OBSERVING FOR CLIMATE SIGNALS IN THE INTRA-AMERICAS SEAS: A PAN REGIONAL APPROACH

Detecting and forecasting physical expressions of climate change, as well as their impacts to ecosystems, have become a high-priority challenge to the global ocean observing community. The interconnection between three IOOS Regional Associations (RAs) arising from the North Equatorial Current, the Caribbean Current-Gulf Stream and Loop Current, predicate a pan-regional approach to optimizing an observing strategy for understanding oceanographic expressions of climate change in the Intra-Americas Seas. The Southeast Coastal Ocean Observing Regional Association (SECOORA), Gulf of Mexico Coastal Ocean Observing System (GCOOS), Caribbean Coastal Ocean Observing System (CARICOOS), and their partners are currently co-developing pan-regional tools to forecast inundation by Sargassum advected by the North Equatorial Current (NEC) into the Intra-americas Seas. An analogous approach to further understand and forecast climate change impacts can enable all three RAs to be more responsive to the geographic scales of stakeholder needs. Each RA has existing observing capabilities, including gliders, buoys, temperature and salinity sensors on animal telemetry receiver arrays, and models that ingest data from these assets. These investments, when leveraged across regions, provide foundational data needed to inform stakeholders about impacts of climate change and provide tools to support event-driven and climate-related decision-making.

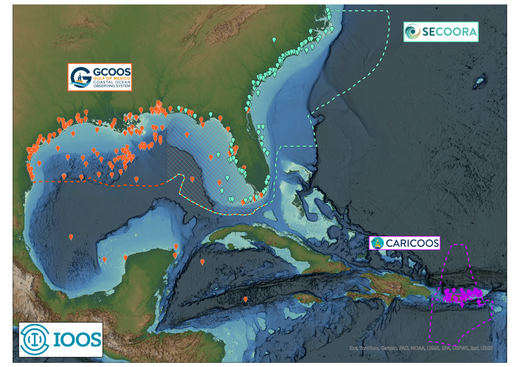


Figure 1: CARICOOS, GCOOS and SECOORA Observing Assets. Source: Jerad King (GCOOS)

SARGASSUM OBSERVING AND FORECASTING

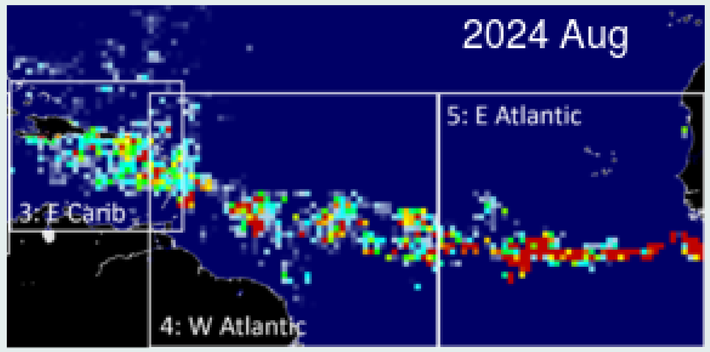


Figure 2: The average *Sargassum* abundance for August 2024. Source: SaWS

Starting in 2011, the Caribbean Sea has experienced major blooms of *Sargassum* macroalgae (or seaweed) annually. Satellite observations showed that the increased *Sargassum* in this area was only part of the Great Atlantic *Sargassum* Belt (Wang et al., 2019) that extended from West Africa to the Gulf of Mexico. The increased *Sargassum* quantity caused significant beaching events around the Caribbean Sea, Gulf of Mexico, and along the southeast coast of the continental U.S. *Sargassum* tracking and modeling across the domain is a priority. Working with Dr. Chuanmin Hu, University of South Florida, who leads the satellite-based *Sargassum* Watch System (SaWS, Hu et al., 2016; optics.marine.usf.edu/projects/saws.html), the following deliverables will be realized:

- Near real-time distribution of high-resolution *Sargassum* maps for selected areas in each region
- Numerical models tailored to predict *Sargassum* trajectory for at least 3 days
- Near real-time distribution of *Sargassum* trajectory maps

MARINE HEATWAVES

Figure 3: A heat map of the North Atlantic Ocean. Source: NOAA

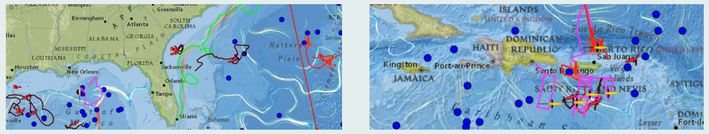
Marine heatwaves are periods of abnormally warm ocean temperatures that can be disastrous for marine life and coastal communities such as fishers. They are often defined as sea surface temperatures (SST) greater than a seasonal threshold for 5+ days (3). SST (1) and marine heatwaves (2) are predicted to continue increasing during this century. Marine heatwaves vary in physical characteristics, impacting marine biota & ecosystems, including corals, seagrasses (6), harmful algal blooms, and marine mammals (7). While coral reef-related recreation in the CARICOOS region generates $1.3 bil per year (5), reefs also provide flood protection, representing $184 mil per year in averted damages (8). The need for action is evident, as coral bleaching conditions arising from 2023 & 2024 heat waves have already impacted coral nurseries operated by restoration practitioners.

Initial collaboration will include analysis of both surface & sub-surface T data across the domain to 1) identify major data gaps and 2) assess trends. Data sources include buoy datasets, temperature data from acoustic receivers moored near the seafloor, glider missions, and satellites.

PAN-REGIONAL PRODUCTS

The three RAs and their partners are co-developing pan regional tools to forecast *Sargassum* inundation advected by the North Equatorial Current (NEC) into the Intra-Americas Seas. An analogous approach to further understand and forecast additional climate change impacts, such as forecasts of marine heatwaves, can enable the RAs to be more responsive to stakeholder needs. Co-development of products will enable:

- Leveraging of expertise & stakeholder engagement strategies across RAs
- Standardization of observing and analysis methodologies
- Efficiencies in development costs
- Smooth production of English and Spanish language products



Figures 4 & 5: Glider maps of the Atlantic, Gulf and Caribbean. Source: GCOOS

Las tres asociaciones regionales (RA, por sus siglas en inglés) y sus socios están desarrollando conjuntamente herramientas panregionales para pronosticar las inundaciones por *Sargazo* transportado por la Corriente Ecuatorial del Norte (NEC, por sus siglas en inglés) hacia los Mares Interamericanos. Un enfoque análogo para comprender y pronosticar mejor otros impactos del cambio climático, como los pronósticos de olas de calor marinas, puede permitir que las tres RA respondan mejor a las necesidades de las partes interesadas. El desarrollo conjunto de productos permitirá:

- Aprovechar la experiencia y las estrategias de participación de las partes interesadas en las RA
- Estandarizar las metodologías de observación y análisis
- Eficiencias en los costos de desarrollo
- Desarrollar productos en inglés y español

IOOS Integrated Ocean Observing System
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