A communication and coordination service for marine biogeochemistry

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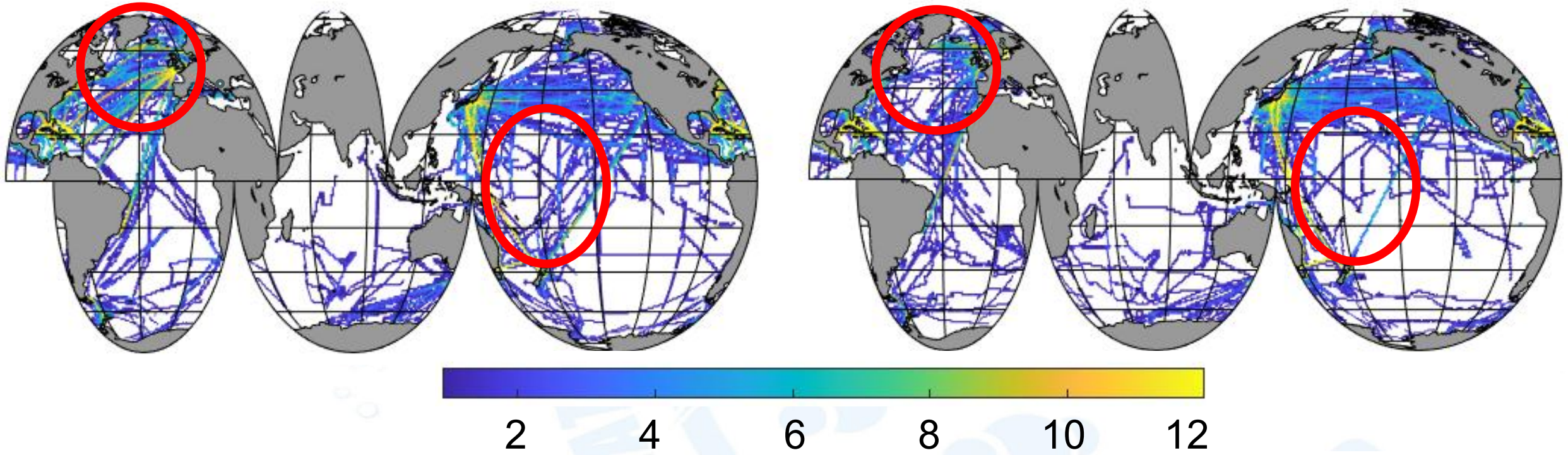
Alarming decline in open ocean CO2 measurements

2014-2017

2018-2021



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

SOCAT version 2023: An alarming decline in the ocean CO_2 observing capacity

Key for

- Quantification of global ocean CO_2 uptake, its variation and response to net zero

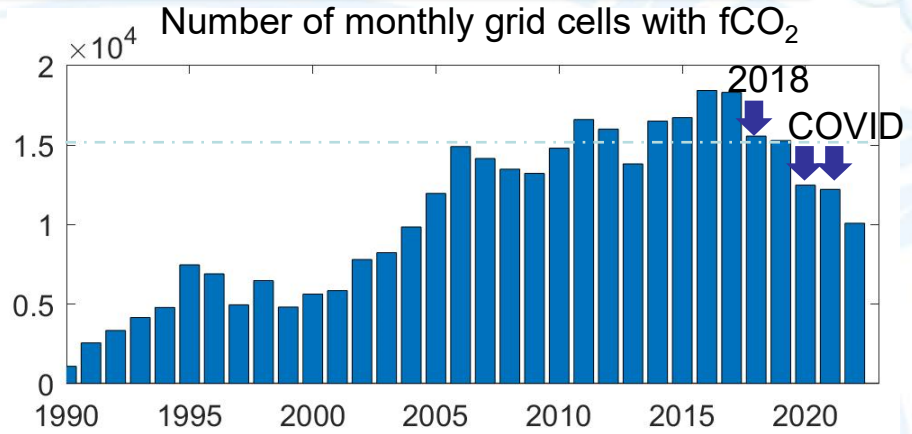
Surface Ocean CO_2 Atlas (www.socat.info)

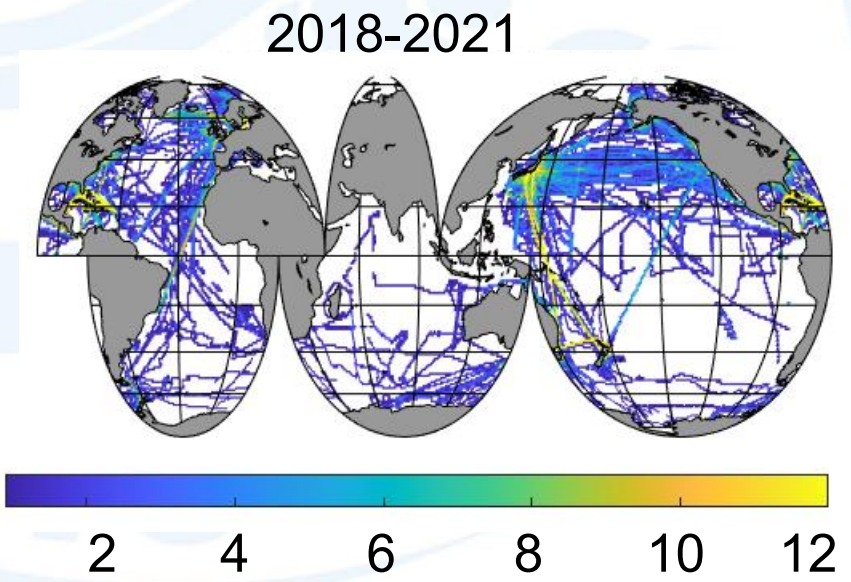
- Synthesis of *in situ* surface ocean CO_2 measurements
- Annual public release
- 36 million CO_2 values (1957-2022), accuracy < 5 µatm in monthly 1° x 1° gridded products
- 7 million CO_2 sensor data, accuracy 5-10 µatm

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.

(Pfeil et al., 2013; Sabine et al., 2013; Bakker et al., 2014, 2016, ESSD)



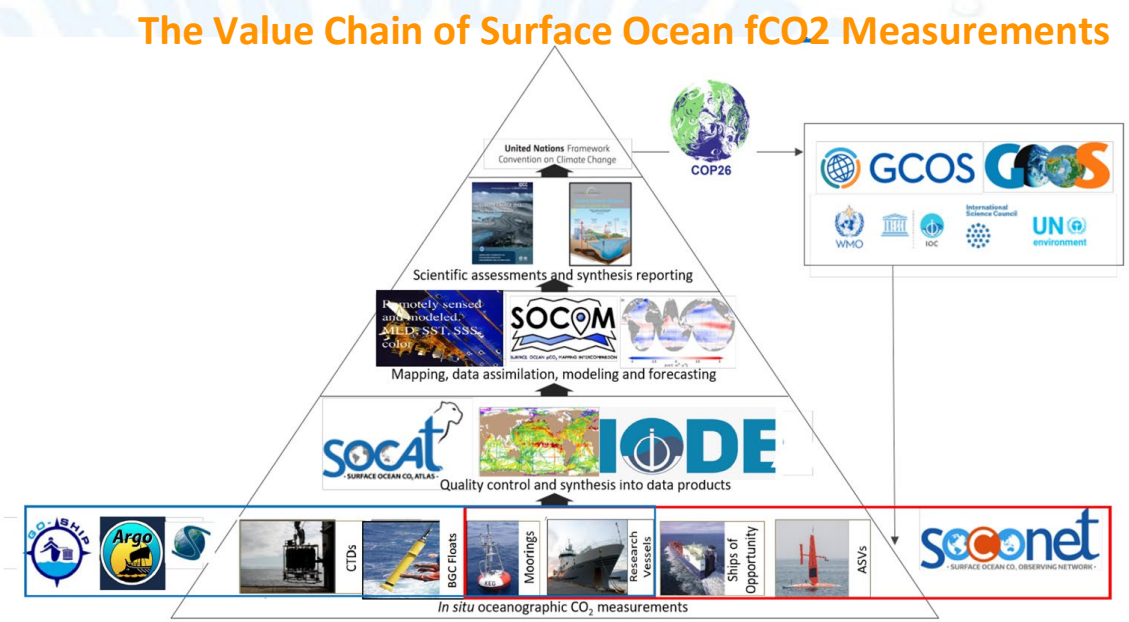


Requirement to rapidly and operationally link ocean data through to policy makers and minimize mitigation/adaptation costs

- We have all the components of the value chain and when they occasionally work together, they have a demonstrated ability to estimate surface ocean CO_2 uptake to very high precision in near real time.

- Much of the system is supported by short term research funding rather than longer term operational funding (similar to Met obs.), which is rather counterproductive at the time of the climate emergency when we most need to know ocean carbon uptake in near-real time for a wide variety of purposes.

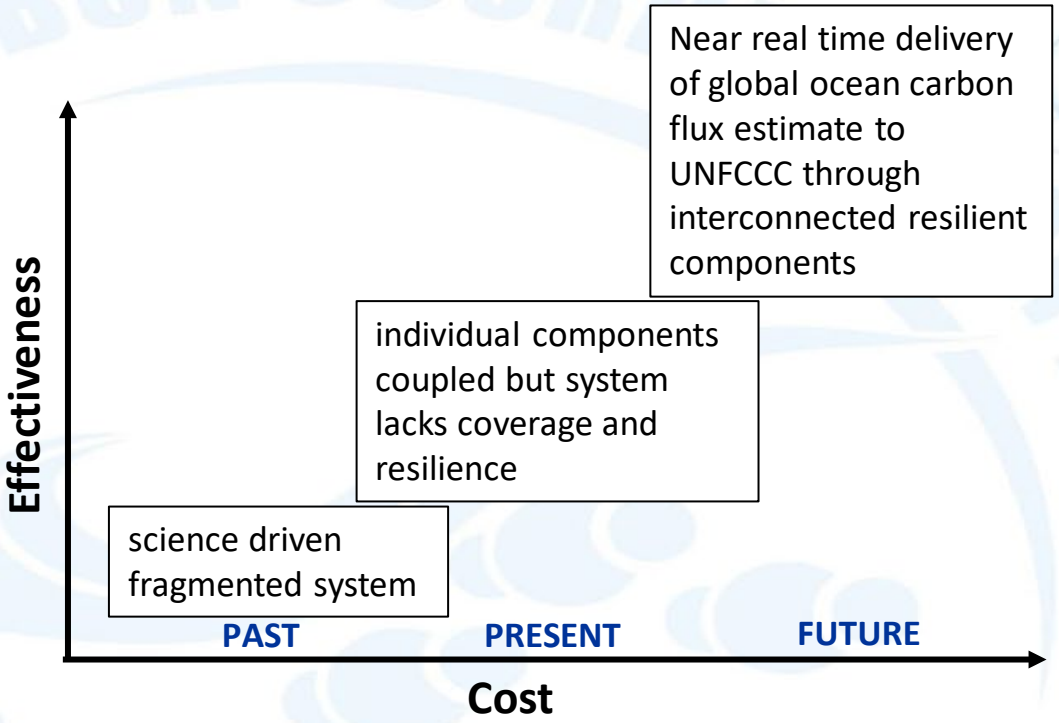
- Significant data gaps are appearing and key parts of the chain operate on a best endeavours basis – we are sliding back down the curve, just when we need to be climbing it.



Effectiveness of operational value chain

- fit-for-purpose design
- speed of delivery
- operational links between components
- system resilience

Operationalizing the value chain of Surface Ocean Carbon Observations



We are in a process of describing a fully operational Ocean Carbon Observing System capable of operationally delivering ocean carbon flux information. Strategy will include a tailored investment in suport of this operation.

Seawater carbonate system RMs 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.

GO-SHIP

Inorganic Carbon Measurements
- Total alkalinity
- pH
- Total Dissolved inorganic carbon
- pCO_2

glodap

SOLAS 22 Aug

The Global Ocean Data Analysis Project (#GLODAP) released the data product #GLODAPv2.2022! GLODAPv2.2022 provides access to quality controlled surface to bottom ocean biogeochemical data, with an emphasis on seawater inorganic carbon.
Discover here: http://www.glodap.info

Global Carbon Budget

Carbon Budget 2021

An annual update of the global carbon budget and trends

ipcc

INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT

IOCCP

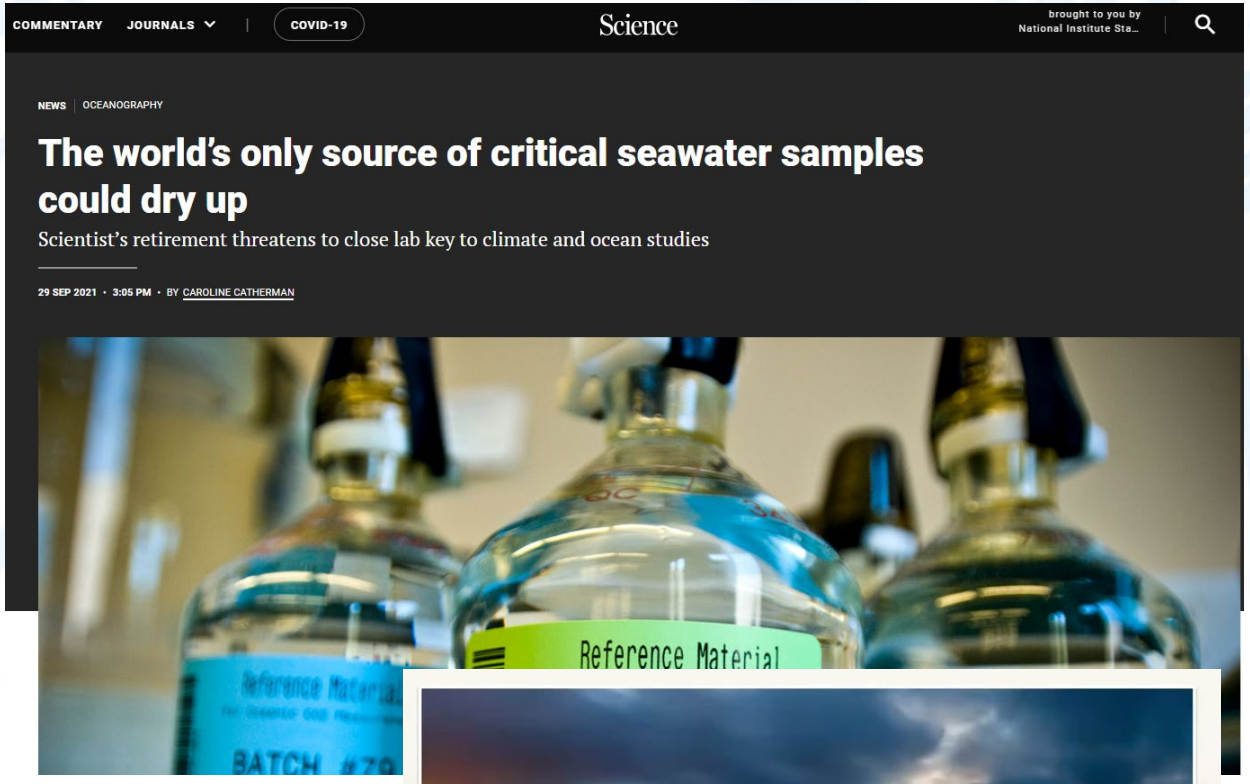
Global access to RMs is vulnerable

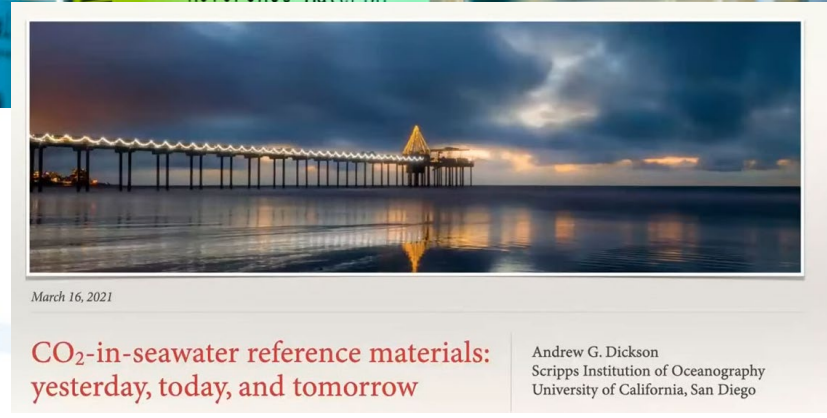
A single production and supply centre at Scripps Institution of Oceanography (USA) provides RM's and other reagents needed for seawater carbonate system measurements:

- 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)

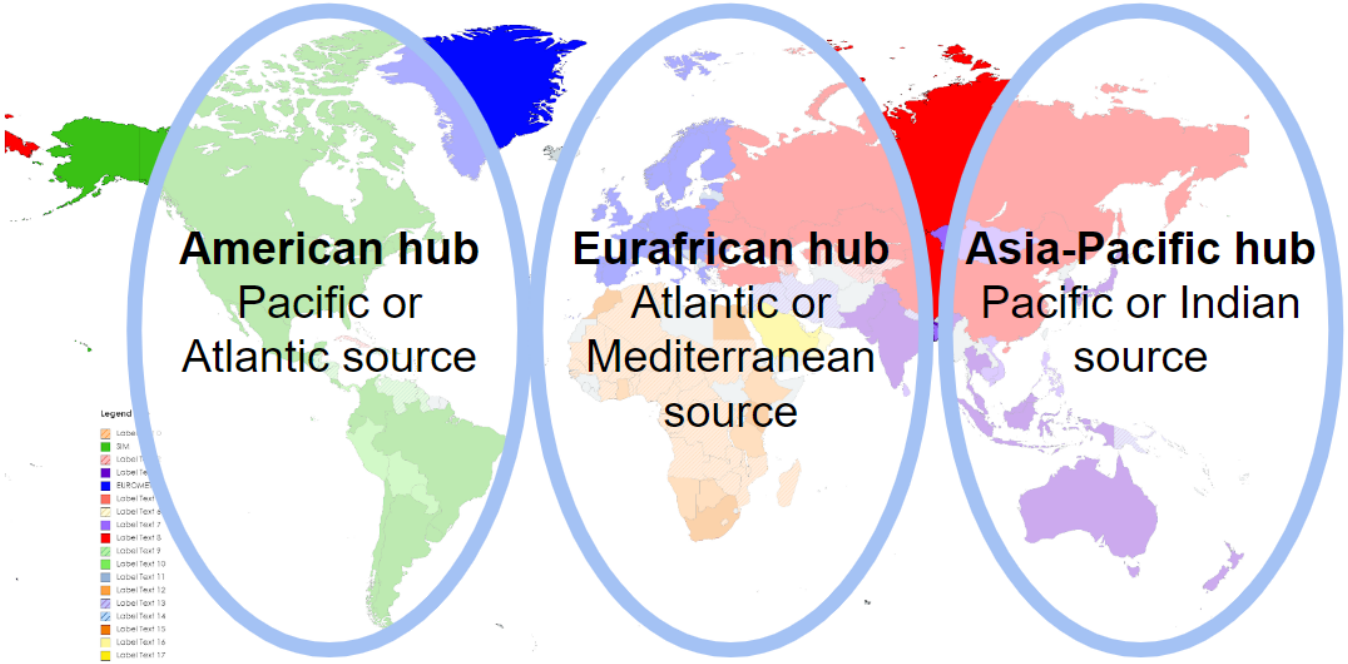




Possible structure of a global RM system

Transitional model

Production (Scripps) and Certification (NIST)	Production	Production



American hub Pacific or Atlantic source	**Eurafrican hub** Atlantic or Mediterranean source	**Asia-Pacific hub** Pacific or Indian source

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

Global coordination of marine debris observations

Achievements

- **Integrated Marine Debris Observing System** (IMDOS) launched as a joint initiative of GOOS, GEO BluePlanet and UNEP Global Partnership on Marine Litter (GPML) at the 2022 UNOC
- Marine Plastics Debris as an emerging EOV
- IMDOS International Steering Committee
- IMDOS Coordination & Communication Office supported jointly by EuroSea & EU4OceanObs
- IMDOS approved as a GOOS Project (April 2023)
- First International Marine Debris Data Harmonization Workshop (August 2023)
- Initiated global observing network for surface microplastics (August 2023)

IMDOS
INTEGRATED MARINE DEBRIS OBSERVING SYSTEM

EuroSea

EU4OceanObs
Funded by the European Union

Essential Ocean Variable Specification Sheet

Marine Plastics Debris

Global coordination of marine debris observations

Impact

- Successful establishment of global coordination of marine debris observations in a **complex and fragmented landscape** - participating organizations incl. UN bodies, governments, research programs and institutions, NGOs

- Coalition of the willing to build a global, federated and interoperable data system for marine debris monitoring

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 manufacturers
- Plenty of networking opportunities
- Attractive leisure time…

Economic evaluation of various elements of the FOO

Why do we need to know an economic value of providing observations-based information?

- Efficiencies – design, operation, management, financial,
- Strategic Planning
- Part of a Business Case for funders
- Evaluation of success or otherwise (is it fit-for–purpose?)
- Justification to stakeholders (tax payers)

How would we quantify an economic value? – there exist other examples

- Commercial value of information
- Cost of a system versus cost of non-action
- Social cost-benefit analysis
- Environmental degradation
- Cost of lack of information (global warming, tsunami risk)

Who? Discussion in an expanded format with partners and stakeholders

- Other systems have done this, do we have expertise in wider GOOS?
- IPCC already includes some aspects of this for the climate system

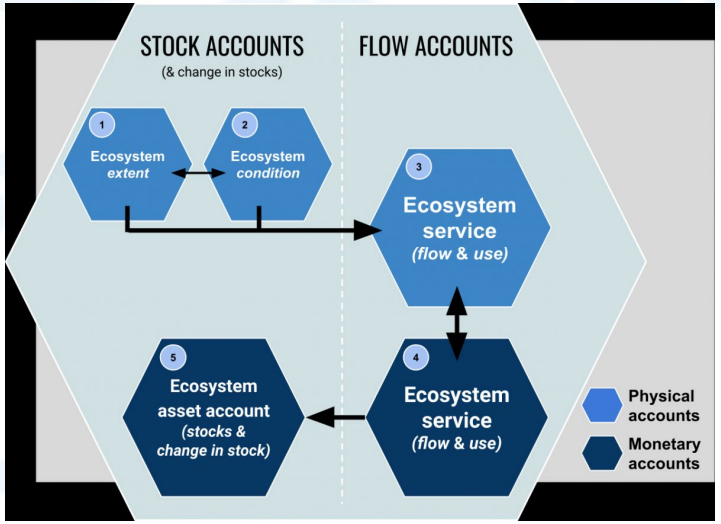
Adams, V. et al., 2011: Analyzing the Socioeconomic Impacts of the Use of Earth Observations, A Primer. Prepared for NASA by Booz Allen, 40pp.

- To sustain and enhance the ocean carbon obs system, this kind of focus is badly needed. For most part we do not even have an idea how to start considering various aspects of economic evaluation concept.

Example: Ecosystem accounting

Potential challenges in valuation (SEEA Experimental Ecosystem Accounting, 2015)

- Target of valuation,
- Distinction between the valuation of ecosystem services and the valuation of ecosystem assets (and the related issue of valuing ecosystem degradation),
- Valuation of intermediate services
- Consistency in the use of valuation concepts and techniques
- Scaling and aggregation
- Valuation of regulating services.
- The measurement of non-use value
- The valuation of biodiversity and resilience.
- Uncertainty in measurement



International Council for Science
SCOR
Scientific Committee on Oceanic Research

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT
IOCCP

The Global Ocean Observing System
GOOS
Biogeochemistry Panel

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

A communication and coordination service for marine biogeochemistry

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Thank You!

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