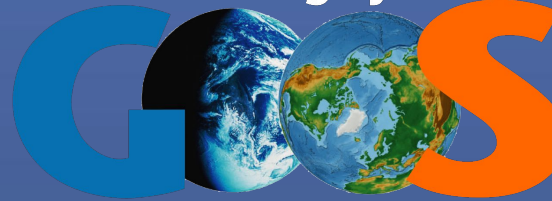




The Global Ocean
Observing System



Global Marine Carbon and Biogeochemistry Observing Capacity and Data Products

Véronique Garçon (IOCCP co-Chair, IPGP, France), **Adrienne Sutton** (IOCCP co-Chair, NOAA, USA),
Maciej Telszewski (IOCCP Director, IO PAN, Poland)



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Scientific Steering Group

10 SSG Experts
1.25 Project Office Staff



Véronique Garçon

Co-chairs



Adrienne Sutton

Project Office

Maciej Telszewski (Director)
Dominik Krzywiński (25% Office)

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.

The screenshot shows the IOCCP website homepage. At the top, there are navigation tabs: ABOUT US, IOCCP SSG, IOCCP CONVEYOR, DOCUMENTS, and JOBS. The main content area features a large banner for the "Declaration on Operationalising the Surface Ocean Carbon Value Chain". Below this, there are sections for "News" and "Calendar". The "News" section includes articles about the "POGO-SCOR Fellowship Programme 2024", the "Coastal DOM database - CoastDOM v1", and a "Call for Nominations: GOOS Steering Committee Experts". The "Calendar" section shows upcoming events, including the "2024 The Ocean Decade Conference" in Barcelona, Spain, and the "Thirteenth Session of GOOS Steering Committee". At the bottom, there is a red-bordered box containing the "IOCCP E-list" subscription form, which includes fields for Name and E-mail, and a "Subscribe" button.

Maciej Telszewski (Poland)
Co-Chairs

Richard Sanders (Norway)
Adrienne Sutton (USA)

Maribel García-Ibáñez (Spain)

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Nico Lange (Norway)

Maribel García-Ibáñez (Spain)

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Steve Jones (Norway)

Nico Lange (Norway)

Emmanuel Boss (USA)

Fei Chai (China)

<http://www.ioccp.org/>

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.

Be part of the

BOOC

- Comprehensive
- Consistent
- Easy to use

The ocean is the highway of our world economy and provides vital goods and services. From carrying cargo to creating jobs to shaping the weather and climate, our understanding of how it works, how it moves, how it changes, and how we can best work in, on, and around it depends on observations.

Sustained operational ocean observations, measurements and forecasts provide an essential input to ocean scientific research. They support a wide range of societal and economic benefits related to safety, operational efficiency, regulation, and management of activities around, on, in, and under the ocean.

Although it is generally accepted that sustained operational ocean observations, measurements, and forecasts deliver substantial socioeconomic benefits, there has been no comprehensive resource detailing such benefits in a consistent framework and available to the ocean community from a single source. Until now.

 IOOS | Integrated Ocean Observing System

As a web-based catalogue, BOOC provides a **valuable resource for the ocean observation, measurement and forecasting community** illustrating the ways in which different types of ocean information delivers benefits in a region or for a type of use.



The catalog has been **built using readily available GIS, web and database tools**. It is being populated with case studies derived from existing published papers and reports as well as unpublished benefit cases sourced across the ocean observation community.



BOOC has been designed so that the community can easily submit additional benefit cases, which will be moderated for inclusion. Through this updating and review process **the catalogue will increase in utility** as it expands over time.



Benefits of Ocean Observations Catalog

Community developed Community driven Community benefit

Community Engagement



Building on work begun at OceanObs 19, the BOOC project aims to engage with the entire ocean observation, measurement, and modeling community.

Collecting Case Studies



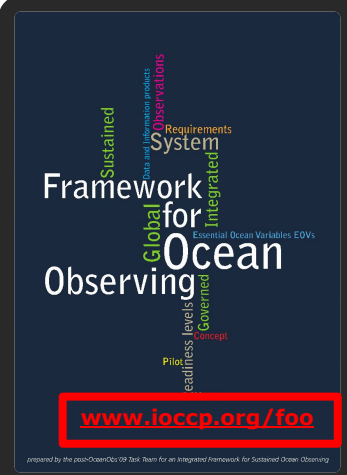
The BOOC will be continuously updated with new use case studies that demonstrate the benefits of ocean observing worldwide.

Developing Standards



The BOOC will provide the community with access to a comprehensive, consistent, and constantly improving view of the benefits of ocean observing that can be easily searched by location, benefit area, and type of observation.

www.booc.info



www.ioccp.org/foo

prepared by the post-OceanObs 19 Task Team for an integrated Framework for Sustained Ocean Observing



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).





Global Carbon Budget 2013-2022

CO₂ emissions



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



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

CO₂ uptake



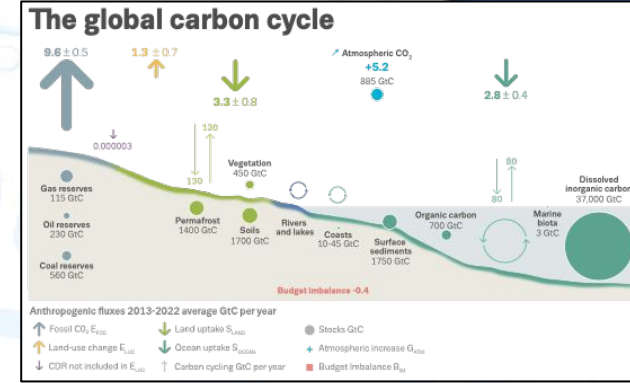
Atmospheric growth rate
5.2 PgC/yr (**48%**)



Ocean sink
2.8 (± 0.4) PgC/yr (**26%**)

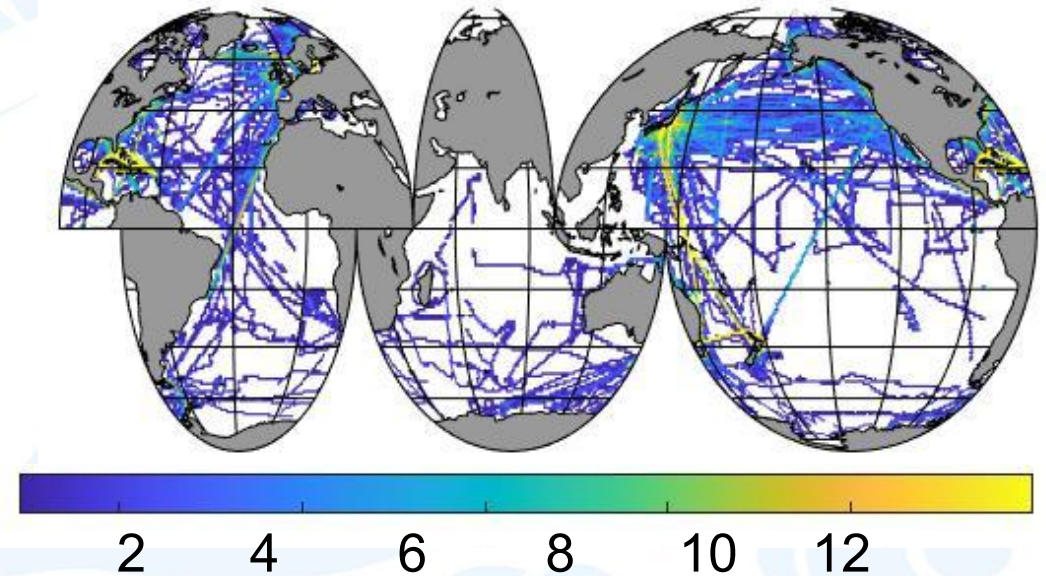
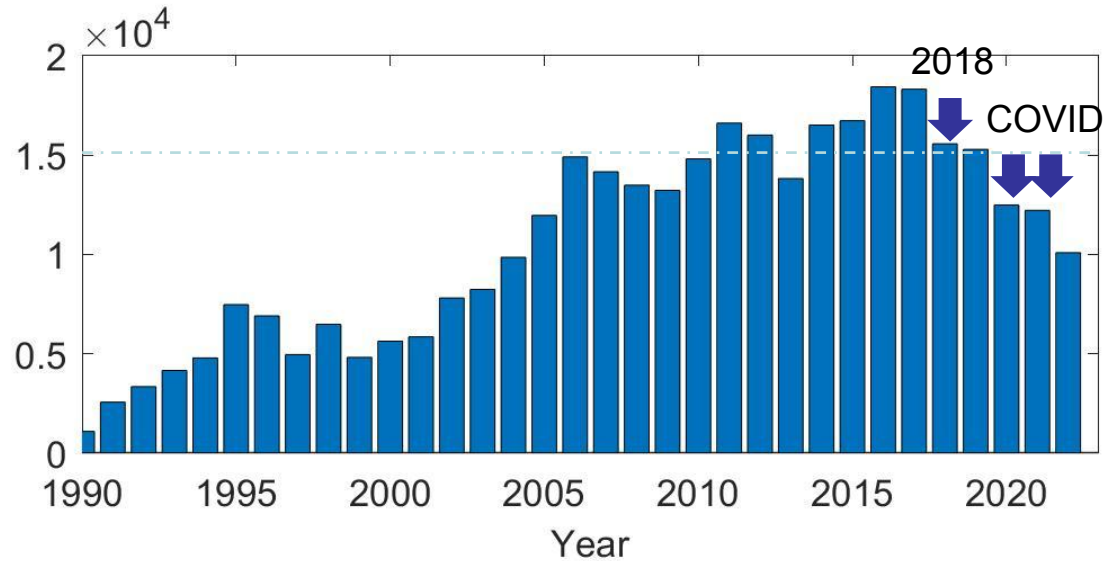


Land sink
3.3 (± 0.8) PgC/yr (**30%**)



Alarming decline in open ocean CO₂ measurements

2018-2021



Number of months with surface ocean CO₂ (V2023)

Surface Ocean CO₂ Atlas (www.socat.info)

- Synthesis of *in situ* surface ocean CO₂ measurements
- Annual public release
- 36 million CO₂ values (1957-2022), accuracy < 5 μatm in monthly 1° x 1° gridded products
- 7 million CO₂ sensor data, accuracy 5-10 μatm

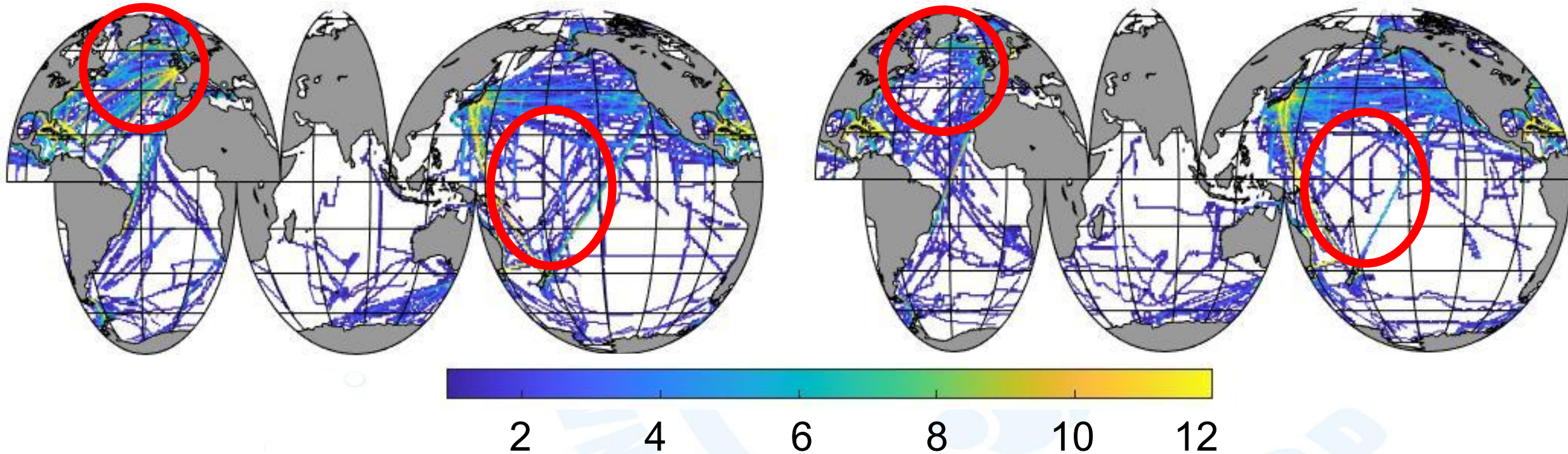
Ocean CO₂ observing capacity at risk

- An alarming decline in open ocean CO₂ measurements
- SOCAT lost a regional hub and has funding shortfalls.
- SOCAT's IT infrastructure needs modernization.

Alarming decline in open ocean CO₂ measurements

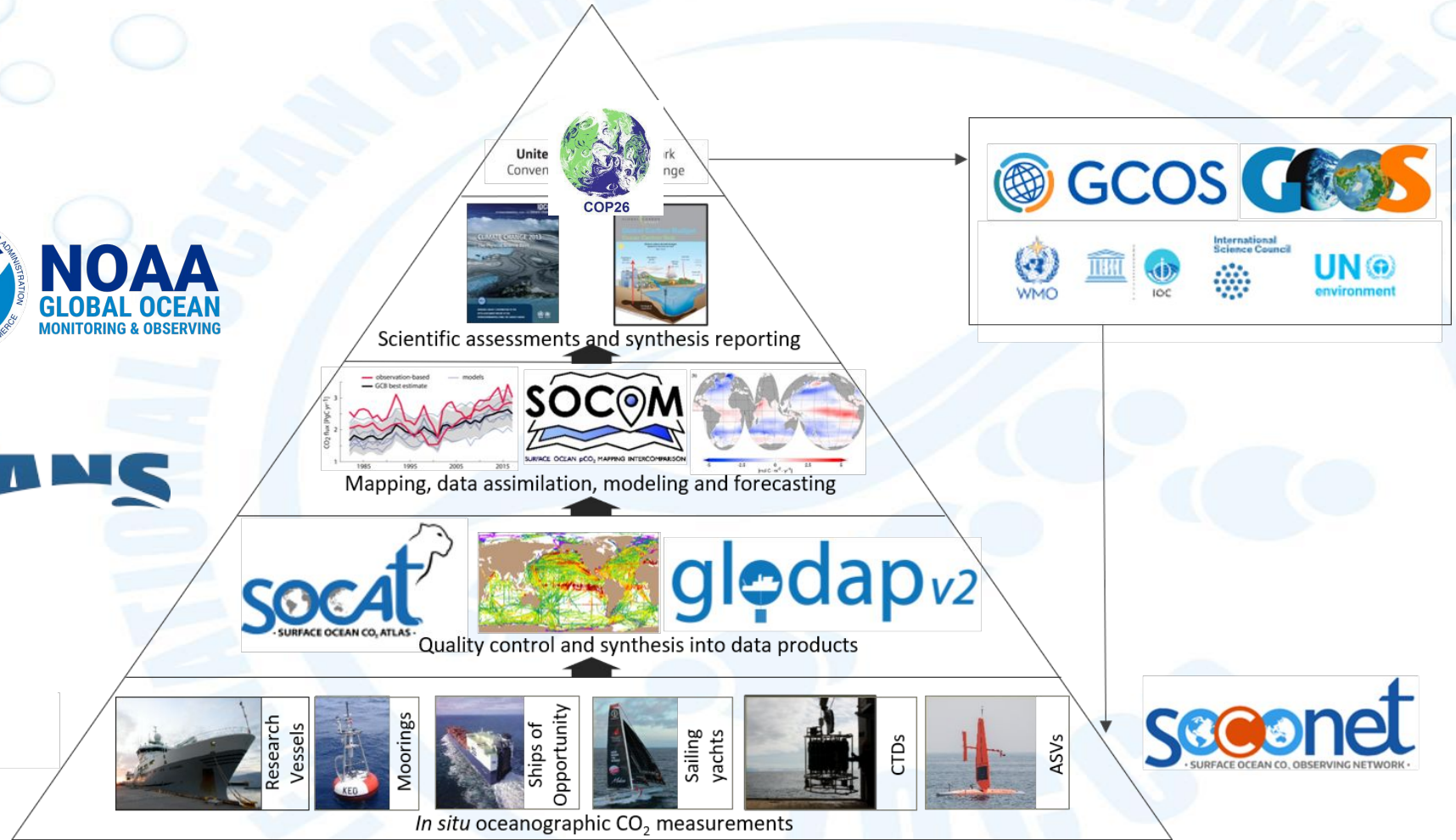
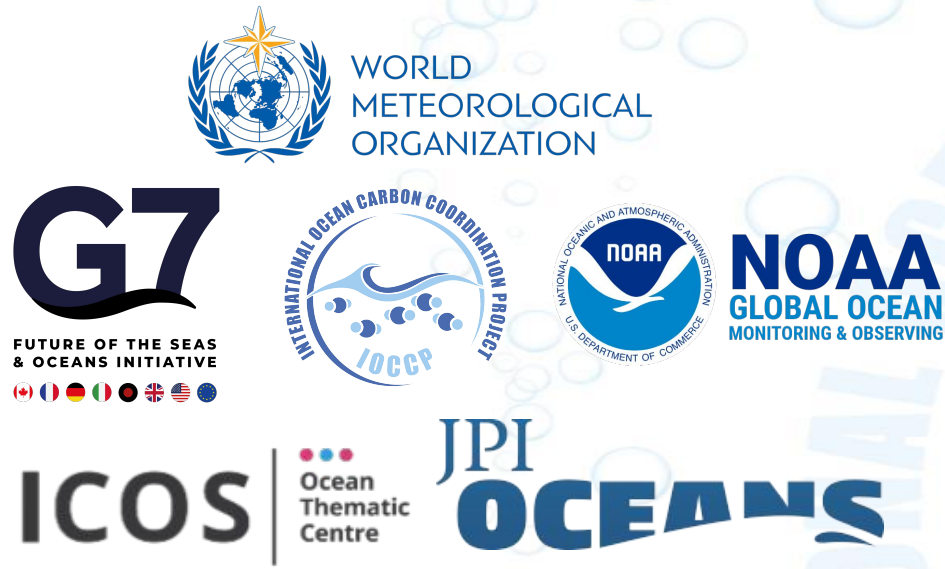
2014-2017

2018-2021



Calendar months with surface ocean fCO₂ per 1° x 1° grid cell in SOCATv2023

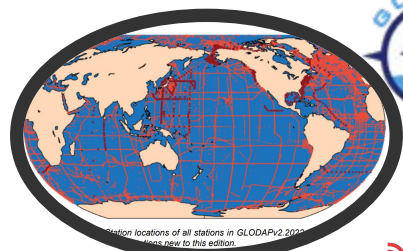
Requirement to rapidly and operationally link ocean data through to policy makers and minimize mitigation/ adaptation costs



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.



gloDAP GLODAPv2.2023: A data product of internally consistent ocean biogeochemical observations

Shirley K. Lauer, Nico Lange, Torbjørn Tjeltveit, Henry C. Billig, Are Olsen, Alex Kozay, Maria Alvarez, Rumiko Aze-Ito, Susan Becker, Peter J. Brown, Brendan R. Carter, Leida Cotrim da Cunha, Richard A. Feely, Maria Hoppe, Matthew Humphreys, Masao Ishii, Emil Jeansson, Steve P. Jones, Gladys Lo Monaco, Akiniko Murata, Jens Daniel Müller, Fitz F. Pérez, Carsten Schröck, Reiner Steinbüchel, Toru Suzuki, Brian Tilbrook, Aileen Ulloa, Anton Velio, Ryan J. Vibostley, and Robert M. Key

Abstract—The Global Ocean Data Analysis Project (GLODAP, www.gloDAP.info) data product provides access to quality controlled surface to bottom ocean biogeochemical data, with an emphasis on seawater inorganic carbon. GLODAPv2.2023 is an update of the previous version. GLODAPv2.2023 includes measurements from more than 1.4 million water samples from the global oceans collected on 1103 cruises. The data for the 13 core variables have undergone extensive quality control, especially systematic evaluation of bias. Data are available at https://www.ioos.gov/oceans/oceans/GLODAPv2_2023/

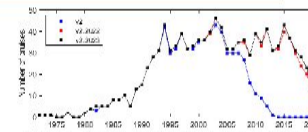
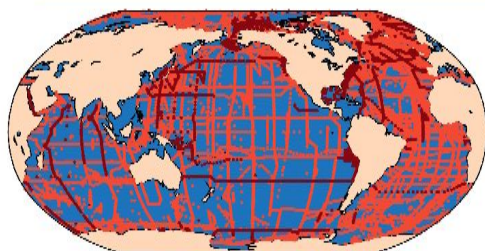
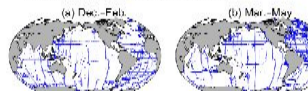


Figure 2. Number of cruises per year in GLODAPv2.2022 and GLODAPv2.2023



GLOBAL CARBON PROJECT

HOME | CARBON ATLAS | CARBON BUDGET | CH₄ BUDGET | N₂O BUDGET | RECCAP | URBANIZATION | SEARCH

Translate this site
Velg språk

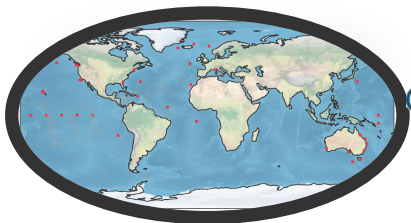
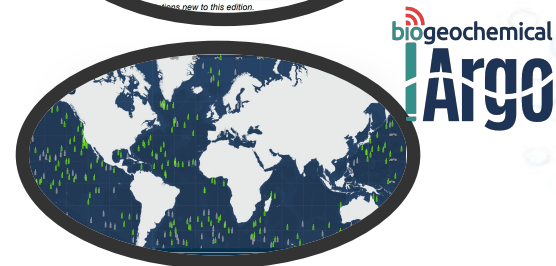
About GCP
Activities
Meetings
Publications
Science
Research Programs

Global Carbon Budget

Carbon Budget 2023 An annual update of the global carbon budget and trends

Published 5 December 2023

In brief
Highlights
Key results from Carbon Budget 2023.
Press releases
From various research institutions
See also
New Carbon Budget



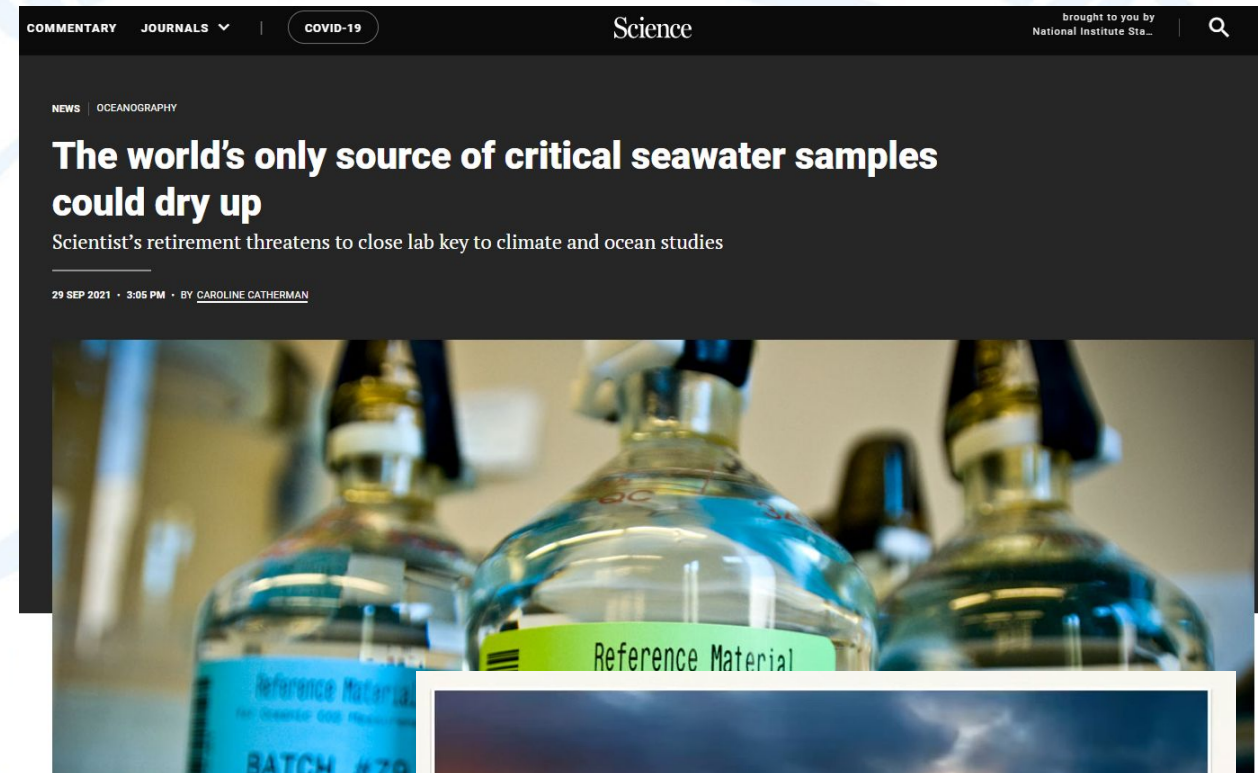
Global access to RMs is vulnerable

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)



March 16, 2021

**CO₂-in-seawater reference materials:
yesterday, today, and tomorrow**

Andrew G. Dickson
Scripps Institution of Oceanography
University of California, San Diego

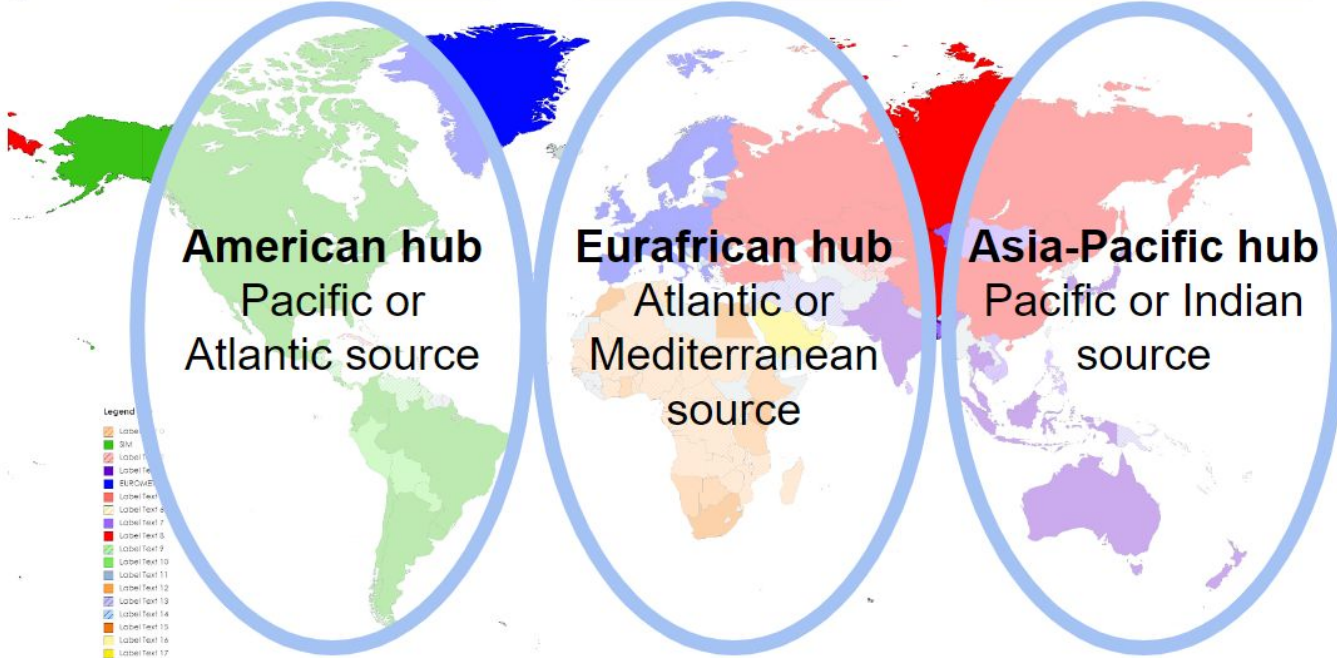
Possible structure of a global RM system

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



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



Global Ocean Acidification Observing Network



Ocean Acidification International Coordination Centre
 OA-ICC



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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Tel +21670730420
Fax +21670732622
Email sana.benismail@instm.rnrt.tn

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.

First DBCP Mediterranean Training Workshop on Ocean Observations and Data Applications

Marine Observational Advances in Tunisia

9 - 11 November 2022

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.

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.



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/join/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

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



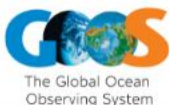
3-18 June 2023, Kristineberg, Sweden



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 (O₂, Bio-optics, pH, pCO₂)

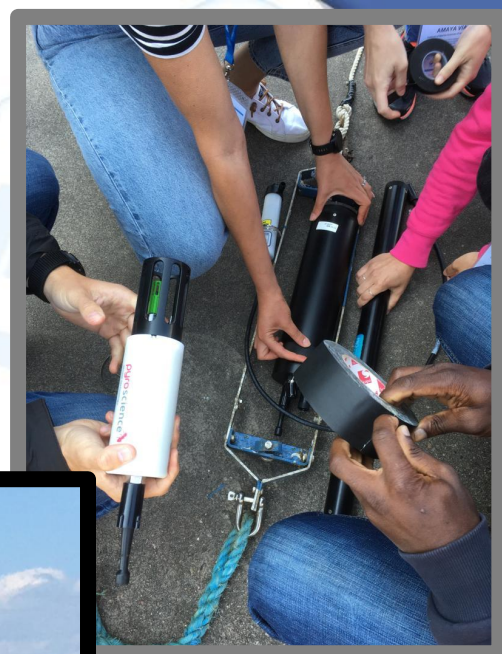
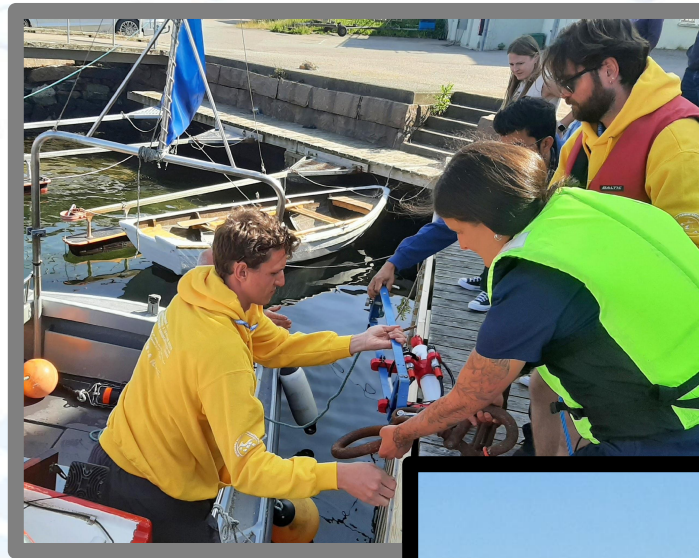
Long-term co-sponsorship at 20% of event budget agreed!



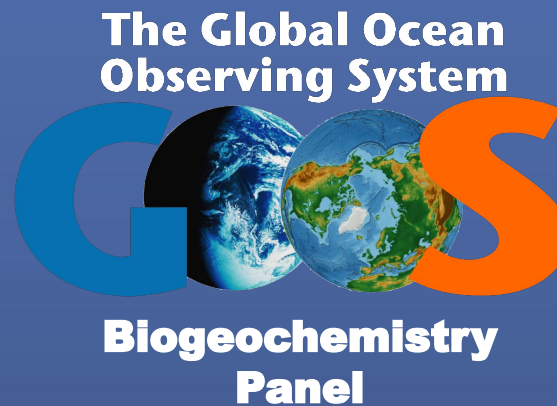
Continued focus on technical capacity building

- 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 manufacturers
- Plenty of networking opportunities
- Attractive leisure time...







A communication and coordination service for marine biogeochemistry

www.ioccp.org

[@ioccp_org](https://twitter.com/ioccp_org)



Thank You!



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