Global Marine Carbon and Biogeochemistry Observing Capacity and Data Products

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Dominik Krzymiński (25% Offic

Project Office hosted by the
Institute of Oceanology of Polish Academy of Sciences

Support for IOCCP is provided by the US NSF through a grant to SCOR (OCE-2140395), the IOC-UNESCO through the GOOS Project Office and by the EU OceanICU Project (Grant Agreement 101083922). Institute of Oceanology of Polish Academy of Sciences provides in kind support for the IOCCP Project Office.

http://www.ioccp.org/

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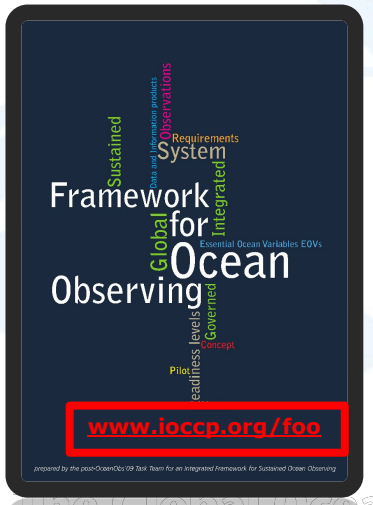
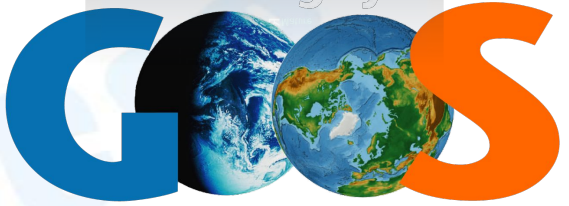
IOCCP/GOOS BGC Terms of Reference

Facilitate a dialogue with stakeholders to implement a scientifically and economically effective, fit-for-purpose observing system for ocean carbon and biogeochemistry.



The Global Ocean Observing System



IOCCP/GOOS BGC Terms of Reference

Develop and maintain a set of specifications, implementation goals, and progress metrics for Essential Ocean Variables for ocean carbon and biogeochemistry parameters for GOOS and corresponding Essential Climate Variables for the Global Climate Observing System (GCOS).

EOVs
Biogeochemistry

- Oxygen
- Nutrients
- Inorganic Carbon
- Transient Tracers
- Particulate Matter
- Nitrous Oxide
- Stable Carbon Isotopes
- Dissolved Organic Carbon
- Ocean Colour

Global Carbon Budget 2013-2022

CO_2 emissions

Fossil fuel & cement sources
9.6 (±0.5) PgC/yr **(89%)**

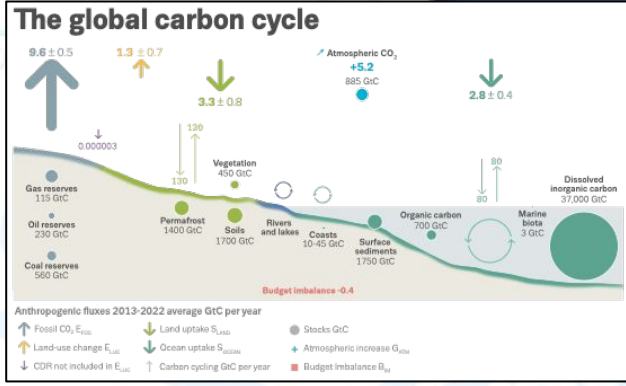
Land-use change
1.3 (±0.7) PgC/yr **(11%)**

CO_2 uptake

Atmospheric growth rate
5.2 PgC/yr **(48%)**

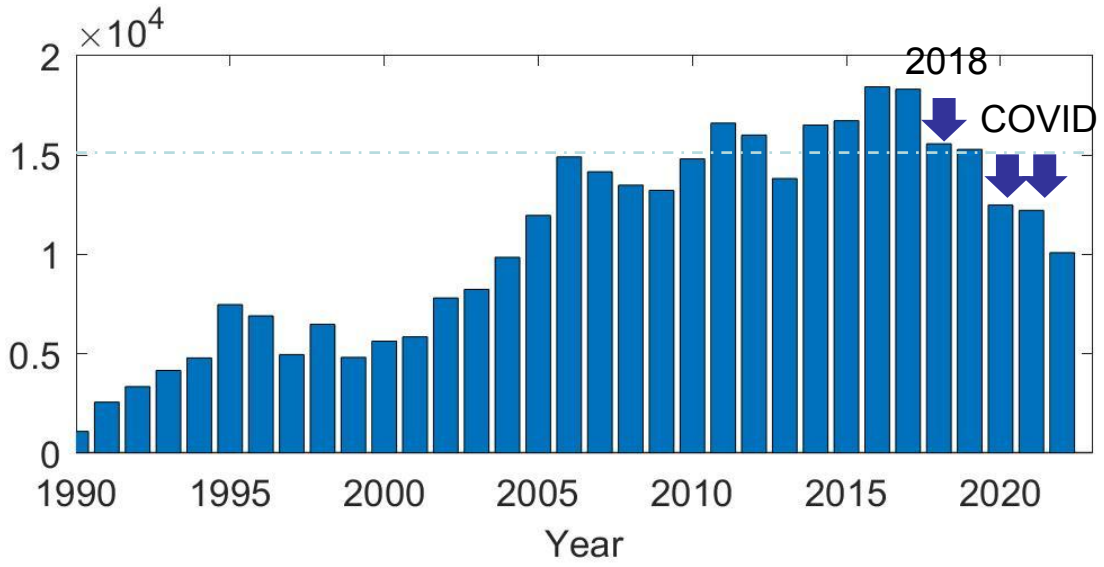
Ocean sink
2.8 (±0.4) PgC/yr (26%)

Land sink
3.3 (±0.8) PgC/yr **(30%)**

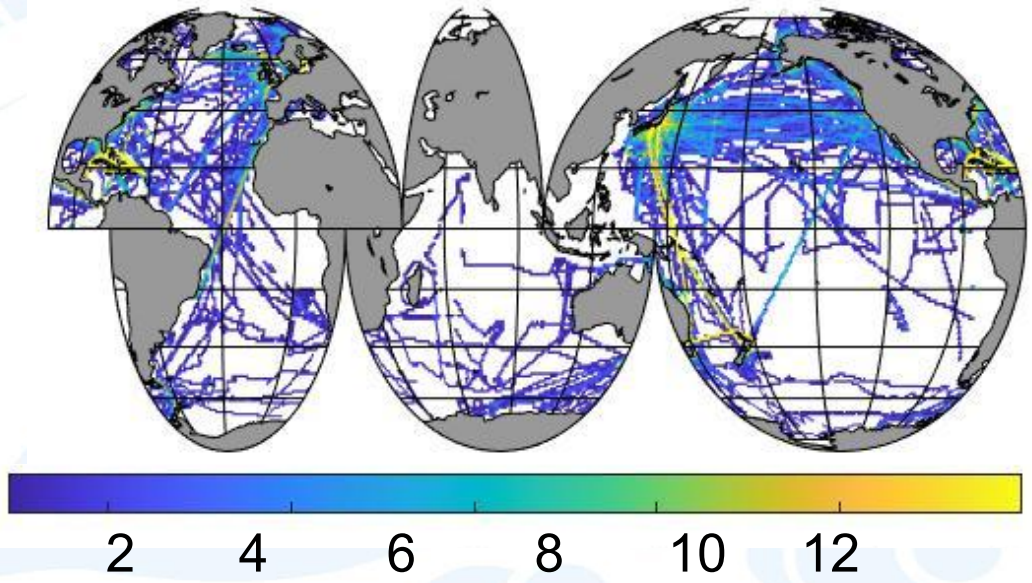


(Friedlingstein et al. 2023 ESSD (121 contributors); Global Carbon Budget 2023, Budget imbalance – 0.4 PgC/yr or 4%)

Alarming decline in open ocean CO_2 measurements



2018-2021



Number of months with surface ocean CO_2 (V2023)

Surface Ocean CO_2 Atlas (www.socat.info)

- Synthesis of *in situ* surface ocean CO_2 measurements
- Annual public release
- 36 million CO_2 values (1957-2022), accuracy < 5 µatm in monthly 1° x 1° gridded products
- 7 million CO_2 sensor data, accuracy 5-10 µatm

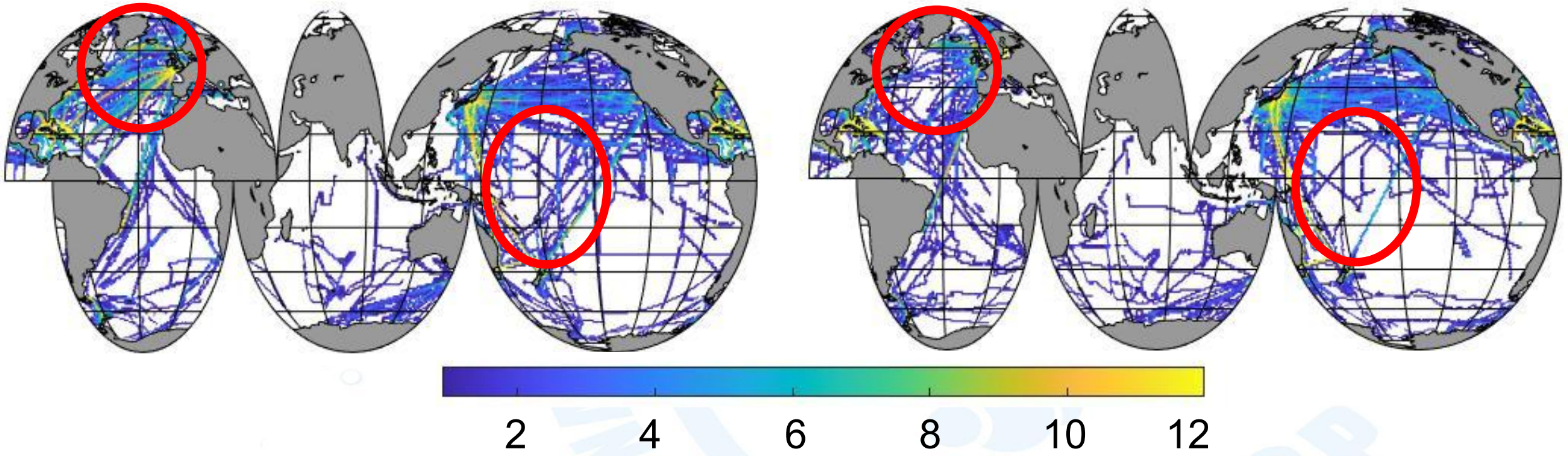
Ocean CO_2 observing capacity at risk

- An alarming decline in open ocean CO_2 measurements
- SOCAT lost a regional hub and has funding shortfalls.
- SOCAT's IT infrastructure needs modernization.

Alarming decline in open ocean CO2 measurements

2014-2017

2018-2021



Calendar months with surface ocean fCO_2 per 1° x 1° grid cell in SOCATv2023

Requirement to rapidly and operationally link ocean data through to policy makers and minimize mitigation/ adaptation costs

WORLD METEOROLOGICAL ORGANIZATION

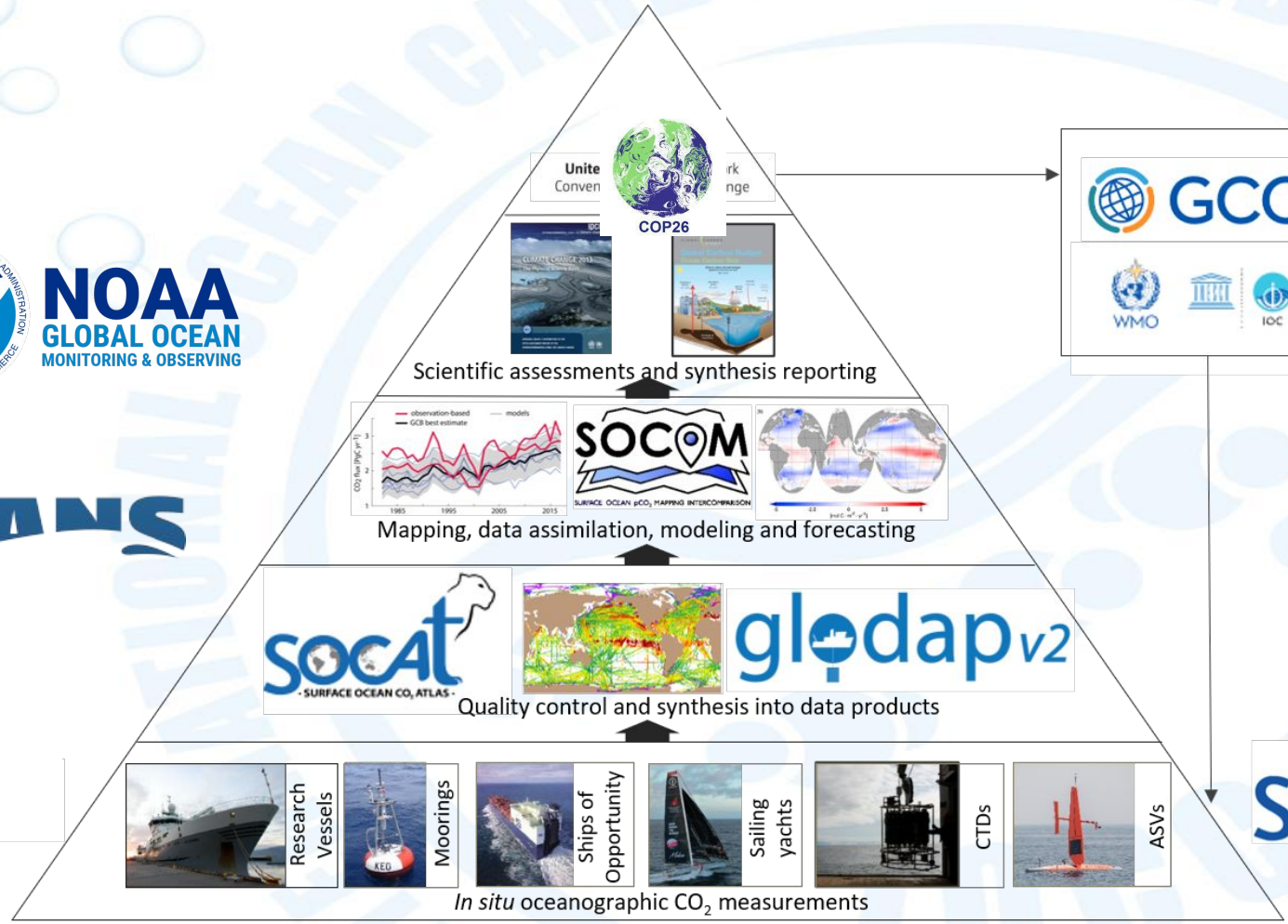
G7 FUTURE OF THE SEAS & OCEANS INITIATIVE

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT IOCCP

NOAA GLOBAL OCEAN MONITORING & OBSERVING

ICOS Ocean Thematic Centre

JPI OCEANS



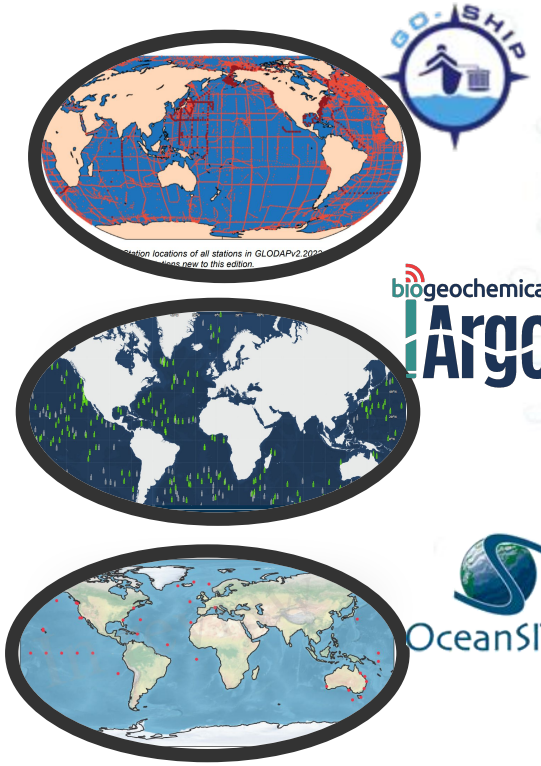
GCOS GOOS

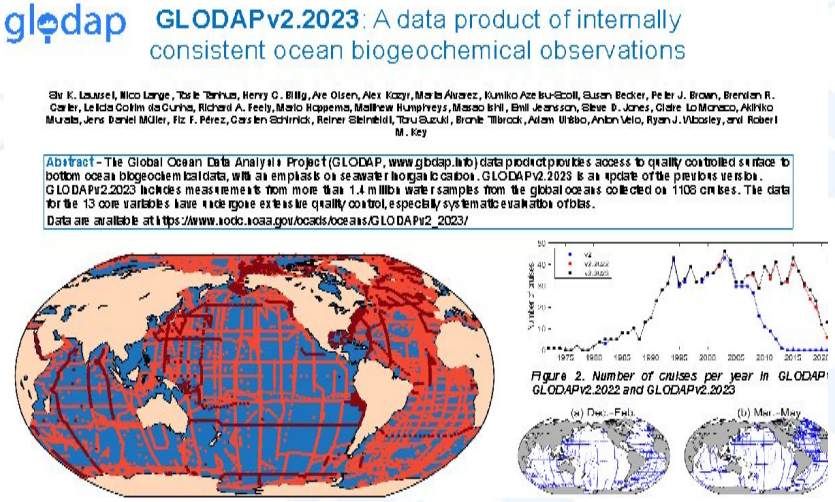
WMO IOC International Science Council UN environment

SOCONET SURFACE OCEAN CO2 OBSERVING NETWORK

Seawater carbonate system Reference Materials critical for ocean carbon science and policy

- Using RMs enables ocean carbon measurements with known quality.
- These measurements allow assessing changes in the ocean carbon cycle, quantifying ocean acidification and informing the IPCC and global environmental policies.





ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

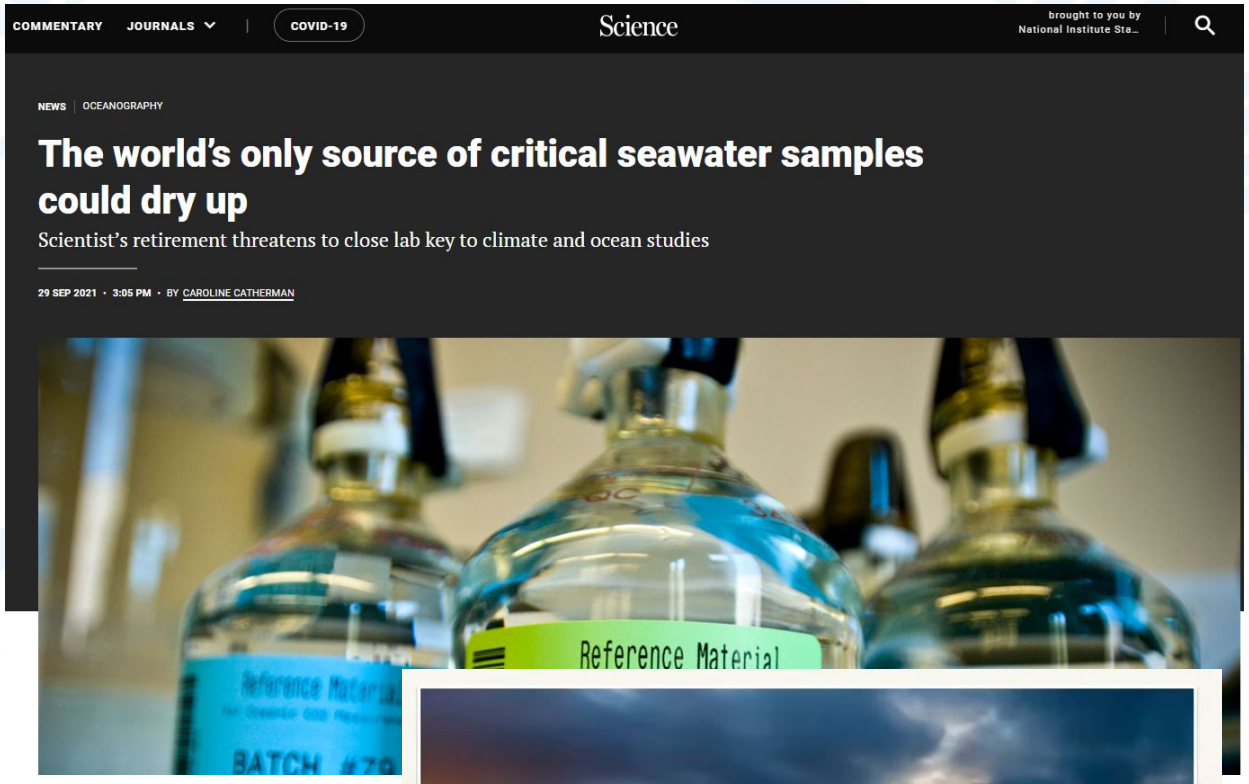
Global access to RMs is vulnerable

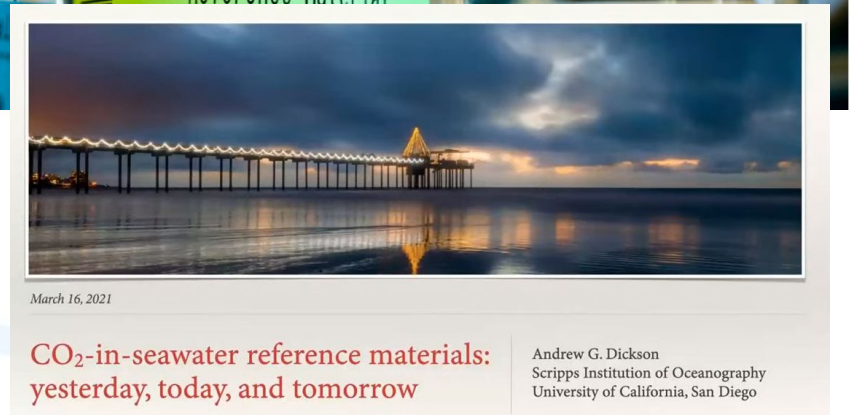
A single production and supply centre at Scripps Institution of Oceanography (USA) provides RM's and other reagents needed for seawater carbonate system measurements:

- Total alkalinity (TA)
- Total dissolved inorganic carbon (DIC)
- Tris buffer for pH
- Standardized HCl (for TA titrations)

Over the past three years, targeted events with stakeholders took place to plan for a more resilient distribution and production scheme of seawater RMs:

- Scripps Institution of Oceanography, Andrew Dickson
- U.S. Interagency Working Group on Ocean Acidification
- International Ocean Carbon Coordination Project (IOCCP)
- Global Ocean Acidification Observing Network (GOA-ON)
- Integrated Carbon Observation System - Ocean Thematic Centre (ICOS-OTC)
- International Atomic Energy Agency (IAEA)

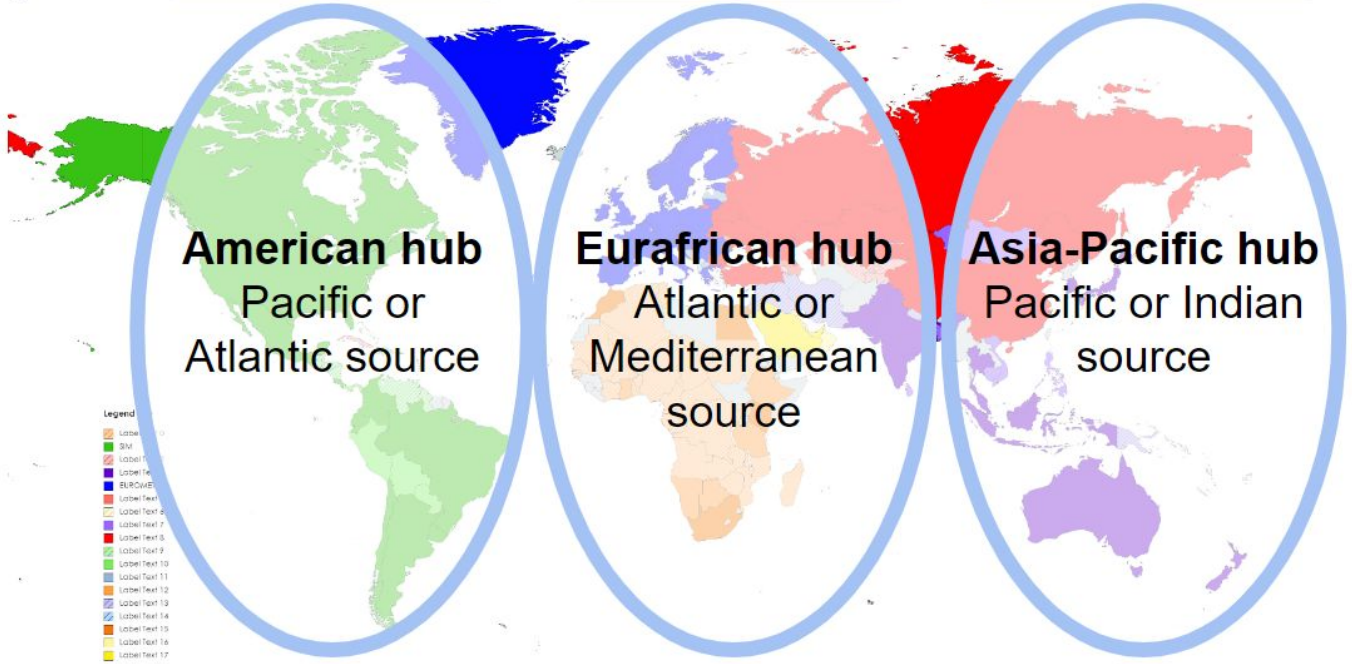




Possible structure of a global RM system

Transitional model

Production (Scripps) and Certification (NIST)	Production	Production



Final new model

Production and Certification (NMIs)	Production and Certification (NMIs)	Production and Certification (NMIs)

CO2-in-seawater Reference Materials Community Survey

OA Week 2021

13-17 September 2021

A virtual multi-day forum to highlight different aspects of ocean acidification research and initiatives from around the world

A Community Discussion Around CO2-in-Seawater Certified Reference Materials (CRMs)
Thursday, September 16 at 9:00 Pacific Daylight Time (UTC-7)

#OAWeek2021 @goa_on

GOA-ON Global Ocean Acidification Observing Network
IAEA Ocean Acidification International Coordination Centre OA-ICC
NOAA
unesco Intergovernmental Oceanographic

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT IOCCP

Production of CRM and RM for the seawater carbonate system

14-17 March 2022 - 22:00-23:00 CET

Please join the online meeting:
https://meet.goto.com/ioccp-office/crm-production-meeting

Regional Implementation of GOOS Biogeochemistry

REGIONAL IOCCP IMPLEMENTATION

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First DBCP Mediterranean Training Workshop on Ocean Observations and Data Applications

Marine Observational Advances in Tunisia

9 - 11 November 2022

Goals for the region:

- Free, open and FAIR access to data
- Regional contribution to global data synthesis products;
- Status of regional observations: building regional coordination, promoting regional PIs, support in joining OCG networks;
- Augmenting regional observing capability with regards to regional needs
- Technical capacity building: use of sensors, access to intercomparison exercises, QA&QC methods, metadata standards, etc.

Actionable outcomes identified:

- Strong thematic contribution to an in-person workshop in May 2023
- Need to use this opportunity to augment regional efforts with focus on biogeochemistry
- Need to work with GOOS Central and DBCP to engage multidisciplinary PIs in the region

Regional Implementation of GOOS Biogeochemistry

In person Workshop:

- The objective of the workshop was to enhance Mediterranean Region capacity to apply ocean observations for societal and economic benefit, and to improve related forecasts.
- The themes for the workshop included the role of ocean observations for regional weather prediction, societal and economic benefits of ocean observations , best practises, data quality and ocean observing with new technologies.

First Data Buoy Cooperation Panel Mediterranean Training Workshop on Ocean Observations and Data Applications (DBCP-Medi-1)-Part 2

2-4 May 2023, Tunis, Tunisia

https://goosocean.org/Medi-1-2

Virtual participation https://teams.live.com/meet/9442134504408

Organized by:

National Institute of Meteorology (INM), Ministry of Transport, Tunisia

WMO-IOC Data Buoy Cooperation Panel (DBCP), OceanOPS/WMO

National Center of Ocean Standards and Metrology (NCOSM), China

Hosted by:

National Institute of Meteorology (INM), Ministry of Transport, Tunisia

Biogeochemistry at the Workshop:

- Our session featured presentations from and discussions led by a number of colleagues (agenda)
- We covered a broad range of topics related to global and regional observing capacity, best practices, availability and use of data products, as well as data synthesis and coordination activities.
- We encouraged any interested members of the community, especially from around the Mediterranean region, to join the workshop online through MS Teams link.

Session 3: Carbon and Biogeochemistry Observations *(20' presentation+10'Q&As)* **Chair: Artur Palacz** **Rapporteur: Sana Ben Ismail**		
13:30-14:00	Global marine carbon and biogeochemistry observing capacity and data products	Maciej Telszewski & Artur Palacz IOCCP
14:30-15:00	Best practices in measuring and reporting some basic Biogeochemical Essential Ocean Variables	Marta Alvarez CSIC
15:00-15:30	Combining in situ and remote sensing biogeochemical observations -examples from the Mediterranean Basin	Sana BEN ISMAIL IOCCP
15:30-16:00	Coffee Break	
16:00-16:30	Ocean Acidification observations - contributions from the Mediterranean community	Abed El Rahman HASSOUN GEOMAR

INSTRUMENTING OUR OCEAN FOR BETTER OBSERVATION:
A TRAINING COURSE ON A SUITE OF BIOGEOCHEMICAL SENSORS

Kristineberg Center for Marine Research and Innovation
Kristineberg, Sweden, 5-17 June 2023

Continued focus on technical capacity building

June 2021 and 2022 Kristineberg, Sweden

COVID-19

3-18 June 2023, Kristineberg, Sweden

Full venue booked for 2 weeks in June 2023

Expanded, 14-day course allowing to include practicals and lectures for the full suite of sensors (O_2, Bio-optics, pH, pCO_2)

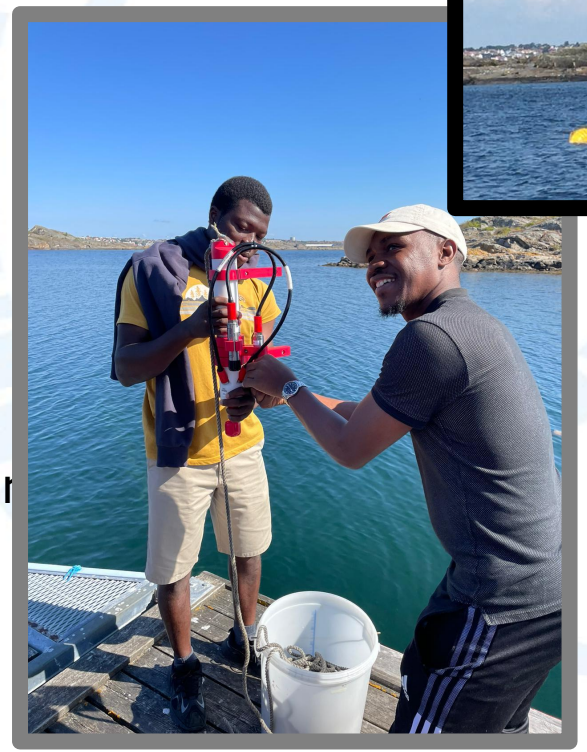
Long-term co-sponsorship at 20% of event budget agreed!

ICOS Ocean Thematic Centre

Continued focus on technical capacity building

- 13 days
- 4 EOVs (6 parameters)
- 19 types of sensors
- 50 people, 19 countries, 26 nationalities, 6 continents
- 22 instructors
- 28 participants (>100 applications)
- ~120,000 USD (20% increase)

- Plenary lectures
- Pre-event recorded lectures on background
- Hands-on practicals
- Group projects on OS design
- 1on1 with lecturers and manufactur
- Plenty of networking opportunities
- Attractive leisure time…



International Council for Science
SCOR
Scientific Committee on Oceanic Research

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT
IOCCP

The Global Ocean Observing System
GOOS
Biogeochemistry Panel

UNESCO
United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

A communication and coordination service for marine biogeochemistry

www.ioccp.org ***@ioccp_org***

Thank You!

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The Global Ocean Observing System
GOOS