2021 2030 United Nations Decade of Ocean Science for Sustainable Development

GOOS | Ocean Observing Co-Design

by The Global Ocean Observing System

Transforming our ocean observing system assessment and design process

- Supporting the Decade of Ocean Science for Sustainable Development -

Ann-Christine Zinkann[1], Jun She[2], Emma Heslop[3], Sabrina Speich[4], David Legler[5], Andrea McCurdy[6]

[1, 5]National Oceanic & Atmospheric Administration | [1,6]University Corporation for Atmospheric Research | [2]Danish Meteorological Institute | [4]Institut Pierre-Simon Laplace | [3]IOC-UNESCO | [6]NASA





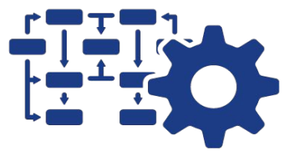


As highlighted by the UN Ocean Decade co-design is crucial to building a transformative and solutions oriented ocean observing system. The Ocean Observing Co-Design Program will evolve the ocean observing system so that it is co-designed with observing, modelling and key user stakeholders to be truly responsive and agile to user needs, and integrated along the value chain.

KEY CHALLENGES

Not enough ocean information to effectively meet global challenges

Need to establish clear priorities for investment in ocean observing

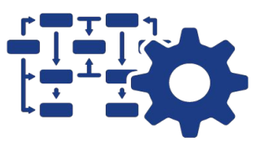


Connecting across the value chain of observing, modeling and users

What is the Value Chain: An ocean observing value chain represents the observations, forecasting, and data management to service and product delivery to users.

What is Co-Design: it is understood to be a continuous process, a collaborative and iterative effort involving various stakeholders.

OUTCOMES



Link along **value chain and users**

Blueprint for services if they don't exist

Observing **design** for user need area

Tracking of implementation against need

Economic value assessment

HOW TO BEGIN?

Ocean Carbon Cycle

Tropical Cyclones

Marine Heatwaves

Storm Surge

MarineLife

Boundary Currents

In the context of the Ocean Observing Co-Design Programme, an 'Exemplar Project' is a societal benefit area around which we **pilot** and **refine** the ocean observing system by establishing **co-design processes**.

Exemplars will identify and address **priority gaps**, **engage** key user **stakeholders**, **integrate** along the observing value chain, **assess value** of investment on ocean observation, support the development of **co-design best practice** and lift the system in key societal areas.

NEXT STEPS

- Tropical Cyclones - Co-design engagement with Caribbean weather forecast and modeling centers – *in planning*
- Agulhas Current Observing System Design Workshop, September 9-13, 2024 - South Africa
- Co-Design Program Workshop, 2025
- Co-Design Best Practices development

GOOS | At the heart of the Ocean Decade

unesco Intergovernmental Oceanographic Commission

WORLD METEOROLOGICAL ORGANIZATION

UN environment United Nations Environment Programme

International Science Council

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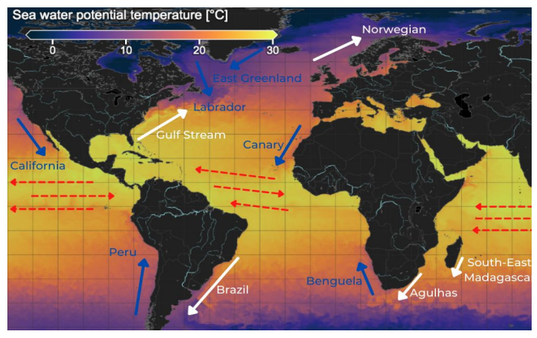
Sustained and effective ocean observations
- A Boundary Current Initiative -

Tamaryn Morris[1] (t.morris@saeon.nrf.ac.za); **Ann-Christine Zinkann**[2] (ann-christine.zinkann@noaa.gov)

[1]Ocean and Polar Coordinator, South African Environmental Observation Network | [2]Program Manager, National Oceanic and Atmospheric Administration & UCAR

Boundary Currents are associated with major ocean currents and their dynamics are determined by coastlines, and fall into two distinct categories: **Western boundary currents** in white - carry warm salty water away from the equator and drives our climate system and **Eastern boundary currents** in blue - carry cold water to the equator and are rich in upwelling and fisheries.

Boundary currents directly influence the understanding of regional weather systems, significantly impact marine heatwave and tropical cyclones and impacts the local fisheries and aquaculture.



How to achieve this?

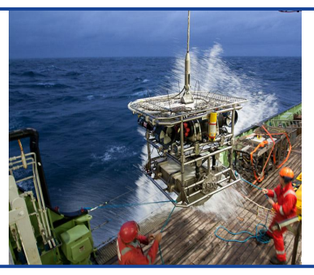
- **Lessons learned** of other Boundary Current ocean observing systems
- Define and engage **stakeholders**, funders, government departments and communities
- **Design** an observing system, products & services with stakeholders based on **priority areas**

Stakeholders involved

- Representatives from boundary current systems
- Regional and global modeling and operational prediction centers
- Ocean Decade Projects (e.g., Synobs)
- Exemplar areas on Tropical Cyclones, Marine Heatwaves








IMPACTS

- ❖ Safety of life at sea
- ❖ Efficient shipping
- ❖ Offshore renewable energy
- ❖ Weather and climate
- ❖ Conservation and fisheries
- ❖ Pollution

Operational modeling centres

- Improved modeling outputs
- Targeted filling of gaps
- Address model weaknesses
- Increase prediction accuracy

Observing networks

- Multi-platform deployments
- Funding to sustain observations
- Improved data accessibility

Society

- Improved forecasting capabilities on regional level
- Better prediction of marine heatwaves, storm surge, tropical cyclones to save lives
- Conservation of fisheries and aquaculture

Industry

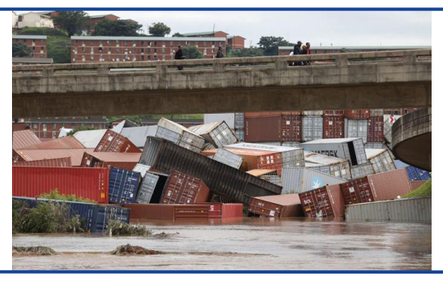
- Safer and efficient shipping routes
- Renewable energy development
- Cost efficient sensor technology

Next steps

- Agulhas Current Observing System Design Workshop, September 9-13, 2024 - South Africa
- Co-Design Program Workshop 2025








References: https://glossary.ametsoc.org | 1Morris et al, 2019 (DOI: 10.1029/2019JC015090) | 2Beal et al, 2011 (DOI: 10.1038/nature09983) | Lutjeharms 2001 (DOI: 10.1016/B978-012374473-9.00365-9)

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Ocean Carbon Exemplar

Ronnie Noonan-Birch[1] **, Anya M. Waite**[1]**, Richard Sanders**[2] (RNB@dal.ca)

[1]Dalhousie University, Ocean Frontier Institute | [2]Norweigan Research Center AS (NORCE)

The ocean is the largest and most important carbon storage depot on Earth, taking up approximately **25%** of the carbon dioxide we emit to the atmosphere **each year**, playing a critical role in slowing climate change. However, ocean carbon remains **critically under observed** with observations decreasing due to the lack of sustainable funding. This threatens our ability to forecast and respond to climate change accurately and effectively.

The carbon exemplar will facilitate **a co-design process** that will produce an **expert design** for ocean carbon observation in collaboration with **end users** which nations can use to integrate marine carbon data into **climate policies** and **solutions**.

How to achieve this?

Analyze which **observation requirements** for the best ocean data products for clearly defined end users, with an focus on improving **climate models** and enabling responsible **mCDR**. We envisage that this process will take place initially at regional to basin scales before expanding globally.

Funding & Stakeholders

We seek funding from **private** and **public sources** for workshops to scope and prioritize critical use cases in collaboration with stakeholders. We aim to fund a scientifically **robust** observation co-design process between **researchers**, **modelers** and **stakeholders** including industry, philanthropy and government.

REASONING

The IPCC indicated that in addition to emission reductions climate goals will not be reached without **active removal of CO2** from the atmosphere. The rapid development of a marine Carbon Dioxide Removal (mCDR) industry demands a more **active engagement** by the carbon observation community. A strong set of **baseline measurements** is required for which the mCDR practitioners can validate C uptake and evaluate any environmental impacts. The WMO's Global Greenhouse Gas Watch has also called for an observing system that can measure surface ocean CO2 to inform mitigation actions taken under the Paris Agreement.

Intergovernmental Organizations

- **Tool** for ocean observers to focus their conversation with intergovernmental systems including IOC and the GGGW / WMO.

Researchers and Observers

- **Opportunity** to determine, the observing system required to deliver key information to stakeholders.
- Allow GOOS and nations to support **targeted funding** of ocean observation
- Develop **links** to private and philanthropic sector

mCDR business users

- Broker **conversations** between the carbon community (observers and researchers), climate modellers, and mCDR business users.

Nations

- Facilitate the development of **comprehensive strategies** for monitoring and mitigating ocean carbon update, crucial for meeting climate policy objectives and commitments under international agreements.

Next steps

Our expert steering committee will oversee the process of identifying specific ocean carbon use case regions and potential pilots within those regions whose design might be usefully prioritized and supported by the Exemplar. This process will include stakeholder discussions as well as a workshop to set priorities and identify funding opportunities for the design process.

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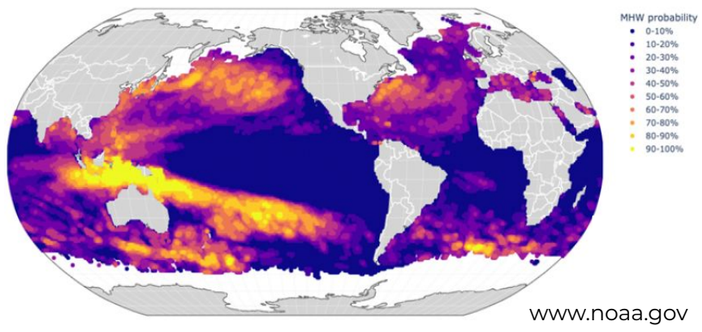
Marine Heat Waves

- Long term Monitoring, Understanding, Asses MHW IMpact , Predict -

Diana Ruiz Pino (Diana.Ruiz-Pino@locean.ipsl.fr), **Alban Lazar** (alban.lazar@locean.ipsl.fr)
& Juliet Hermes (South African Environmental Observation Network), Sabine Speich (Institut Pierre-Simon Laplace)

Enhanced frequencies, duration and intensities of Marine Heat Waves (**MHWs**) is one of the most prominent expressions within the oceans of global warming. Marine Heat Waves directly influence the understanding of regional weather systems, significantly impact tropical cyclones, influence ocean current and impacts the local fisheries and aquaculture. **Impacts** of this phenomenon on **marine ecosystems**, as well as on **human economy** and **health** are increasingly pointed out by Science and Society. It is **urgent to carry out a major international effort** aimed at developing an observing system capable of responding to different societal and scientific requirements linked with MHWs, that will foster the emergence of innovative science-based solutions.



www.noaa.gov

How to achieve this?

- **Lessons learned** of key region were MHW were detected and observed with adapted ocean observing systems
- Define and engage **stakeholders**, National and International funders, government, communities
- **Design** an observing system, products & services with stakeholders based on **key impact** and **priority areas**
- **Development of the existing observation Infrastructure** and potential for significant improvement

Stakeholders involved

- Representatives from MHW impacted region
- Regional and global modeling and climate services and operational prediction centers
- Ocean Decade Program (Cost-Predict) and Projects (Synobs)
- International Scientific Project (CLIVAR, IMBeR..)
- Other Exemplar areas
- Government, Enterprise, NGO, Fundation, Association

REASONING

- Causing widespread, unprecedented changes in the structure and function of marine ecosystems.
- Changes in the distribution patterns.
- Loss of biodiversity and collapse of numerous organisms and the ecosystems they support.
- Damaging effects in marine protected areas, aquaculture farming.
- MHW are further compounding the overfishing practices leading to a further decline in fisheries.

Biological services

- Commercial fisheries managers and agencies
- Artisanal fisheries communities
- Aquaculture operations /
- Health services in coastal communities (seafood consumption, pollution).

Sustainability, Adaptation and Economy

- Coastal ecosystems user and managers
- Reserves managers
- Exclusive Economic Zone managers
- Conservation and Restoration managers
- Climate adaptation officers
- Blue green economies

Science and Litteracy

- Research Scientists
- Capacity building program to develop observing system in the Global South.
- Citizen Science and Education program.

Climate services and prediction

- Climate services
- Weather forecasting services
- Ocean prediction providers (local, regional and global levels)

Next steps

- **Pilot** : Mediterranean and Caribbean Sea, upwelling Eastern Atlantic Ocean (Senegal Coast)
- **Workshop** : - Marine Heat Waves Workshop, with MHW International Working Group, Dec. , 2024 - Paris
- **Fund** : Submission European Project INFRADEV 2024-2025 (Europe - Africa, Europe - Latin America

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Storm Surge Exemplar

- A joint initiative with the CoastPredict Programme -

Giovanni Coppini (giovanni.coppini@cmcc.it)[1]; **Mairéad O'Donovan**[1] (mairead.odonovan@cmcc.it)

[1]Euro-Mediterranean Centre on Climate Change Foundation (CMCC), Italy

Exemplar overview

Sufficient lead-time and accuracy in forecasting storm surge is critical to minimise impacts on natural and human resources and assets. Observing and forecasting capabilities will be developed to be relocatable at the local level for vulnerable communities. The Storm Surge exemplar in co-design and co-develop jointly with CoastPredict Program, its PredictOnTime Core Project, and CoastPredict GlobalCoast Experiment through the selected Pilot Sites which focus on storm surge extreme events challenges.

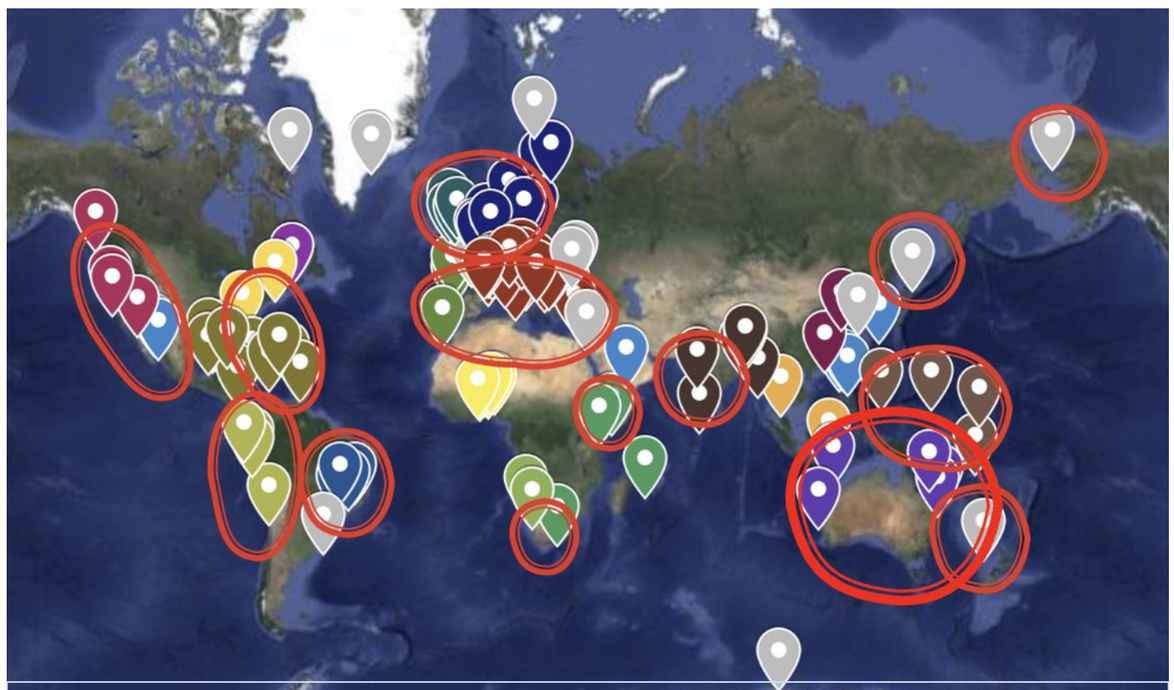
How are you going to do this

Cost-effective / low-cost sensors

Integrated people centred multi-hazard early warning systems

GlobalCoast Pilot Sites

Digital platform - knowledge exchange



32 GlobalCoast Pilots Sites focussing on Storm Surge highlighted in red.

Who involved

32 GlobalCoast Pilot Sites focusing on Storm Surge are contributing.

25 Nations: Italy, Belgium, Malta, South Africa, Mexico, Nigeria, Puerto Rico, Brazil, Tunisia, Colombia, Spain, USA, Argentina, Netherlands, United Kingdom, Poland, Philippines, India, New Zealand, Portugal, Greece, China, Egypt, Germany, Kenya.

Description of benefits / impacts to society

The multi-hazard people centred early warning system to sufficient lead-time and accuracy in forecasting extreme events (e.g. storm surge) to minimise on natural and human resources and assets.

User sector A
39 National weather & ocean forecast centres
33 National agencies managing marine directives and water directives and frameworks
35 Research community

User sector B
31 Ports authorities / managers
32 Local / regional authorities

User sector C
22 Urban planners
18 Coastal resilience planners
10 Insurance Companies

User sector D
32 Emergency response - first / second responders
11 Navy
24 Coast Guard

Next steps

Continue the cooperation with CoastPredict Program
Coordinate the implementation of GlobalCoast Pilot Sites focussing on StormSurge.
Co-designed, regionally distributed ocean observing and forecasting systems at the local Global Coast Pilot Sites (32) in the global coastal ocean consisting of:

- Relocatable integrated observing and prediction system for storm surge
- Storm surge and multi-hazard people-centred early warning systems,
- End-to-end demonstration
- Best practices and toolkits for practitioners

Ways to get engaged / contact information / ASK
giovanni.coppini@cmcc.it; mairead.odonovan@cmcc.it

References and info: https://coastpredict.org

https://www.coastpredict.org/globalcoast/

PredictOnTime