A communication and coordination service for marine biogeochemistry

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Science Steering Group

http://www.ioccp.org/contacts

2 Co-chairs
10 SSG Experts
2 Project Office Staff

Co-chairs

K. Currie
V. Garçon

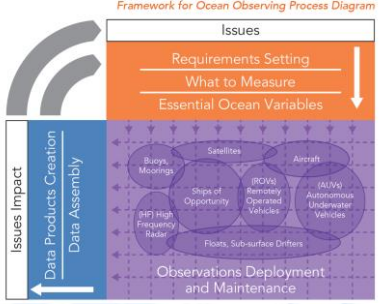
Project Office

M. Telszewski (Director)
A. Palacz (Officer)

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

Framework for Ocean Observing	*M. Telszewski, A. Palacz*
Underway CO_2 Observations	*Selection process*
Ocean Interior Observations	*Selection process*
Time Series Efforts	*Selection process*
Ocean Acidification	*K. Currie*
Regional GOOS BGC Implementation	*Selection process*
Oxygen	*V. Garçon*
Instruments and Sensors	*D. Atamanchuk*
Data and Information Access Services	*Selection process*
Data Synthesis Activities	*S. Lauvset*
Particulate Matter	*E. Boss*
Observations – Modelling Interface	*F. Chai*

Coordination efforts to support TRL increase for Particulate Matter EOV

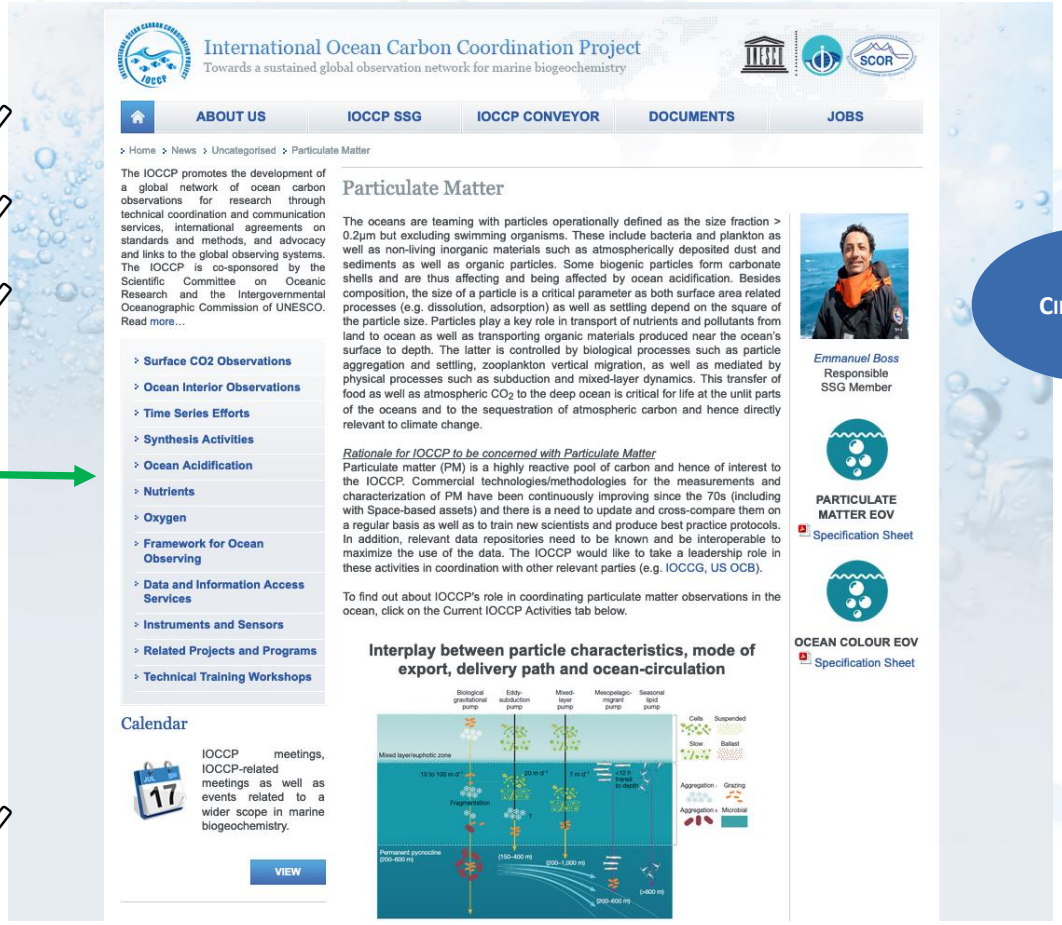


IOCCP Terms of Reference

3. **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 ✓


International Ocean Carbon Coordination Project
Towards a sustained global observation network for marine biogeochemistry

ABOUT US | IOCCP SSG | IOCCP CONVEYOR | DOCUMENTS | JOBS

Home › News › Uncategorised › Particulate Matter

The IOCCP promotes the development of a global network of ocean carbon observations for research through technical coordination and communication services, international agreements on standards and methods, and advocacy and links to the global observing systems. The IOCCP is co-sponsored by the Scientific Committee on Oceanic Research and the Intergovernmental Oceanographic Commission of UNESCO. Read more…

- Surface CO2 Observations
- Ocean Interior Observations
- Time Series Efforts
- Synthesis Activities
- Ocean Acidification
- Nutrients
- Oxygen
- Framework for Ocean Observing
- Data and Information Access Services
- Instruments and Sensors
- Related Projects and Programs
- Technical Training Workshops

Calendar

IOCCP meetings, IOCCP-related meetings as well as events related to a wider scope in marine biogeochemistry.

VIEW

Particulate Matter

The oceans are teaming with particles operationally defined as the size fraction > 0.2µm but excluding swimming organisms. These include bacteria and plankton as well as non-living inorganic materials such as atmospherically deposited dust and sediments as well as organic particles. Some biogenic particles form carbonate shells and are thus affecting and being affected by ocean acidification. Besides composition, the size of a particle is a critical parameter as both surface area related processes (e.g. dissolution, adsorption) as well as settling depend on the square of the particle size. Particles play a key role in transport of nutrients and pollutants from land to ocean as well as transporting organic materials produced near the ocean's surface to depth. The latter is controlled by biological processes such as particle aggregation and settling, zooplankton vertical migration, as well as mediated by physical processes such as subduction and mixed-layer dynamics. This transfer of food as well as atmospheric CO_2 to the deep ocean is critical for life at the unlit parts of the oceans and to the sequestration of atmospheric carbon and hence directly relevant to climate change.

Rationale for IOCCP to be concerned with Particulate Matter

Particulate matter (PM) is a highly reactive pool of carbon and hence of interest to the IOCCP. Commercial technologies/methodologies for the measurements and characterization of PM have been continuously improving since the 70s (including with Space-based assets) and there is a need to update and cross-compare them on a regular basis as well as to train new scientists and produce best practice protocols. In addition, relevant data repositories need to be known and be interoperable to maximize the use of the data. The IOCCP would like to take a leadership role in these activities in coordination with other relevant parties (e.g. IOCCG, US OCB).

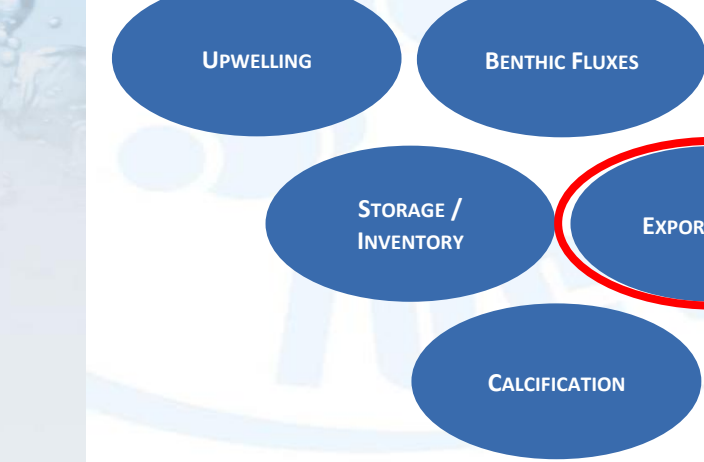
To find out about IOCCP's role in coordinating particulate matter observations in the ocean, click on the Current IOCCP Activities tab below.

Interplay between particle characteristics, mode of export, delivery path and ocean-circulation

Emmanuel Boss
Responsible SSG Member

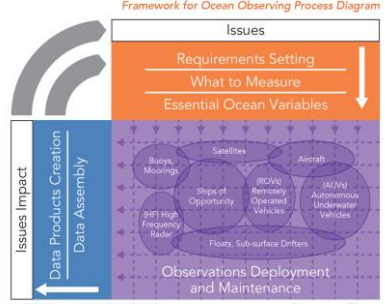
PARTICULATE MATTER EOV
Specification Sheet

OCEAN COLOUR EOV
Specification Sheet



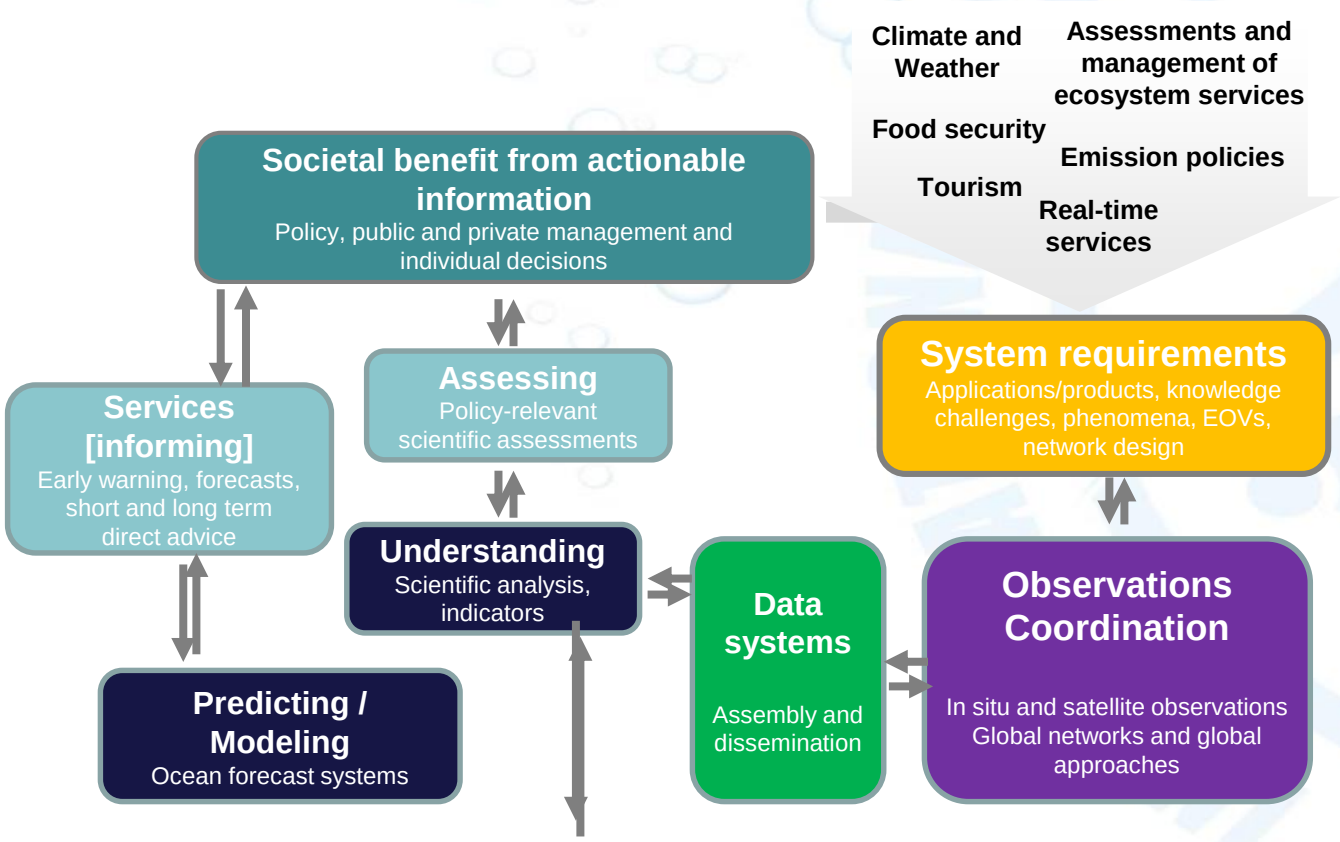
Strengthening the in situ & modelling interface

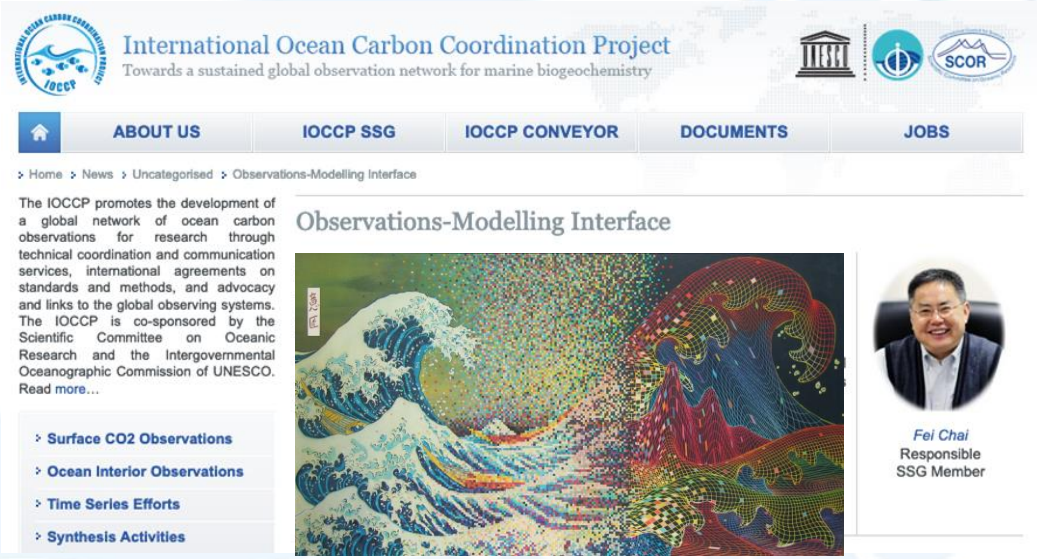
recognizing biogeochemistry as new frontier in operational oceanography



IOCCP Terms of Reference

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

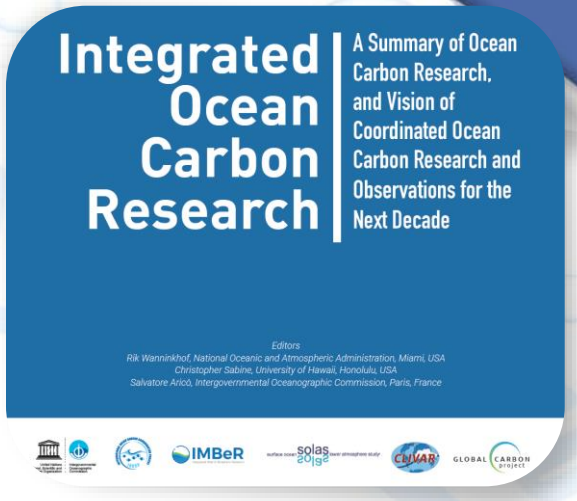




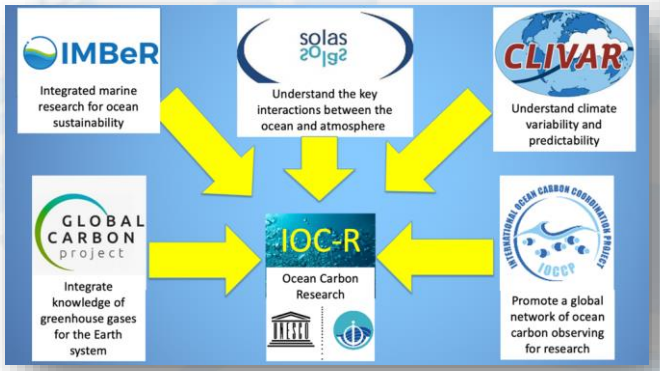
Initial directions:

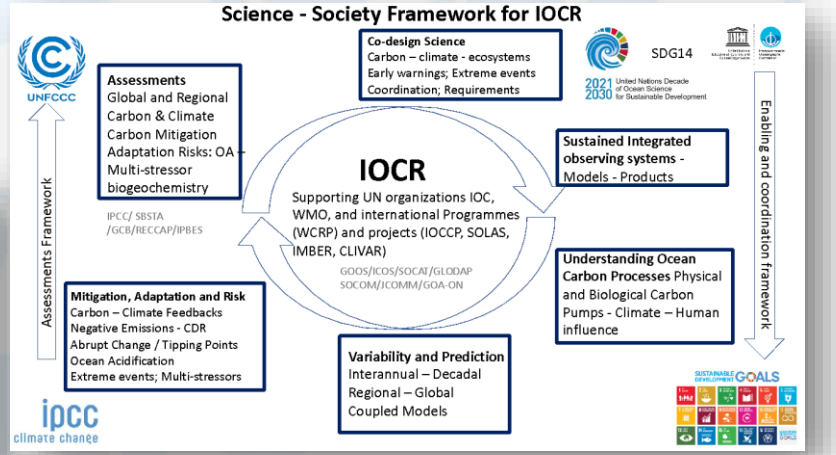
- Needs for and use of biogeochemistry observations in data assimilation and ocean-based forecasts
- activities aimed at better use of model outputs informing the design of the ocean observing system across scales (coastal, basin-scale, global)
- Integration of remote sensing and in situ ocean observations, including from autonomous platforms
- Specific focus on **land-coastal-open ocean continuum** across the global coastal and in-shore domains.

IOC WG on Integrated Ocean Carbon Research (IOCR)



- Co-convened by the **IOC**, the **IOCCP/GOOS BGC**, **SOLAS**, **IMBeR**, **CLIVAR**, and the **GCP**.
- **Aimed at:**
  - Identification of critical knowledge gaps in the ocean carbon cycle
  - Identification of research activities in order to close this gaps
  - Bridging between science and policy: the UN Decade, the UNFCCC and its Paris agreement, the Intergovernmental Panel on Climate Change AR6 and subsequent AR's.
- **Current and near-future focus stemming from Vision of Coordinated Ocean Carbon Research and Observations:**
  - Strengthen sustained financial support for observing networks
  - Enhance and coordinate the existing suite of carbon observing and synthesis projects
  - Highlight regional priorities and need for process studies and experiments
  - New technologies to enhance autonomous observations and analyses
  - Integrate models and observations
  - Boundary regions: Land-ocean continuum and air-sea Interface
  - The changing role of biology in the ocean carbon cycle





Developing a time-series data synthesis product

based on ship-based in situ biogeochemical data from open ocean stations

(Led by Björn Fiedler, Nico Lange @ GEOMAR, Germany)

24 participants representing most major TS: Hawaii (HOT), Bermuda (BATS), New Zealand (Munida), Venezuela (CARIACO), Canada (Line-P), Cabo Verde (CVOO), Canary Islands (ESTOC), Iberian Peninsula (Radiales) and Iceland (Iceland Sea). Also, leaders from IGMETS, GOA-ON, OCB, SOCAT, GLODAP, ICOS and the recently funded US METS RCN. Colleagues from Japan (K2, KNOT), as well as from France (DYFAMED) did supply material but could not join in person.

Workshop organized on 23-25 November 2020:

Objectives:

- Bringing the ocean bgc ship-based time-series community together to jointly develop a consistent data product and agree on best practices, striving for OCG network status
- A regularly updated data product delivering timely and high impact bgc TS-data from ocean ship-based time-series for global assessments

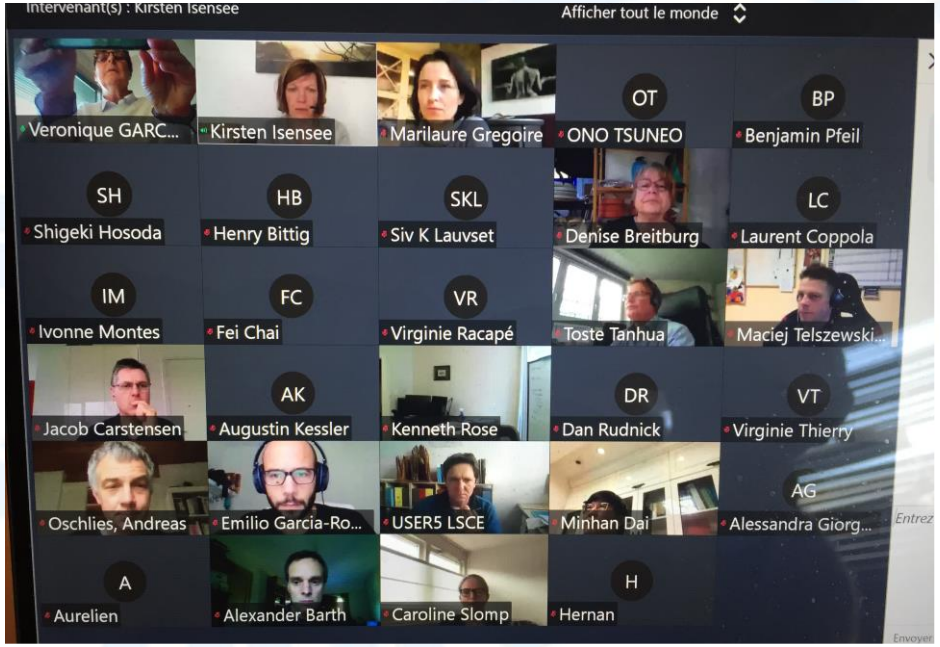
Four thematic working groups work on:

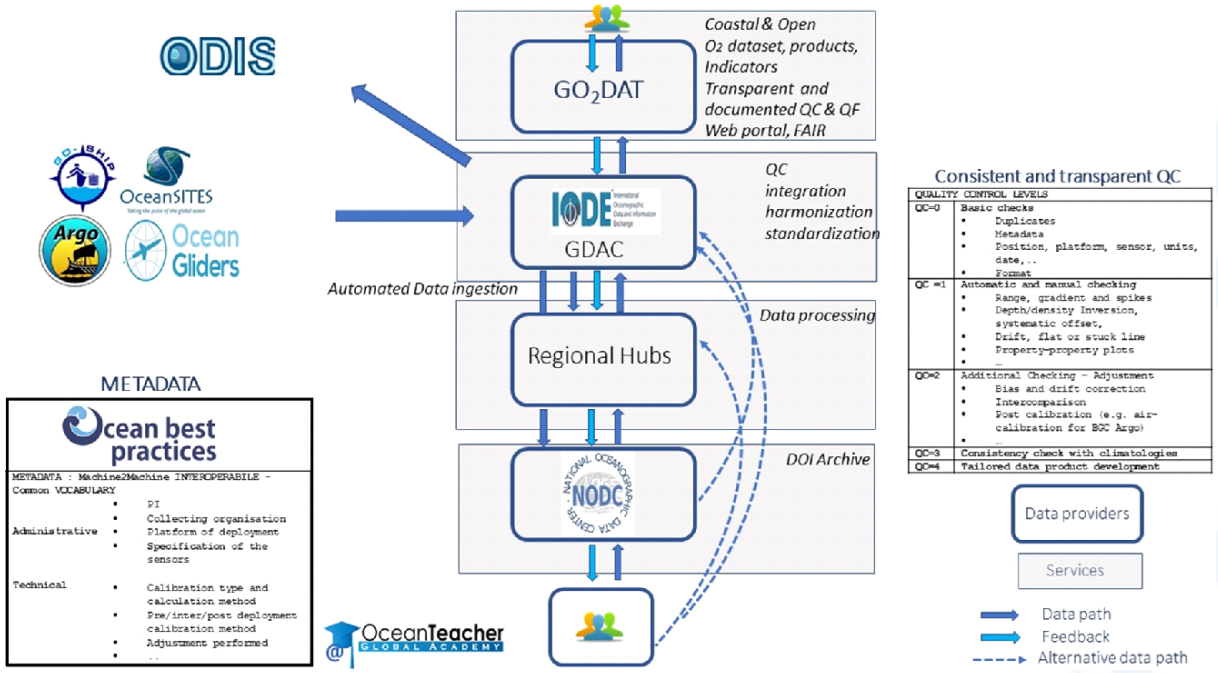
- Overall product concept
- Commonality of methods
- Data handling
- Data policy

Oxygen Data Portal / Synthesis Product

- Joint effort by IOCCP, GO_2NE, IOC, NOAA NCEI & GLODAP
- Aim to include all oxygen data from all relevant eulerian and lagrangian platforms
- GOOS Biogeochemistry Panel engaged in building the framework in terms of aims, end users, structure, funding sources, community coordination, etc.

Building a Global Ocean Oxygen Data Base and Atlas for assessing and predicting deoxygenation and ocean health in the open and coastal ocean

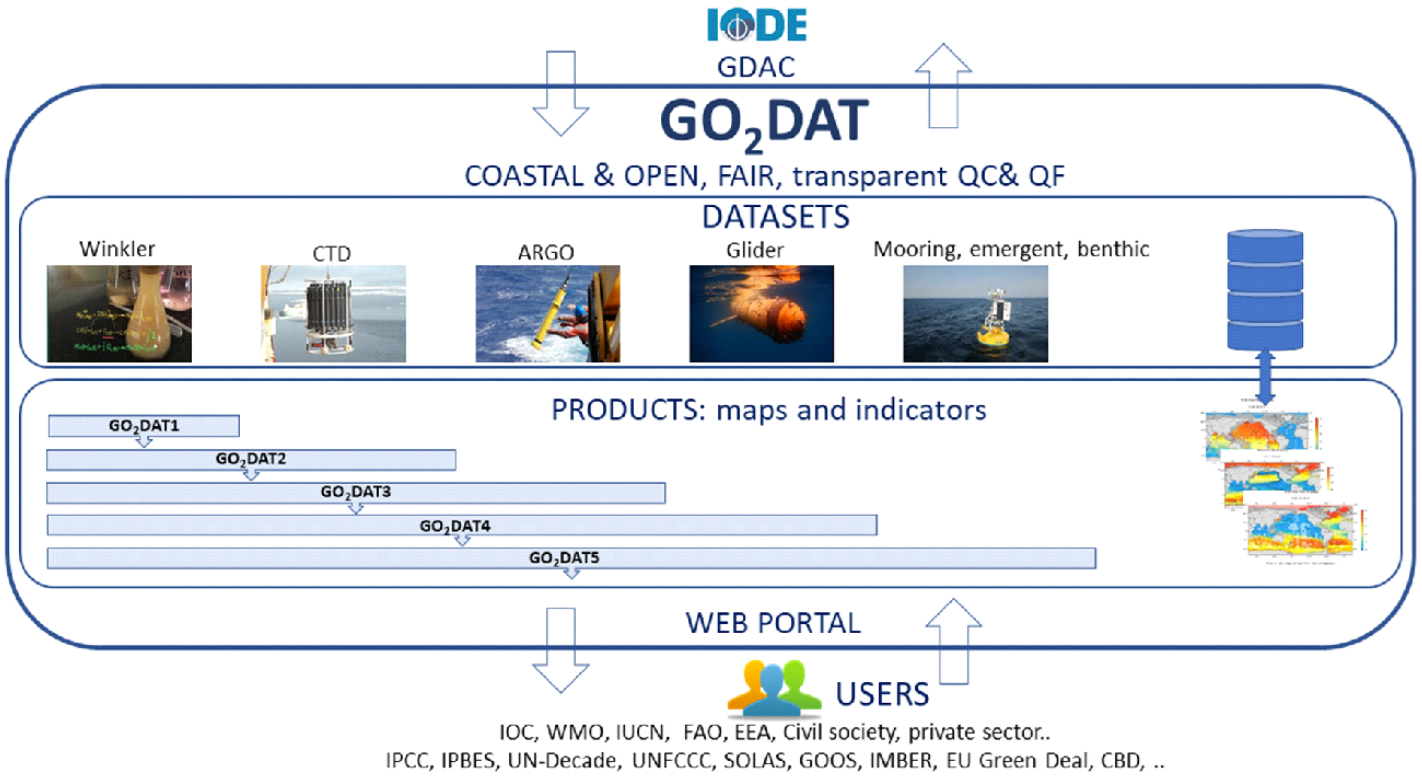


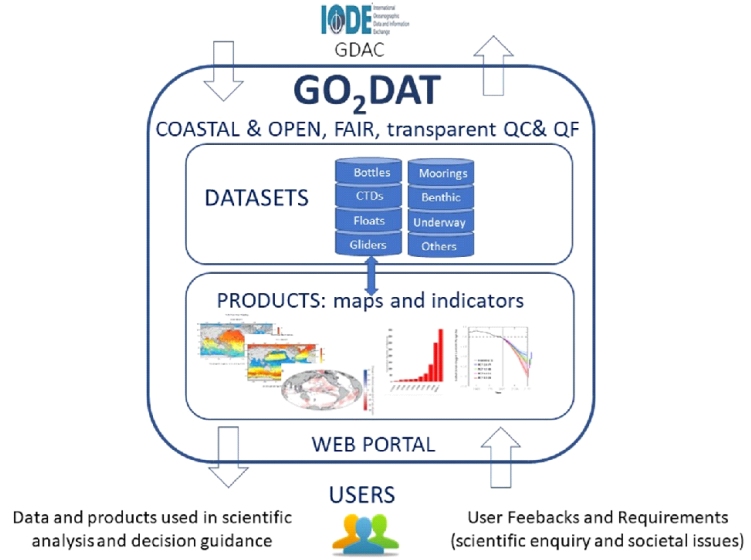


•Oxygen data platform scoping workshop **November 11-12, 2019** in Sopot with support from IOCCP, IOC, GO_2NE, NOAA and SFB754 and one on line on **November 5-6, 2020**

Community White Paper to Frontiers in Mar. Sci. (Ocean Observation)

frontiers





To be submitted early May 2021

International community effort gathering scientists, data managers and end-users

58 authors, 21 countries, all continents

Hopefully second semester of 2021, we will be able to set up a face-to-face meeting to assess progress in implementation of the roadmap and IOCCP will support this workshop.

IOCCP and the UN Decade : Global Ocean Oxygen Decade (GOOD)

1. Deoxygenation and ocean life: **identifying and understanding threats** to improve mitigation and adaptation strategies
2. Deoxygenation, water quality and the climate system: **Understanding processes** and feedbacks and developing actionable indicators
3. Deoxygenation and ecosystem services: Assessing and **valuing the impact** of deoxygenation
4. Deoxygenation and co-stressors: Understanding, **monitoring and mitigating deoxygenation** in a multiple stressors context
5. **Economic and societal consequences** of deoxygenation.
6. Deoxygenation: Understanding causes, attributing changes and **developing mitigation approaches**
7. Mapping and Modelling oxygen: **GO_2DAT**
8. **Capacity building and ocean literacy**

IUCN, GOOS, IOCCP, IOC-OBPS, GOA-ON, CoastPredict, DOSI, CE2COAST, Coastal-SOS, DITTO, Dissolved Oxygen Scientific Expertise Consortium (CES) from ODATIS

2 Mio EUR per year over the decade 2021-2030

IOCCP and the UN Decade : GOOS and GOA-ON

GOOS – Observing Together

- Understanding and responding to the needs of end users, down to the community level.
- Making every observation count
- Applying GOOS expertise to enable all observations to contribute to the global system
- IOCCP contribution to Task Team: Kim Currie (NZ)

GOOS – CoastPredict

- Extending into the coastal space has been a longstanding need not yet adequately addressed through GOOS
- Exploring new observing technologies and techniques appropriate to coastal observations in resource-constrained environment
- Bid to integrate observations and modeling as one community by the end of the Decade
- IOCCP contribution to Task Team: Maciej Telszewski (PL) and Artur Palacz (PL)

GOA-ON - Ocean Acidification Research for Sustainability

- Providing society with the observational and scientific evidence needed to sustainably identify, monitor, mitigate and adapt to ocean acidification; from local to global scales
- Enhancing regional collaborative efforts, coordination of capacity building in science,
- Codesign and implement observation and research to address the threat of ocean acidification
- communication and delivery of the outputs to policy makers and communities.
- IOCCP contribution to Task Team: Kim Currie (NZ), Maciej Telszewski (PL), Fei Chai (US, China), Benjamin Pfeil (Norway)

SDG Target 14.3: Minimize impacts of ocean acidification

- Methodology accepted UN, Tier II
- Computation method – aggregation and disaggregation
- Sampling strategy, including sampling frequency
- Methods and guidance available to countries for the compilation of data at the national level, including:
- Data submission: 2020, 2021
- 2021: Methodology update,
  - Increased clarity
  - data collection, submission and data flow,
  - Data visualization products
  - Federated data collection system
  - Compatibility with other databases and products
  - Metadata compatibility
  - Data quality
- IOCCP contribution: Kim Currie (NZ), Siv Lauvset (Norway), Fei Chai (US and China) plus former IOCCP SSG members

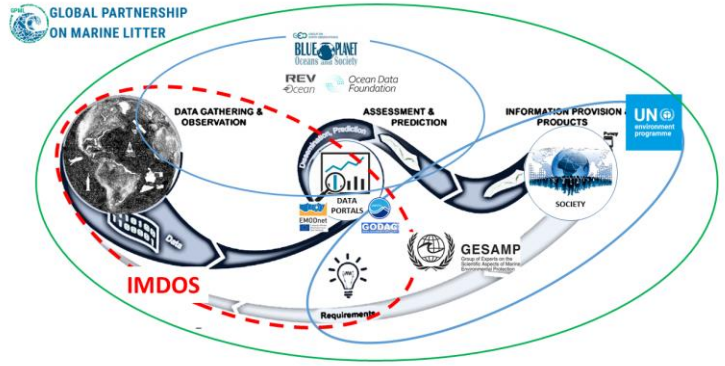
SDG indicator 14.3.1 methodology – revisited
Online Technical Workshop, 12-13 April 2021

14 LIFE BELOW WATER

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Indicator 14.3.1: Average marine acidity (pH) measured at agreed suite of representative sampling stations

Marine (Plastics) Debris EOV & Integrated Marine Debris Observing System (IMDOS)



Main Achievements:

- **Draft Action Plan** for Establishing Global Coordination of IMDOS
  - received support from many key partner organizations, continuously updated

- **Recommendations for standardization** of marine litter monitoring, modeling, remote sensing, data management - outcomes from Marine Litter WG @ Ocean Best Practices System (OBPS) IV Workshop in Sep 2020
  - organized and led by Artur Palacz (IOCCP) & Rene Garello (IEEE, France)
  - **7 thematic sessions led by 14 international experts on monitoring, citizen science, modelling, remote sensing and data management** from GOOS, UNEP, CBD, ESA, GEO Blue Planet, GESAMP and many others
  - set **priorities for global scale measurements** to inform the new Marine Plastics Debris EOV Specification Sheet

- GOOS as a stakeholder in the **MOEJ/G20 project on global microplastics data hub and synthesis project**
  - provided advice during two expert workshops in December 2020 and February 2021

Ocean best practices

EuroSea

環境省
Ministry of the Environment
Government of Japan

Marine (Plastics) Debris EOV & Integrated Marine Debris Observing System (IMDOS)

NEW **Human Pressure Variables: Marine (Plastic) Debris**

Current work and future plans

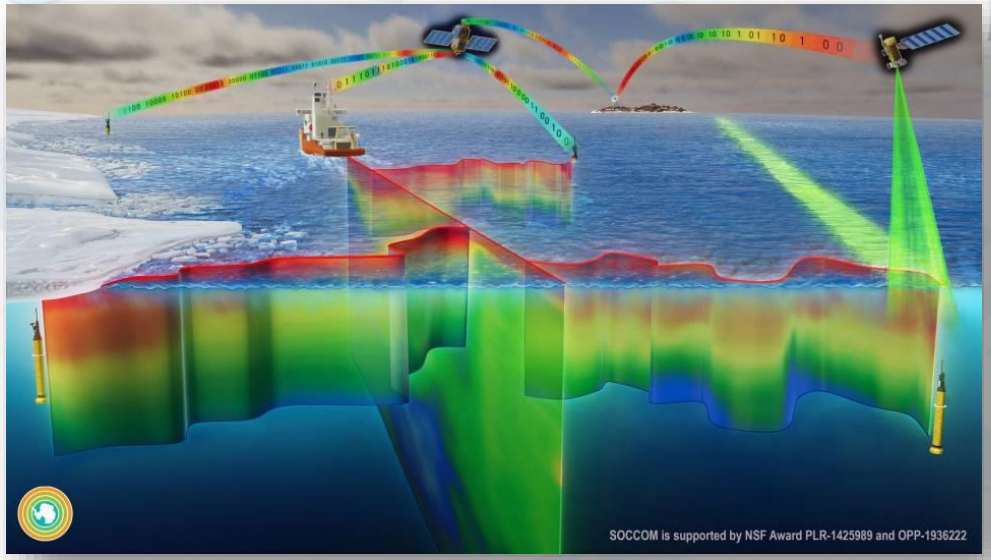
- Proposal drafted for a **joint GOOS-UNEP project on IMDOS**
  - To be discussed with UNEP, also as part of broader GOOS-UNEP partnership
  - Close collaboration with IOCCG Task Force on Remote Sensing of Marine Litter, MSFD Technical Group on Marine Litter, GESAMP WG40 and GEO Blue Planet among others

- Developing the **Marine (Plastics) Debris EOV Specification Sheet**

- **Sampling co-design and augmenting existing SOPs**
  - e.g. aligning seafloor litter protocols with seagrass and macroalgae SOPs
  - e.g. use of periodic ship servicing of moored observatories

- Promoting a **coordinated observing effort on surface ocean microplastics**
  - Building on the Japan/G20 efforts on global microplastics data hub

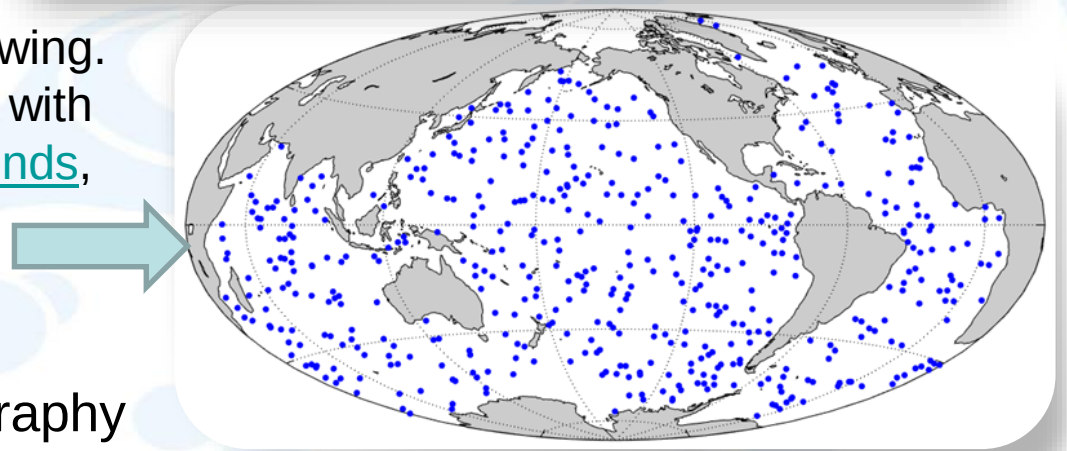
Biogeochemical Argo array on the rise



- October 2020: US NSF announced a **$53 million grant to build a global network of BGC-Argo** (Global Ocean Biogeochemistry Array) (**~500 floats**).

  https://www.princeton.edu/news/2020/10/29/princeton-project-expands-create-worldwide-fleet-robotic-floats-monitor-ocean

What will the 500 float **BGC array** look like? Try the following. But this would just be half the planned array. Double this with international contributions. Thank you @NSF, @hnedmonds, @MBARI_News and the GO-BGC team. (K. Johnson)



Imaginary map of 500 BGC-Argo array

- March 2021: UK NERC and the National Oceanography Centre announced an investment of **£3.7 million** to deploy **30 Biogeochemical Argo profiling floats** in the Atlantic Ocean over the next three years as part of the UK Argo programme.

Continue focus on technical capacity building

~~7-20 June 2021, Kristineberg, Sweden~~

COVID-19

6-19 June 2022, Kristineberg, Sweden

- Venue booked for 2 weeks in June 2022
- 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!

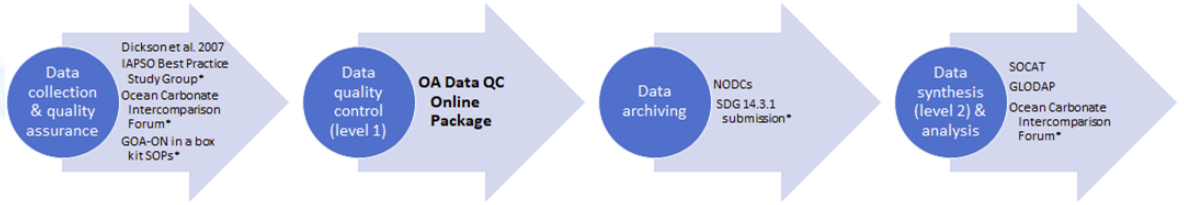
ICOS Ocean Thematic Centre

- Lecturers, technical experts and scientific advisors agreed to work together to refine the agenda, pre-workshop tasks and post-workshop metrics.

GOA-ON
Global Ocean Acidification Observing Network

Ocean Acidification Data Quality Control Online Package

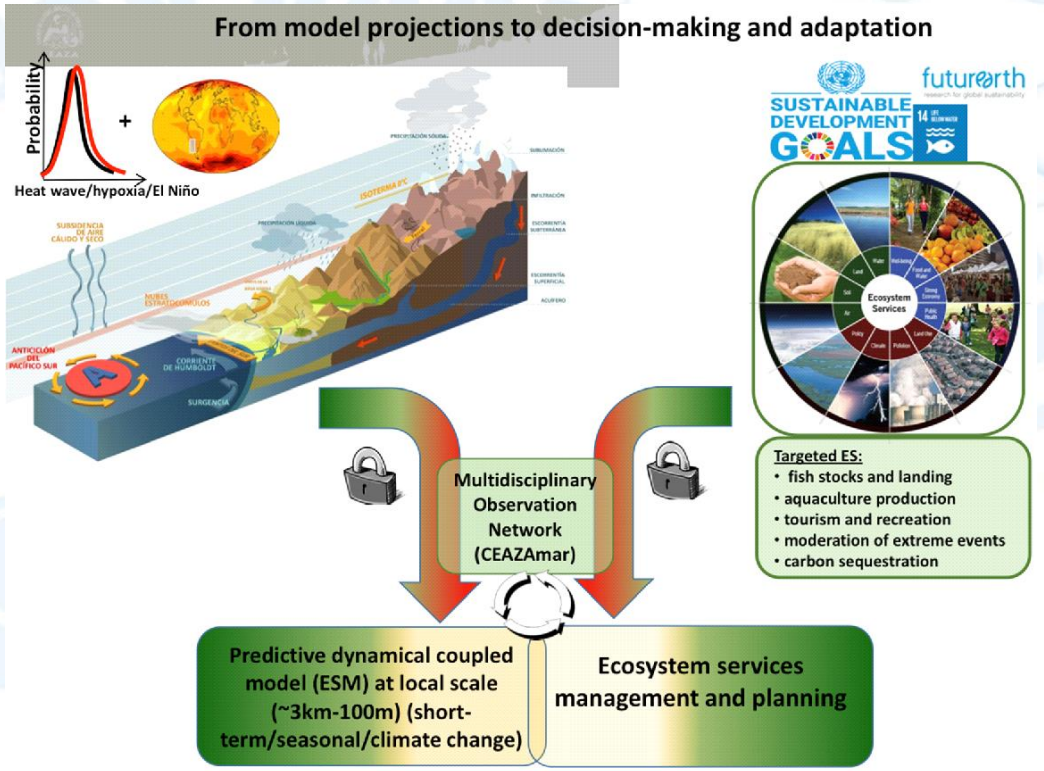
- Community-developed best practices for level 1 QC of ocean acidification chemical data (pH, total alkalinity, pCO_2, dissolved inorganic carbon).
- Bringing together a combination of different types of resources from video to slideshows to written materials to interactive decision trees.
- Fully accessible online to aid in learning and putting into practice data QC techniques. Resources will be available for download to enable offline use for researchers in areas with unreliable access to the internet. Translation into several languages is planned.



GOOS IP Action 6.1 :

Initiate the implementation of multidisciplinary GOOS initiative VOICE: Variability of the Oxycline and its Impact on the Ecosystem

- **Lead:** BGC Panel
- **Plus:** SC, GRAs, OOPC, BioEco Panel, OCG/OceanOPS
- Provide global coordination of regional pilots initiated through resources external to GOOS. 100kS for regional workshops on details of implementation and engagement of local funders who actually fund observations.
- **Output / Impact:** Integrated regional multidisciplinary observing systems in place in the EBSs (Eastern Boundary Systems) for observing variability of the oxycline and its impact on the ecosystem, towards increasing readiness levels for the three FOO pillars/Enhanced ocean observing value chains in the EBSs
- Connection Decade: Observing Together, ObsCoDe
- Partners: AtlantOs, SCOR, OceanPredict
- 1 FTE/yr from 2023 BGC Panel node



CLAP: Climate Action Planning, Chilean ANID
Agencia Nacional de Investigación y Desarrollo
PIs: B. Dewitte and M. Rivadeneira

GOOS SO6 and SO5

Anthropogenic impacts on coastal ocean and needs to connect open ocean and marginal seas

1. Challenges

- Synergistic effects of climate variability and human activities on coastal systems
- Man-made impacts: eutrophication, HABs, hypoxia, and OA
- Open ocean impact on boundary current systems (both eastern and western boundary systems)
- Marine heatwaves, extreme events, and their impacts on coastal marine ecosystems

2. How to connect land, estuarine, coastal seas, and open ocean?

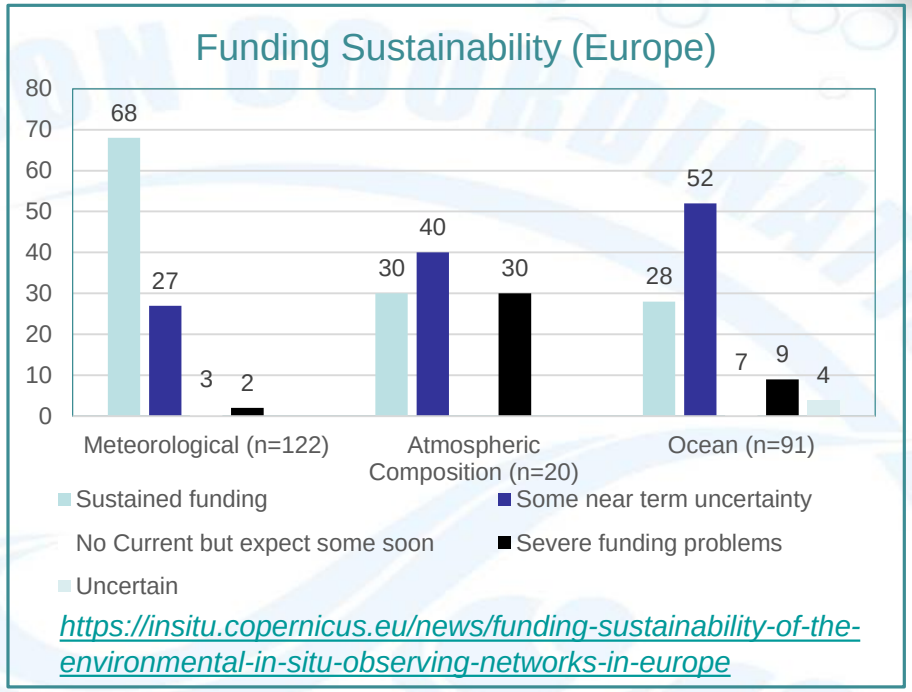
- One integrated coastal observing system serving most (all) challenges
- What kind of modeling framework is needed?
- Global IPCC models downscaling and/or regional models upscaling to the global ocean
- Need for a socio-economic perspective to be integrated with environmental information

Operationalizing surface ocean carbon observations

- Much of the network 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.

- We plan to describe a fully operational Ocean Carbon Observing System capable of operationally delivering ocean carbon flux information and invite the community to join us in creating a blueprint for this vision.

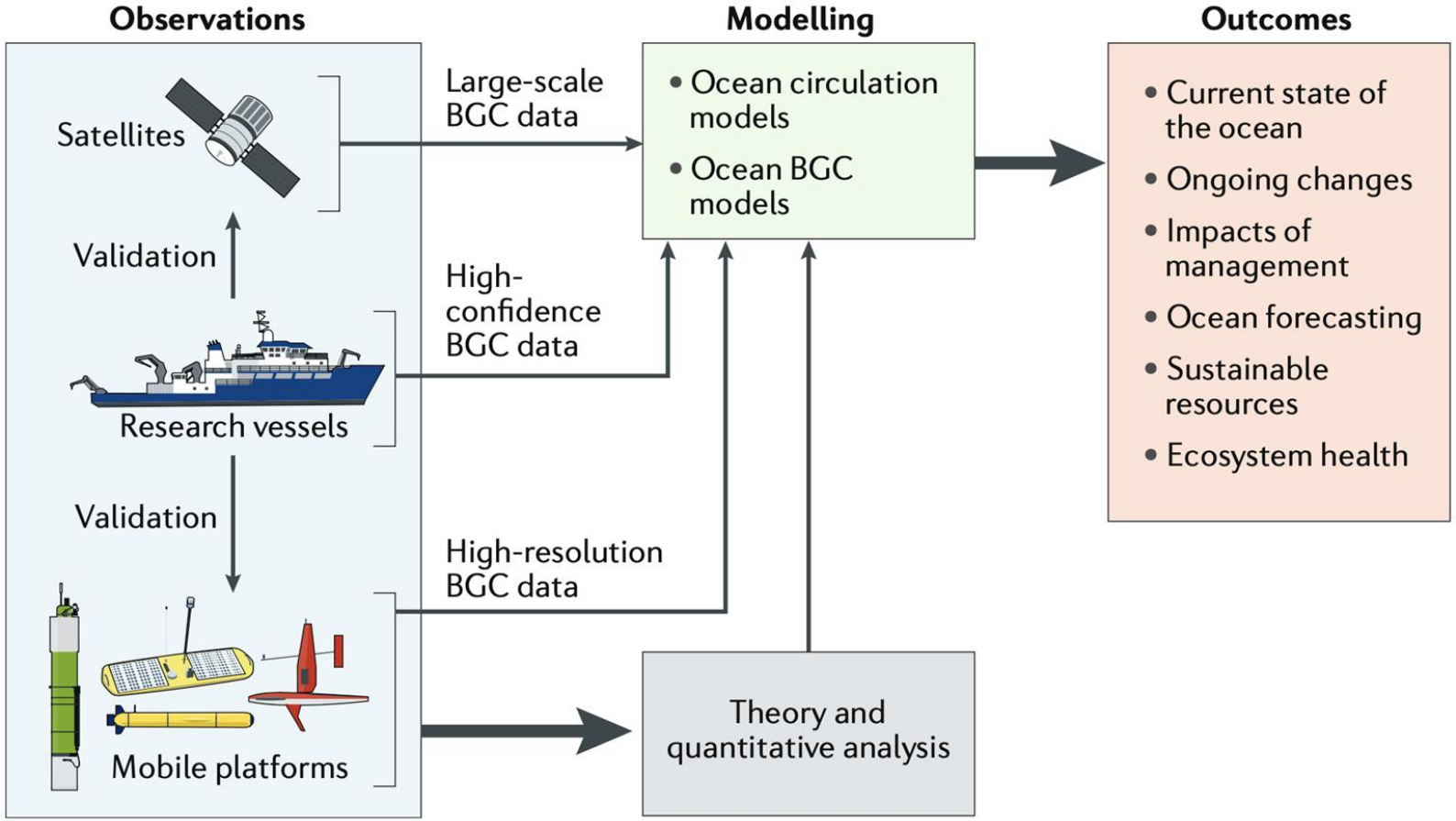
- This year our efforts will be focused on 3 activities:
  - Publishing a commentary in Nature alerting a variety of stakeholders to the problem
  - Organizing a technical workshop focused on building a blueprint of the technical, financial and organizational solutions allowing for sustainable ocean carbon flux monitoring required to deliver an annual traceable, robust estimate of ocean carbon uptake
  - Continuous liaison with stakeholders: at COP 26, UNFCCC SBSTA, UN Oceans Conference



https://insitu.copernicus.eu/news/funding-sustainability-of-the-environmental-in-situ-observing-networks-in-europe

Strengthening the in situ & modelling interface

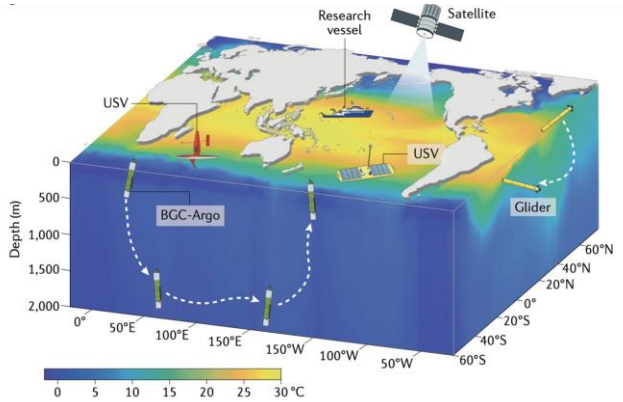
recognizing biogeochemistry as new frontier in operational oceanography



Chai, …,Boss, Sutton et al., Nature Reviews Earth & Environment (NREE), May 2020

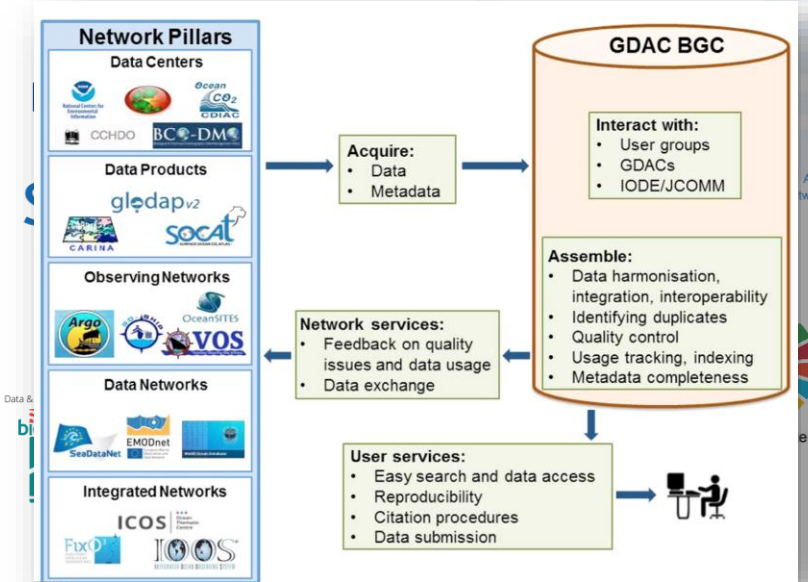
Initial directions:

- Needs for clear data QA/QC protocols, FAIR data management protocols across biogeochemistry observations from variety of (new) platforms
- activities aimed at better use of model outputs informing the design of the ocean observing system across scales (coastal, basin-scale, global)
- Integration of remote sensing and in situ ocean observations, including from autonomous platforms into biogeochemical models

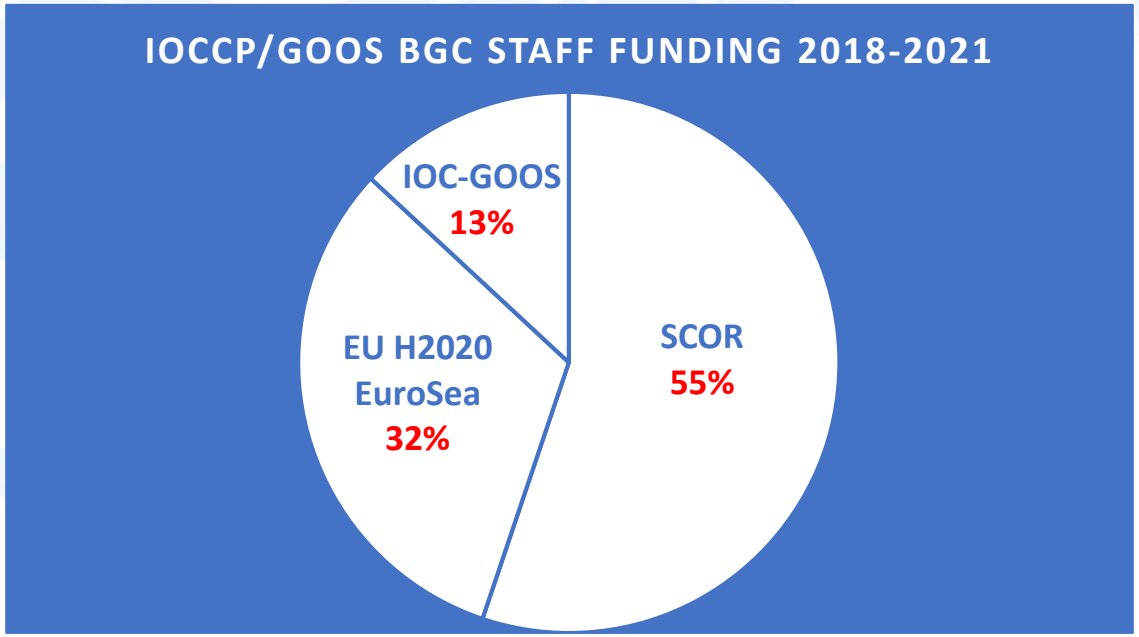


Cross-GOOS issues/threats

- **Data management: is there a GOOS-wide strategy on data management (obs. networks, OCG, ODIS, IODE, WIGOS, WIS)**
  - Move away from community-based volunteer QC efforts run purely on voluntary basis;
  - Use available resources to produce data synthesis products (e.g. SOCAT, GLODAP, GO2AT) in an automated, operational manner which would increase the TRL of the whole operation;
  - Make sure that services depending on data/synth. products acknowledge that clearly and in a variety of manners;
  - Efforts to operationalize funding for oceanographic data management
  - One united data product -> easy access, fit for purpose (e.g. uncertainties) and user friendly…



- **Staff funding regimen: how to change from soft-money, short-duration, only partially overlapping funding streams to dedicated, operational, long-term funding for those employed to deliver GOOS.**
  - large time overhead related to developing relatively short-term funding opportunities
  - large time overhead related to delivering to projects not entirely aligned with our mission
  - Reporting to multiple funders frustrates and might cause clashes of interest



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