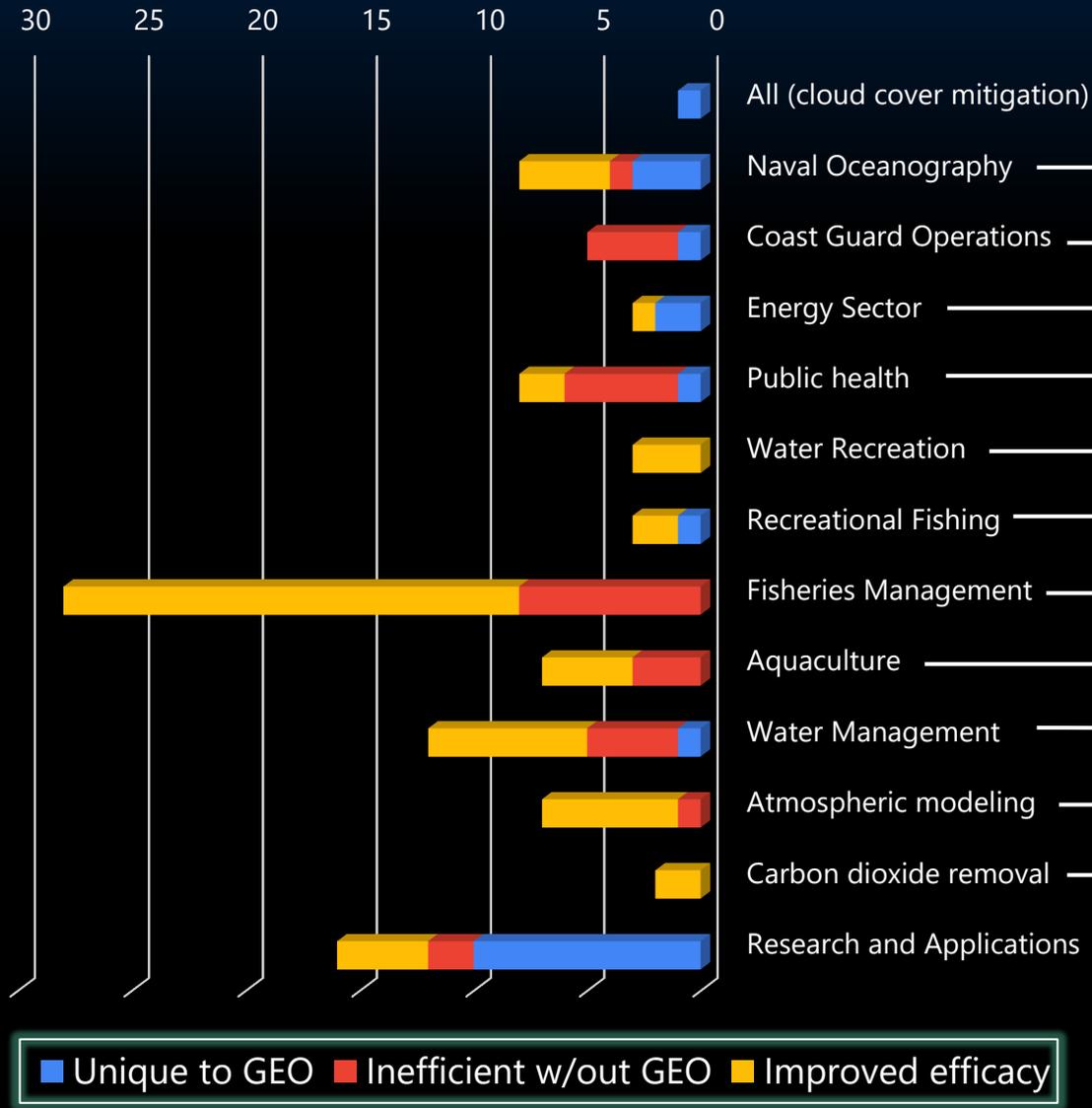
Baseline Instrument Requirements

(performance may exceed requirements)

GSD	300 meters (at nadir)
Coverage area	Full Disk pointing capacity; targeted at Exclusive Economic Zone (EEZ) + Great Lakes
Revisit time	2 - 3 hours during daylight
Spectral bands	350 – 1020 nm Hyperspectral (≤ 20 nm res./ ≤ 10 nm sampling) (≤ 10 nm res./ ≤ 5 nm sampling @680 nm)
Signal:Noise	$\geq 600:1$ between 0.350 and 0.890 μm , with achievable SNR reported up 1.02 μm



Over 100 applications enabled/enhanced by Geostationary Ocean Color observations

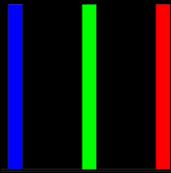


- Optical communications, diver visibility
- Search and rescue, debris tracking, sea fog
- Kinetic energy spectra, windfarm impact
- HAB/vibrio forecasts, flood mapping
- Sargassum forecasts, water clarity
- Fish habitat preference, frontal boundaries
- Trophic energy potential, habitat indices, end-to-end ecosystem models, risk indicators, overfishing estimates, dynamic management
- Effluent tracking, siting, HAB/SPM advisories
- Dredging, trophic state index, hypoxia models, wastewater contamination, cyanobacteria
- Heat capacity, isoprene, ice-nucleation, hygroscopicity of aerosolized organic matter
- CDR monitoring, seaweed CDR harvest
- Photophysiology, BRDF, validation of models, pCO2 flux, photodegradation, migration

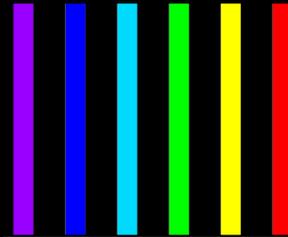
Living a Hyperspectral Data World



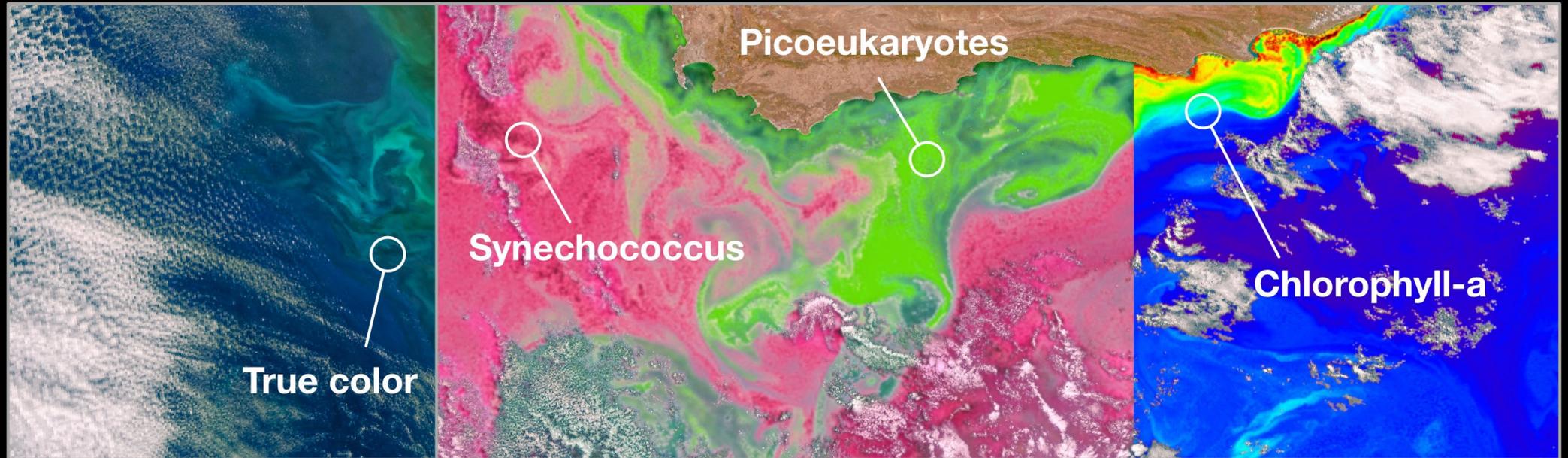
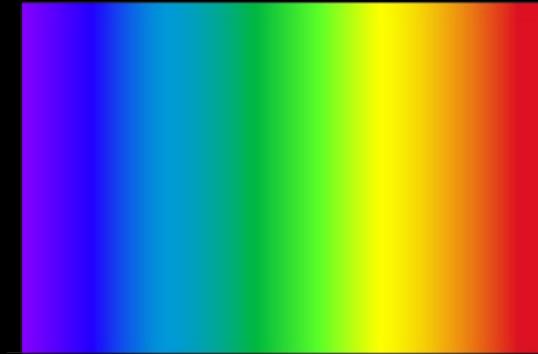
RGB



Multispectral



Hyperspectral

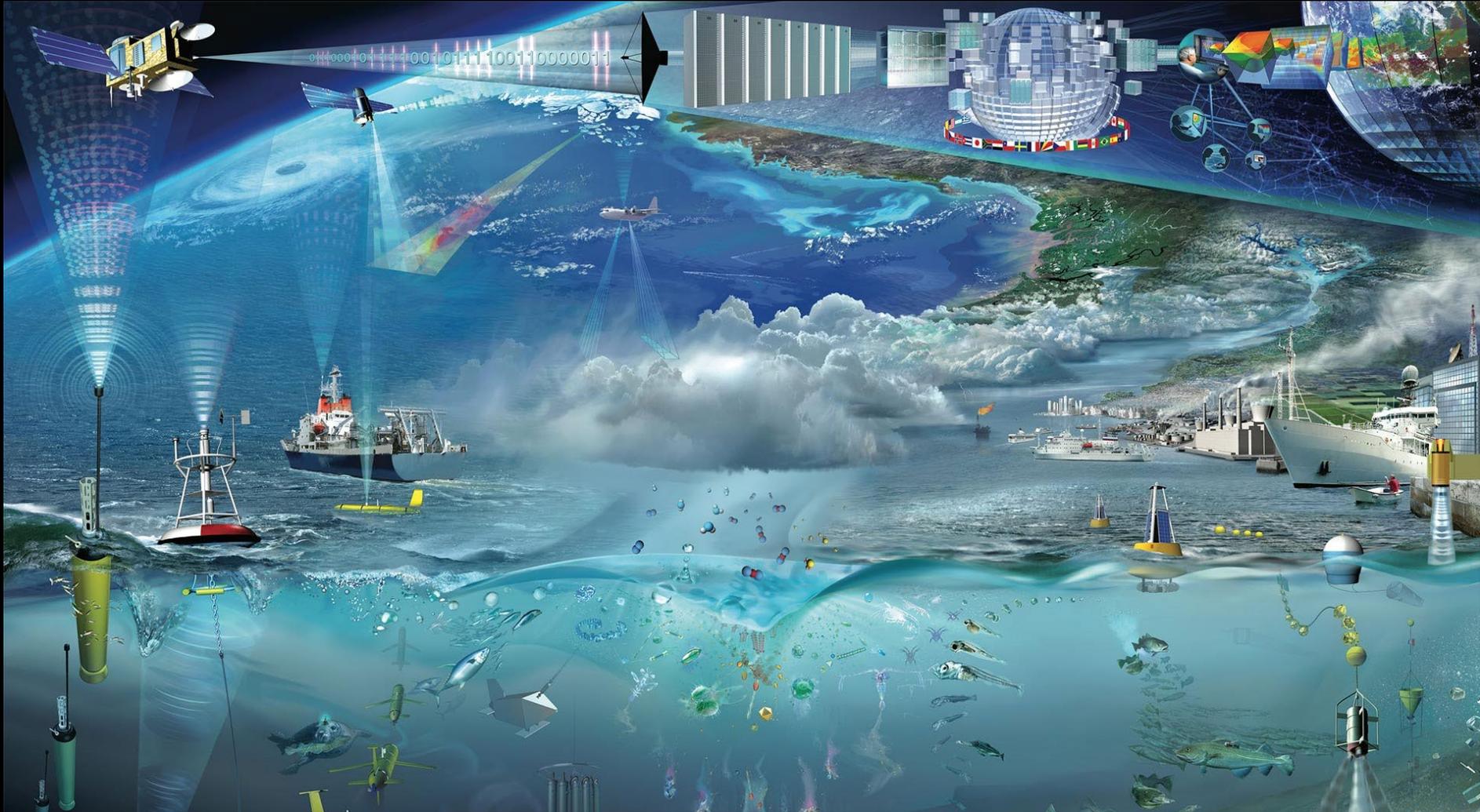


A Next Generation Ocean Calibration Network

We need to be able to measure water color in high spatial resolution at and around the locations where and when in situ observations and water samples are being collected.

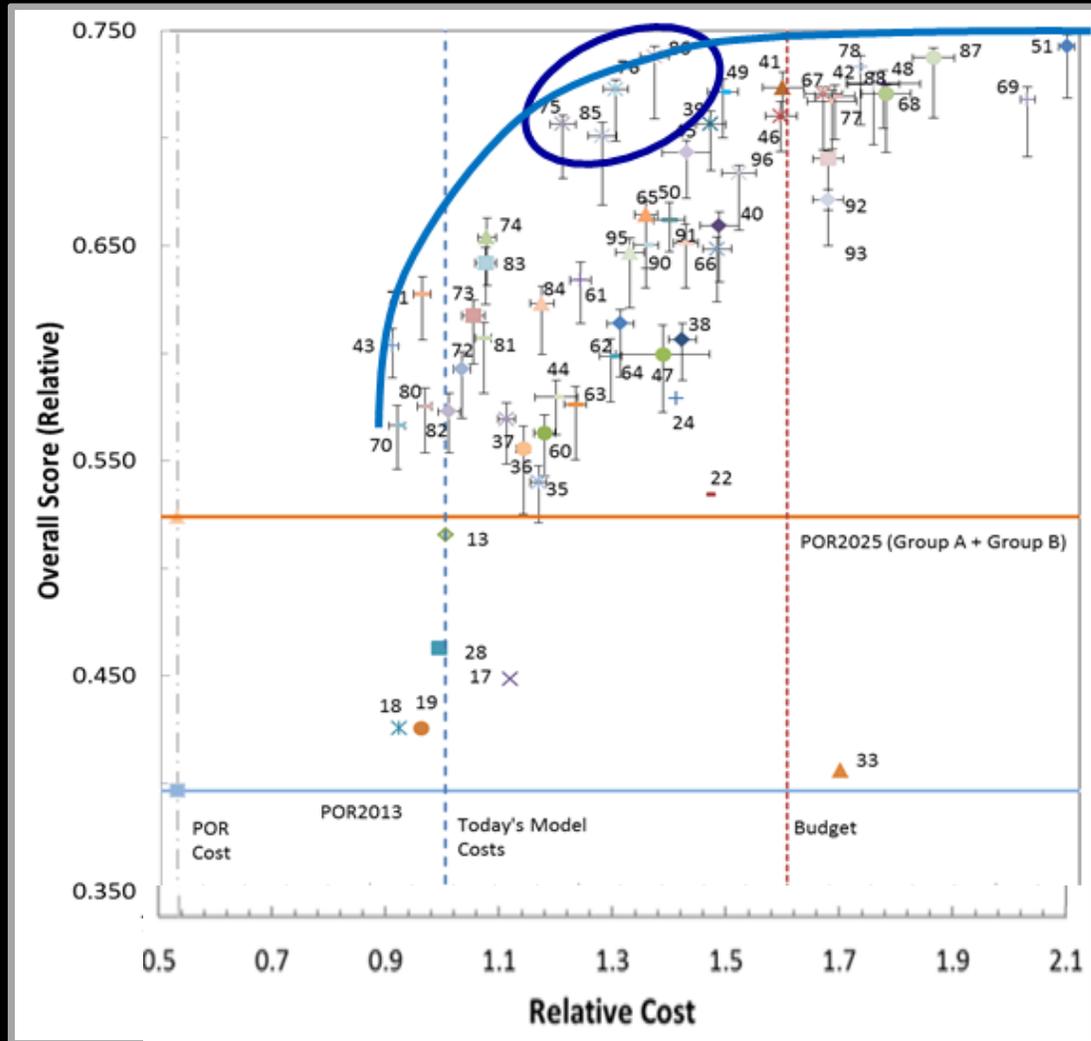


An Integrated Global Ocean Observing System is Needed



How do we get there?

NSOSA Objective: To Define the Path for Future Systems



Conduct Essential Study Pre-Work

- Identify current and future mission needs, including extensive user engagement
- Identify driving trends in technology, observing systems, IT, modeling, ...
- Identify current and future partner and commercial trends and intentions

Study Execution & Outcomes

- Include extensive community engagement throughout
- Numerous architectures should be developed, to understand the range of options and costs
- Candidate architectures consider performance, risk, and cost
- Study produced significant separation by mission type, risk, philosophy ... and path forward

NSOSA Study – Identified Observational Objectives

3-D Winds

Real Time (RT) regional weather imagery

Global GNSS-RO soundings

Global RT imagery

Global Near RT microwave (MW) soundings

Global Near RT infrared (IR) soundings

Global ocean surface vector winds

Non-RT global weather imagery

Global ocean color/phytoplankton composition

Microwave imagery

Lightning

Radar-based global precipitation rates

Regional MW soundings

Regional IR soundings

Global sea surface height

Global chemical concentration

Ozone

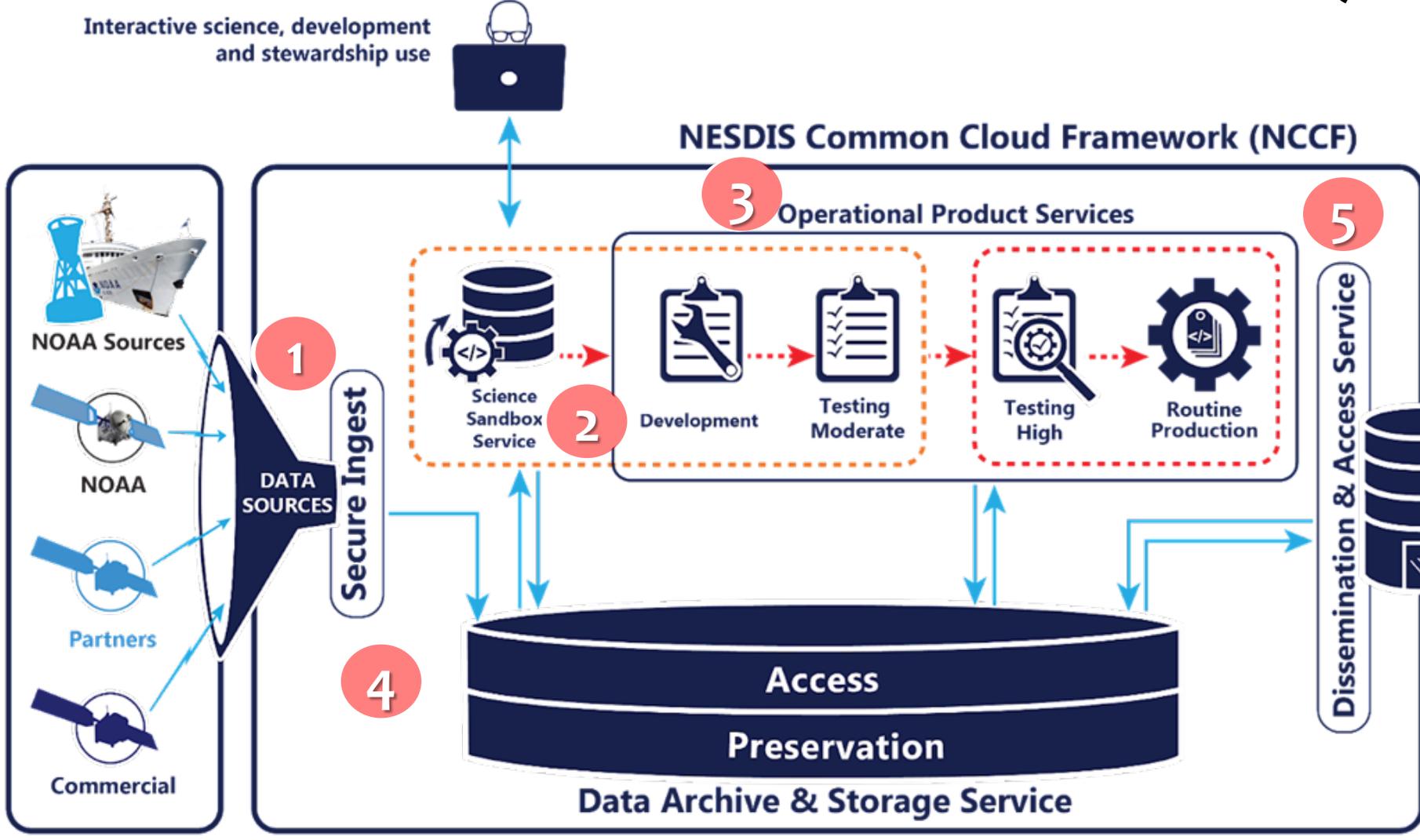
Outgoing Long Wave Radiation (NASA Mission)

Incoming solar radiation (NASA Mission)

TERRESTRIAL/OCEAN OBJECTIVES



NESDIS Common Ground Framework (NCCF) Approach



Five Basic Services:

- 1 Secure Ingest
- 2 Science Sandbox
- 3 Operational product processing
- 4 Data archive & Storage
- 5 Dissemination & Access

➔ Data Ingest from Sources
 ↔ Data Flow
 - - - ➔ Automated Code Deployment
 Moderate FISMA
 High FISMA



Fisheries Data Modernization

is accelerating time to science for mission success to support a climate-ready nation.

At the end of 3-years we will have modernized the delivery of science, technology, and data working together with people-focused solutions that fulfill mission requirements. We will also have FAIR information that supports the equity, accessibility, and vitality of communities.

IRA Investment | \$33.4M Total FY 23-26

- ❖ Fisheries Dependent Data Modernization \$17.5M
- ❖ Protected Resources Modernization \$8.4M
- ❖ Sustainable Fisheries Modernization \$8.3M

What We Are Doing

Technology-Supported

Technology-supported solutions are the backbone of human-centric and information-first approaches. Fisheries will accelerate mission goals through the use of leading technology products and tools that are both interoperable and flexible, such as cloud, artificial intelligence, machine learning, and more.



Human-Centric

People are paramount. Data provides the “what” so that humans can know the “why.” Human-centered solutions consider who will use our information and how the process can be defined to best fit the needs of our enterprise and maximize the potential usage of our current and future data collections.

Information-First

Information must be at the forefront of all we do to answer mission questions. It must be brought up in the early planning of all efforts to spend less time trudging through files and more time doing what matters most – protecting habitats and ecosystems, and recovering species vulnerable to climate change.

How We Are Doing It

Funding high priority, impactful projects with a science and management connection

Aligning data management practices with strategy to enable data standardization*

Developing and deploying **fully enabled cloud solutions** for enhanced scalability

Promoting a data-driven culture through the **adoption of open science initiatives**

Increasing data expertise & technical solutions that enable enterprise collaboration

*Significantly reducing the burden (both human and financial) of managing data and streamlining workflows while maintaining the uniqueness and autonomy of each of our Fisheries-wide offices and centers.

NOAA Data Governance

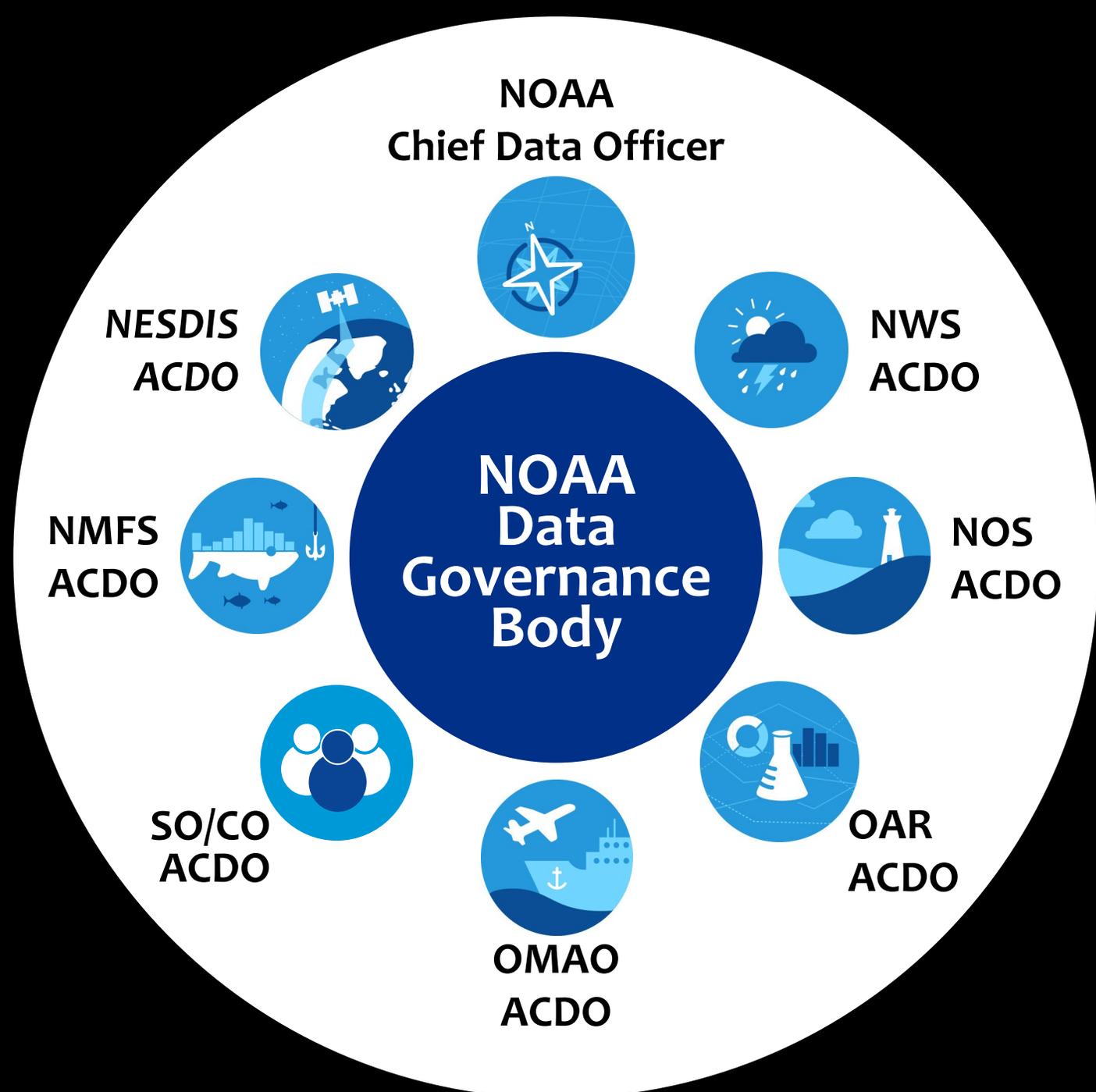


NOAA Chief Data Officer

- *Tony LaVoi*

LO Assistant Chief Data Officers

- *NESDIS – Jessica Morgan*
- *NWS – Maria Sims*
- *NMFS – Noriko Shoji*
- *NOS – Megan Cromwell*
- *OAR – Amy Biggs*
- *OMAO – Solomon Tadele*
- *SO/CO - ???*



Expanding Future of Ocean Observations

NOAA JPSS



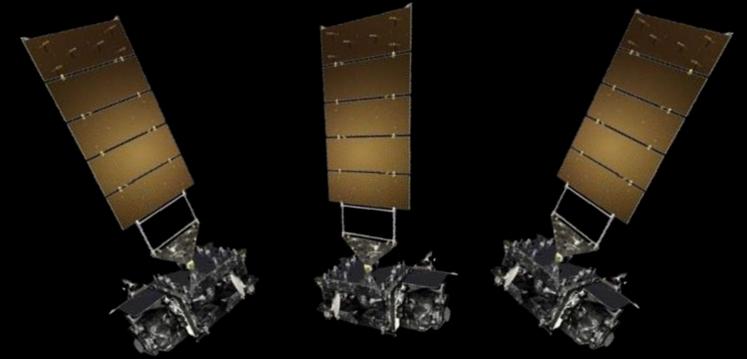
NASA PACE



NASA GLIMR



NOAA GeoXO Constellation



2011-2015

2016-2020

2021-2025

2026-2030

2031-2035

2036-2040

2041-2045

2046-2050

2051-2055

JPSS: 2011~2040

GOES-R: 2016~2038

PACE: 2024-2029

GLIMR: ~2026-2028

GeoXO: 2032-2055

NEON: 2026-2050s

Thank You!

