Global Ocean Observing System

unesco Intergovernmental Oceanographic Commission

WORLD METEOROLOGICAL ORGANIZATION

UN environment programme

International Science Council

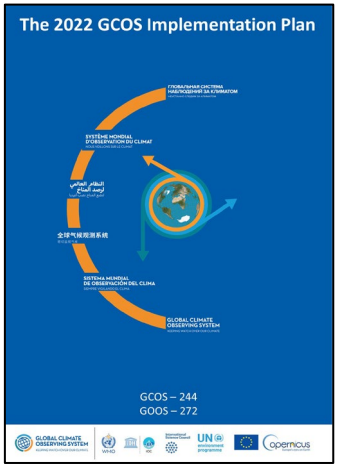
Session 7.5: Carbon and GHG Plan

Adrienne Sutton, Veronique Garçon, Maciej Telszewski

15th GOOS Steering Committee Meeting (SC-15) | 25-27 March 2026 | Hyderabad, India

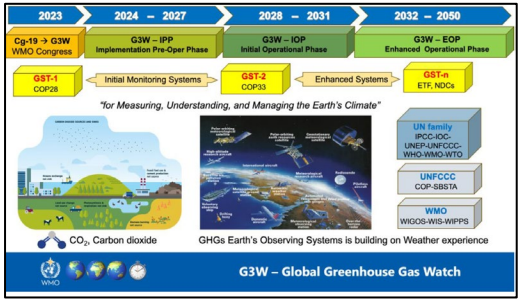
Responding to needs: Detailed, costed Carbon and GHG Plan

including research, technology, human capacity and economic evaluation



GCOS IP 2022

Collects and documents the data needs for monitoring the climate system and for assessing the impacts of climate variability and change. Submitted every 5 years to the United Nations Framework Convention (UNFCCC) and is recognized by the Conference of the Parties (COP).



GGGW IP 2024

GGGW provides an integrated, operational framework in relation to GHG monitoring, striving to reduce the uncertainty in assessing the efficacy of climate action. Approved by WMO Congress and recognized by SBSTA59 at COP28. IP Requested by WMO Congress to allow Member States to facilitate actions required in 2024-2027

IOC IOCR WG 2021-2025

The IOC-R addresses key issues in ocean carbon research through a combined strategy of investigative and observational goals around changing ocean carbon sink and impact that increasing CO2 levels have on ocean ecosystems. Reports to SBSTA and IOC Member States.

Carbon and GHG Plan Motivation

Sources = Sinks

35.9 $GtCO_2/yr$

88%

12%

5.0 $GtCO_2/yr$

20.4 $GtCO_2/yr$

50%

21%

8.7 $GtCO_2/yr$

29%

11.8 $GtCO_2/yr$

GLOBAL CARBON BUDGET 2025

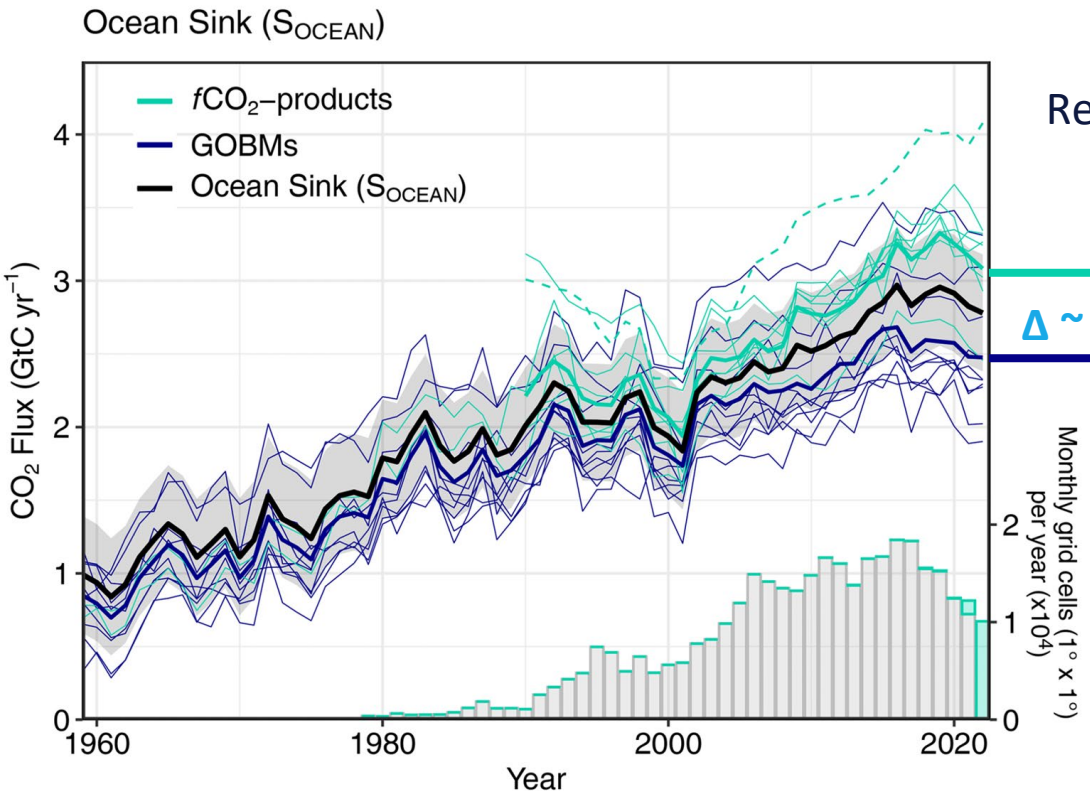
Budget Imbalance:
(the difference between estimated sources & sinks)

<1%

0.1 $GtCO_2/yr$

Global Carbon Budget 2025: Friedlingstein et al. (2025)

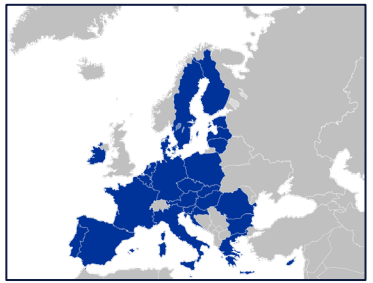
Carbon and GHG Plan Motivation



Recent divergence of obs- and model-based ocean CO_2 sink estimates.

Δ ~ 0.6 GtC yr^{-1}

EU27 emissions:
0.68 GtC yr^{-1} in 2024



Observing Networks: SOCONET

SC and website in late 2025 by GOOS Biogeochemistry Panel - IOCCP, NOAA, ICOS-OTC, EU TRICUSO and inter'l PI's

TRICUSO
SOUTHERN OCEAN CARBON OBSERVATION

soconet.info

About | Steering Committee | Activities | Documents | SOCONET Platforms | SOCONET Data | Mapping products

IOCCP

Global Ocean Observing System

NOAA GLOBAL OCEAN MONITORING & OBSERVING

Surface Ocean CO_2 Reference Observing Network

International Science Council SCOR Scientific Committee on Oceanic Research

SOCONET Steering Committee


Bronte Tilbrook
Commonwealth Scientific and Industrial Research Organisation (CSIRO)
CSIRO Marine Research
P.O. Box 1538
7001 Hobart, Tasmania, AUSTRALIA
Email: Bronte.Tilbrook@csiro.au


Tobias Steinhoff
GEOMAR Helmholtz Centre for Ocean Research Kiel
Wischhofstr. 1-3 | 24148 Kiel
Germany
Email: tsteinhoff@geomar.de


Craig Neill
Commonwealth Scientific and Industrial Research Organisation (CSIRO)
CSIRO Marine Labs
3 Castray Esplanade
Battery Point, TAS 7004
Australia
Email: Craig.Neill@csiro.au


Sebastiaan van de Velde
University of Otago – Ōtākou Whakaihu Waka
Earth Sciences New Zealand
Marine Science | Te Tari Pūtaiao Tōmaera
Room G.S08, Geology Building, 360 Leith Street, Dunedin | Ōtepoti
New Zealand | Aotearoa
Email: sebastiaan.vandevelde@otago.ac.nz


Siyabulela Hamnca
Southern Ocean Carbon-Climate Observatory (SOCCO), Council for Scientific and Industrial Research (CSIR)
15 Lower Hope Street
Rosebank
Cape Town, South Africa
Email: shamnca@csir.co.za


Dorothee Bakker
University of East Anglia
School of Environmental Sciences
Norwich Research Park|Norwich, Norfolk|NR4 7TJ
UK
Email: D.Bakker@uea.ac.uk


Rodrigo Kerr
Laboratório de Estudos dos Oceanos e Clima - LEOC
Instituto de Oceanografia - IO
Universidade Federal do Rio Grande - FURG
Av. Itália km 8, s/n, Rio Grande – RS, Brasil, 96203-900
E-mail: rodrigokerr@furg.br


David Munro
University of Colorado & NOAA Global Monitoring Laboratory
Cooperative Institute for Research in Environmental Sciences (CIRES)
Boulder, Colorado
USA
Email: david.munro@colorado.edu


Louise Delaigue
Sorbonne Université – CNRS
Laboratoire d'Océanographie de Villefranche, LOV
06230 Villefranche-sur-mer, France
Email: louise.delaigue@imev-mer.fr


Richard Sanders
ICOS Ocean Thematic Centre
Norwegian Research Centre (NORCE), Bjerknes Centre for Climate Research
Jahnebakken 5, 5007 Bergen,
Norway
Email: rsan@norceresearch.no


Siv Kari Lauvset
Norwegian Research Centre (NORCE)
Bjerknes Centre for Climate Research
Jahnebakken 5, 5007 Bergen,
Norway
Email: sivk@norceresearch.no


Partick Martin
Asian School of the Environment
Nanyang Technological University
50 Nanyang Avenue,
Block N2-01C-83
Singapore 639798
Email: pmartin@ntu.edu.sg


Denis Pierrot
NOAA Atlantic Oceanographic & Meteorogical Laboratory
4301 Rickenbacker Causeway, Miami, FL 33149
USA
Email: Denis.Pierrot@noaa.gov


Adrienne Sutton
NOAA Pacific Marine Environmental Laboratory
7600 Sand Point Way NE
Seattle, WA. 98115, USA
Email: adrienne.sutton@noaa.gov


Vlad Alexandru Macovei
Helmholtz-Zentrum Hereon
Max-Planck-Straße 1
21502 Geesthacht
Germany
Email: Vlad-Alexandru.Macovei@hereon.de


Thanos Gkritzalis
Flanders Marine Institute (VLIZ)
InnoOcean Campus
Jacobsenstraat 1, 8400 Ostend, Belgium
Email: thanos.gkritzalis@vliz.be


Shin-Ichiro Nakaoka
National Institute for Environmental Studies (NIES)
16-2 Onogawa, City of Tsukuba, Ibaraki 305-8506,
Japan
Email: nakaoka.shinichiro@nies.go.jp


Steve Jones
Flanders Marine Institute (VLIZ)
InnoOcean Campus
Jacobsenstraat 1, 8400 Ostend
Belgium
Email: steve.jones@vliz.be

Ex-officio Expert Advisor


Kathy Tedesco
NOAA Global Ocean Monitoring & Observing Program and UCAR Cooperative Programs for the Advancement of Earth System Science
P.O. Box 3000
Boulder, CO 80307-3000
303-497-8666
USA
Email: kathy.tedesco@noaa.gov

SOCONET Technical Coordinator


Kevin O'Brien
OceanOPS
Technopôle / Campus Ifremer
1025 Route de Sainte Anne
CS Pointe du Diable
Bâtiment Blaise Pascal
29280 Plouzané, France
Email: kobrien@wmo.int

SOCONET Coordinator


Maciej Telszewski
Institute of Oceanology – Polish Academy of Sciences
Lt. Powstancow Warszawy 55,
81-712 Sopot, Poland
Email: m.telszewski@ioopc.org

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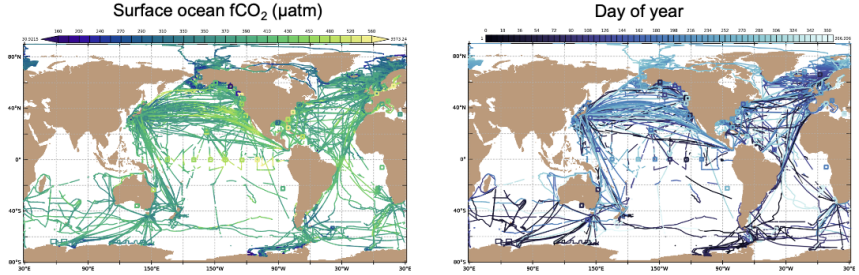
SOCONET Stock-take and Implementation Plan

SOCONET
Inventory of Ocean CO_2 Observations

- 116 platforms with recurring surface ocean CO_2 measurements (from 2019 to 2023 in SOCATv2024 & new platforms)
- Ships (59), moorings (55), uncrewed surface vehicles (2)



1. Executive Summary
2. Introduction: history, motivation, partnerships and funding
3. Governance structures and scientific leadership
4. Vision for SOCONET
   - Intercomparison of Instruments and Sensors
   - Technical support (eg. Reference gases)
   - Innovations in support of SOCONET's Vision
   - Funding needs to deliver the system globally
   - Future ambition to incorporate N_2O+CH_4
5. Section on **Tiered Network** (Task Team)
6. Section on **Capacity Building** (Task Team)
7. Section on **Data and Metadata** needs (Task Team)
8. Section on **Network Design** (Task Team)
9. Section on **Atmospheric Measurements** (Task Team)
10. Section on **Communication Dissemination and Exploitation Strategy** (Task Team)

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Ocean Carbon Observing System Design

Optimal Ocean Carbon Observing Design Workshop

Dates: June 10-11, 2026

June 8-9: SOCONET & SOCAT governance meeting, with SOCOM leadership

June 10-11: **Ocean Carbon Observing Design Workshop 1 - Surface**

Location: Flanders Marine Institute, Ostend, Belgium - www.vliz.be

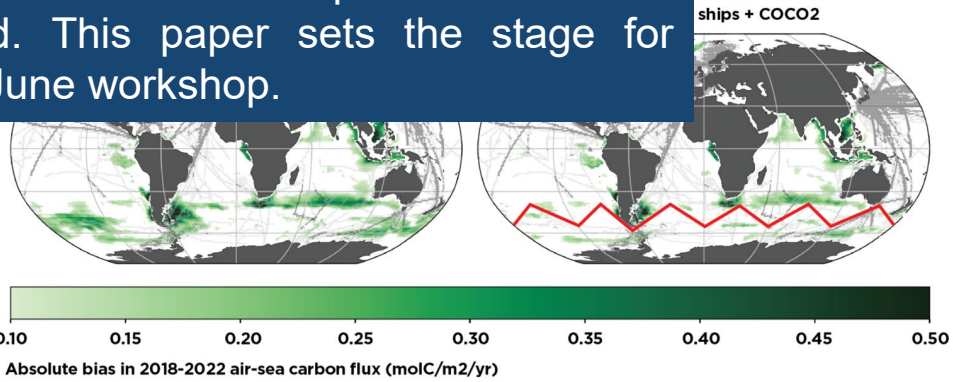
Supported by: GOOS, NOAA, VLIZ, TRICUSO, IOCCP

Outcomes:

1) SOCONET
near term
reflect the
2026 and s
over time, i
into SOCO

1) Proposal fo
workshop,
workshop scope, and workshop organizers.

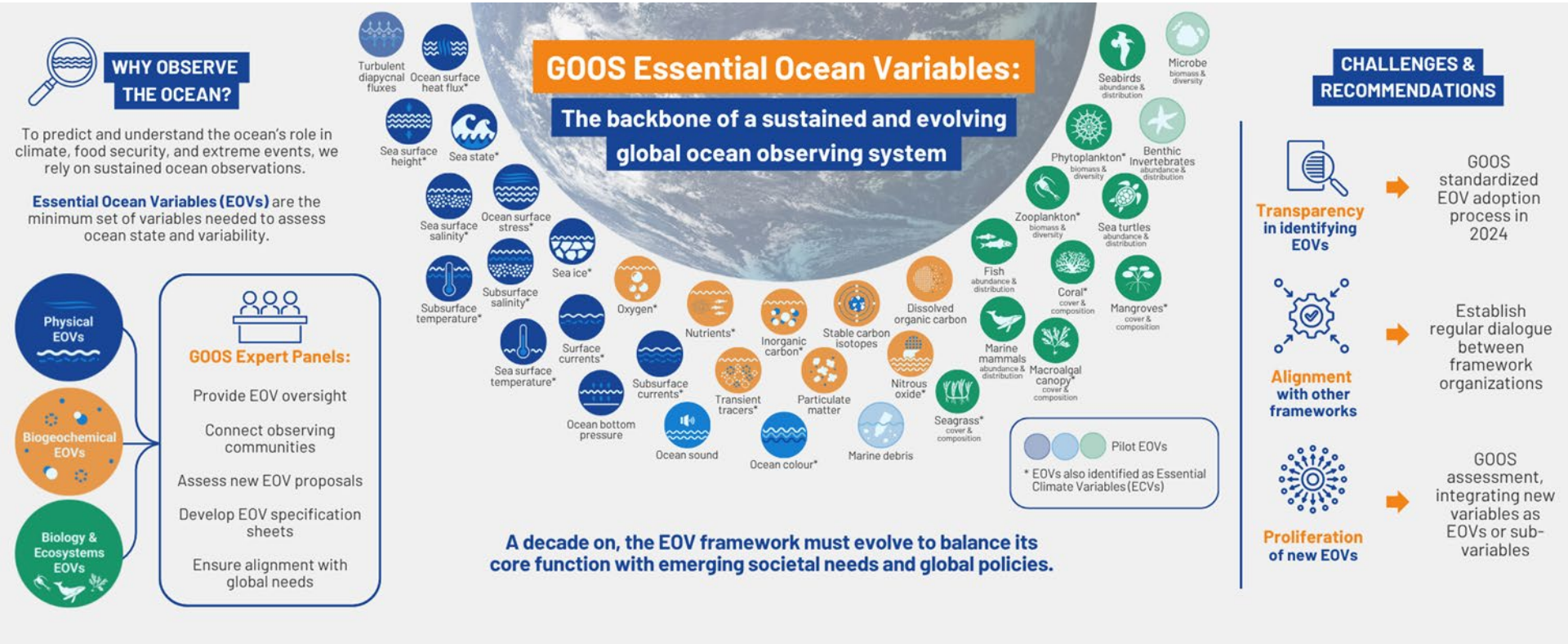
We are leading a paper nearing submission, that includes the carbon representatives from the science committees of GO-SHIP, BGC-Argo, and SOCONET. It covers the overarching research questions driving these three networks, their inherent synergies and dependencies, and recommendations for optimizing these relationships and an intra-network strategy moving forward. This paper sets the stage for optimal design discussions at the June workshop.



Outcomes of the Workshop Series

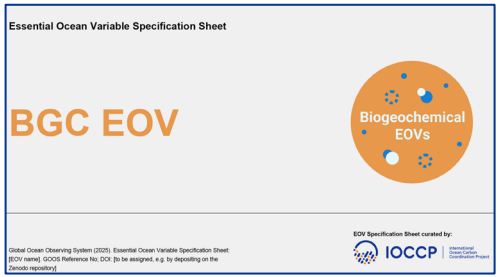
will make up a comprehensive ocean carbon observing design from surface to deep, inclusive of all observing platforms and networks

Setting Requirements: Essential Ocean Variables



BGC Essential Ocean Variables

Review and improvement of decade-old BGC EOV Specification Sheets



- **Current status**
  - **BioGeoSea** started on 1 September 2025 as one of 3 "sister projects" alongside BioEcoOcean and ObsSea4Clim,
  - GOOS BGC hosted at IOPAN is a partner with one of the responsibilities to significantly **update BGC EOV SS in line with concepts developed across 3 GOOS Panels,**
  - New staff member, **Malek Belgacem**, to start at IOPAN in March 2026 and lead the work,
  - **Stakeholders and users** identified to **discuss gaps** in existing BGC EOV SS's,
  - IOCCP/BGC Panel members agreed as Lead Authors of some EOV SS's, wider community experts to be approached soon,

Observing Networks	SOCONET	International	in preparation
	GO-SHIP	International	http://www.go-ship.org/
	Biogeochemical Argo	International	https://biogeochemical-argo.org/
	Ocean Gliders	International	https://www.oceangliders.org/
	OceanSITES (moored point observations)	International	https://www.ocean-ops.org/oceansites/index.html
	METS-RCN (ship-based point observations)	International	https://www2.whoi.edu/site/mets-rcn/

Data Product Developers and Data Specialists	SOCAT	International	https://socat.info/
	GLODAP	International	https://glodap.info/
	GO2DAT	International	https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2021.724913/full
	SPOTS	International	https://essd.copernicus.org/articles/16/1901/2024/
	ODIS	International	https://oceaninfohub.org/odis/
	EMODnet Chemistry	EU	https://emodnet.ec.europa.eu/en/chemistry
	SeaDataNet	EU	https://www.seadatanet.org/

Expert Communities	GOA-ON (Ocean Acidification)	International	https://www.goa-on.org/
	GO2NE (Ocean Deoxygenation)	International	https://www.ioc.unesco.org/en/go2ne
	IMDOS (Marine Debris)	International	https://imdos.org/
	OBPS (Best Practices)	International	https://www.oceanbestpractices.org/

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BGC EOV Gap Analysis

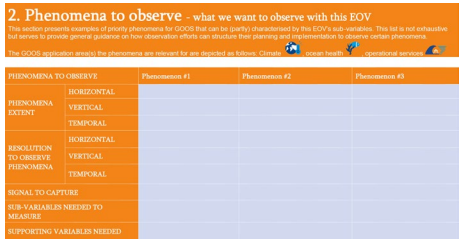
Review and improvement of decade-old BGC EOV Specification Sheets

a. Structural inconsistencies	b. Incomplete requirement definitions	c. Technology and observing system developments not reflected
- The structure of tables and figures is not fully coherent. Example: ➢ Figures often duplicate information already present in tables ➢ There is no clear link between requirements and observing systems	- Current uncertainty relative to the signal - Target uncertainty - Temporal and spatial scales - Vertical coverage	- Expansion of BGC-Argo - Autonomous sensors - Machine learning QC and bias correction - Improved sensor calibration and intercomparison exercises

v2.0

v3.1

Critical elements □ because they define how observations should be designed.



2. Phenomena to observe - what we want to observe with this EOV

This section presents examples of priority phenomena for GOOS that can be (partly) characterised by this EOV's sub-variables. This list is not exhaustive but serves to provide general guidance on how observation efforts can structure their planning and implementation to observe certain phenomena.

The GOOS application area(s) the phenomena are relevant for are depicted as follows: Climate, ocean health, operational services

PHENOMENA TO OBSERVE		Phenomenon #1	Phenomenon #2	Phenomenon #3
PHENOMENA EXTENT	HORIZONTAL			
	VERTICAL			
	TEMPORAL			
RESOLUTION TO OBSERVE PHENOMENA	HORIZONTAL			
	VERTICAL			
	TEMPORAL			
SIGNAL TO CAPTURE				
SUB-VARIABLES NEEDED TO MEASURE				
SUPPORTING VARIABLES NEEDED				

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BGC EOV Gap Analysis

Review and improvement of decade-old BGC EOV Specification Sheets

d. Data management and FAIR principles are weakly reflected

- List some repositories
- but do not describe the data flow from platform to products
- Missing metadata standards
- Data submission pipelines
- Interoperability guidance
- Links to best practices

e. Alignment with international frameworks

- GOOS EOV framework
- GCOS Essential Climate Variables
- WMO Rolling Review of Requirements

Example: GOOS (9 BGC EOVs)

GCOS (6 BGC ocean ECV

- Current doc. do not clearly explain these differences

f. Societal and policy relevance

Example:

background section do not connect observations to policy frameworks, such as:

- biodiversity conventions
- SDG14
- ocean health monitoring.

v2.0

v3.1

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Key issues for GOOS SC

SOCONET Implementation Plan Review

Later this year SOCONET will engage in community consultation of its Implementation Plan. We would like GOOS SC to engage with this consultation directly, but also by solicitating review comments from your respective regions and communities. We want SOCONET implementation to be globally relevant and applicable.

Economic evaluation of the system including coordination function

BGC Panel has indicated during the two past GOOS SC meetings that an effort aimed at assessing the economic cost (and perhaps indication of economic benefit) of the existing observing system would be a very valuable tool when designing the optimal observing system. Could that non-trivial exercise be included in new GOOS structures, in alignment with potential expectations from the Donor Coordination Group?

Approval of updated Biogeochemical EOVs

Following the review and update of BGC EOVs, which will include consultations with users and stakeholders, the BGC Panel will present the new EOV Spec Sheet deck for GOOS SC's comments, input and eventually approval. Consultation with SC is planned to happen before the next SC meeting to allow discussions during SC-16.

IOCCP | International Ocean Carbon Coordination Project

GOOS Biogeochemistry Panel

International Science Council SCOR Scientific Committee on Oceanic Research

UNESCO

GOOS Global Ocean Observing System

A communication and coordination service for marine biogeochemistry

www.ioccp.org

www.linkedin.com/company/ioccp/

Institute of Oceanology of Polish Academy of Sciences

ul. Powstańców Warszawy 55, 81-712 Sopot, Poland
Phone: +48 58 731 16 10 / Fax: +48 58 551 21 30