

Global Marine Carbon and Biogeochemistry Observing Capacity and Data Products

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Scientific Steering Group

http://www.ioccp.org/

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V. Garçon

Project Office

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

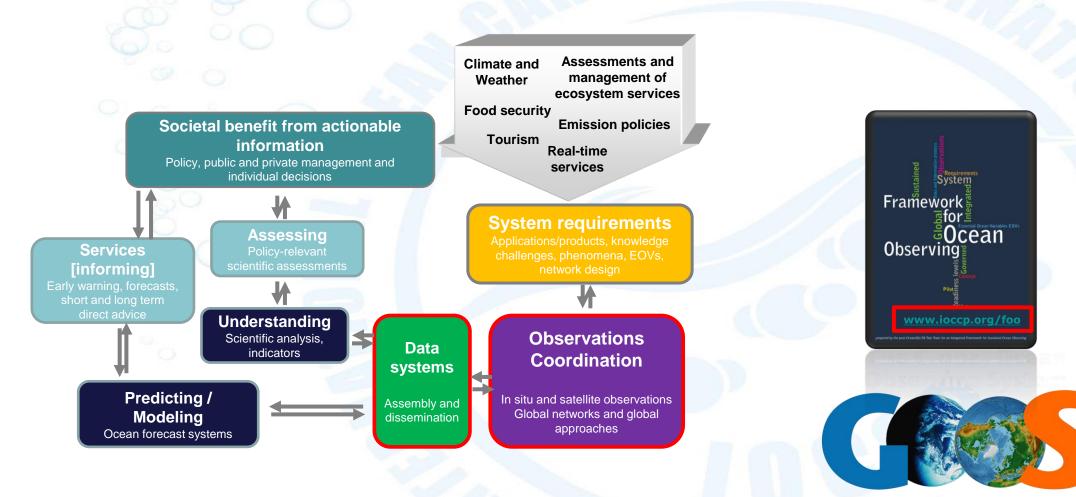
Project Office hosted by the Institute of Oceanology of Polish Academy of **Sciences**



ABOUT US	IOCCP SSG IOCCP CONVEYOR DOCU	Maciej Telszewski JOBS Artur Palacz (both Poland)
ome ploCCP promotes the development of global network of ocean carbon ervations for research through nnical coordination and communication vices, international agreements or ndards and methods, and advocacy links to the global observing systems o IOCCP is co-sponsored by th	Statement from the WMO International Greenhouse Gas Monitoring Symposium	tatement from the VMO International Greenhouse Gas Ionitoring
entific Committee on Oceani search and the Intergovernmenta sanographic Commission of UNESCO ad more	WORLD METEOROLOGICAL	ymposium e outcomes from the World Meteorological ganization (WMO) International eenhouse Gas Monitoring Symposium that (Spain)
Surface Ocean Biogeochemistry Observations Ocean Interior Observations Time Series Efforts		ak place at WMO Headquarters in Geneva 30 January-1 February 2023. > 0000 Keyhong Park (Rep. Korea)
• Synthesis Activities • Ocean Acidification	News	Hans to the Func Caches + more news Kim Currie (New Zealnd)
Oxygen	Call for sediment organic carbon data contribudatabase	tions to the Euro-Carbon
Particulate Matter	Thursday, 27 April 2023 We are pleased to inform you about the EURO-CARBON database	initiative which aims to provide a baseline of
Nutrients	sediment organic carbon levels on a European regional sea scale. sediments, then please consider contributing your data to the EURC	If you have relevant carbon data from marine
Observations-Modeling	latest. The database can potentially be updated periodically in the future	to determine trends in organic carbon pools. Sana Ben Ismail
Calendar		(Tunisia)
IOCCP meetin		tions, synthesis and data products, 6-8
IOCCP-related meetings as well		pps on surface ocean pCO ₂ observations, synthesis Véronique Garçon
events related to wider scope in man	a and data products which will be held on 6-9 Nov	ember 2023 at Flanders Marine Institute (VLIZ).
biogeochemistry.	Surface ocean pCO2/fCO2 (partial pressure/fugacity of CO2) data	(France)
VIEW	them have become an important input in the quantification of the Budget (GCB) as well as in determining variability and trends of ocea	ocean carbon sink strength in the Global Carbon
	of the pCO ₂ products and the fluxes based on them that are less v method of interpolation/gap filling and the overall uncertainty in the ai	
	> more	(Canada)
IOCCP E list		
IOCCP E-list Subscribe to the IOCCP mailing list	8	
Subscribe to the IOCCP mailing list receive frequent news updates		Steve Jones (Norway)
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Subscribe to the IOCCP mailing list eccive frequent news updates Name Subscrite	Upcoming IOCCP Events First DBCP Mediterranean Training Workshop on Ocean 2 02.05.2023 - 04.05.2023 Jun Instrumenting our ocean for better observation: A training	Observations and Data Applications-Part 2 3 Pl's applied
Subscribe to the IOCCP mailing list receive frequent news updates Name Subscrib	Upcoming IOCCP Events First DBCP Mediterranean Training Workshop on Ocean 02.05.2023 - 04.05.2023 Jun 105.06.2023 - 17.06.2023 Jun 14th session of Observation Coordination Group	¹ Observations and Data Applications-Part 2 g course on a suite of biogeochemical sensors 3 <i>PI's applied</i> Emmanuel Boss (USA

IOCCP Terms of Reference

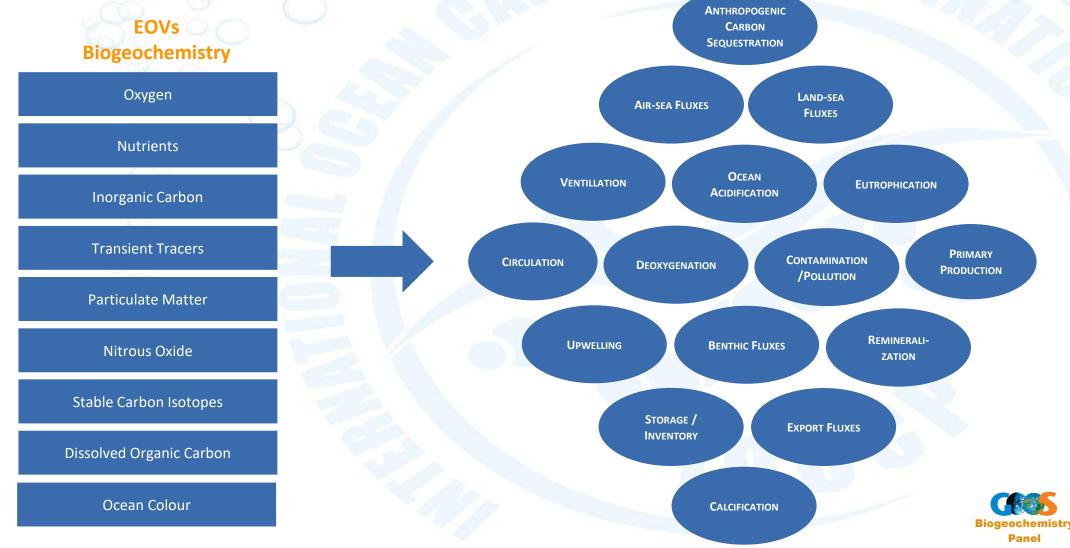
Facilitate a dialogue with stakeholders to implement a scientifically and economically effective, fit-for-purpose observing system for ocean carbon and biogeochemistry.



Biogeochemistry Panel

IOCCP 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).





GPS system

Observing network mission, design, and community of practice

FAIR data principles that feed into SOCAT and other products and facilitate data assimilation and model assessment

> Best practices and interoperability

SOCONET:

- Surface ocean CO₂ measurements from moving and fixed platforms (With other parameters in concept and pilot phase pH, TA, DIC);
- Atmospheric CO₂ from some data originators (discussions with GAW);

Atmospheric sampling tube

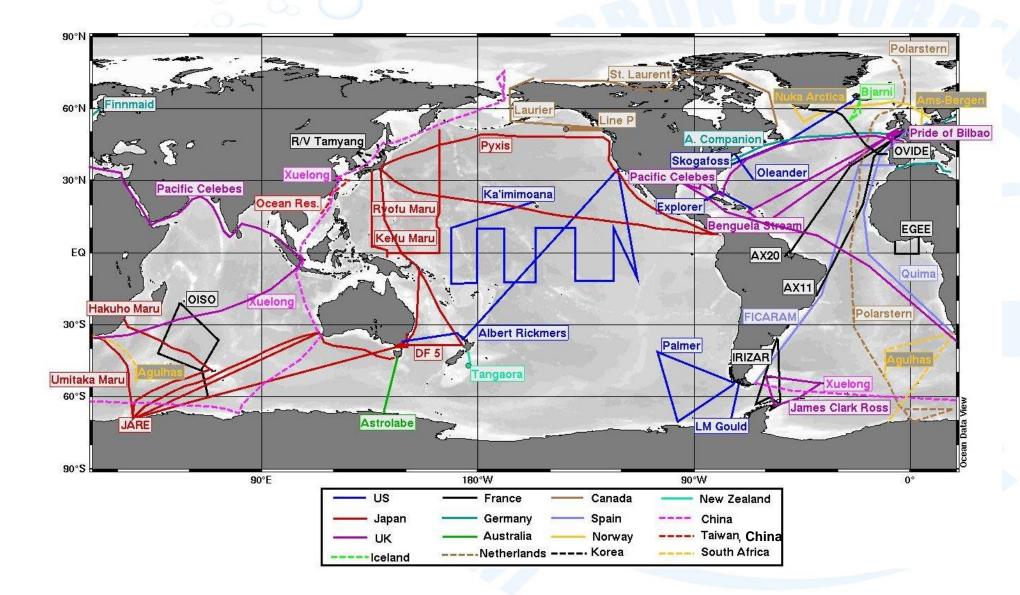
Seawater system

Electronics/detector

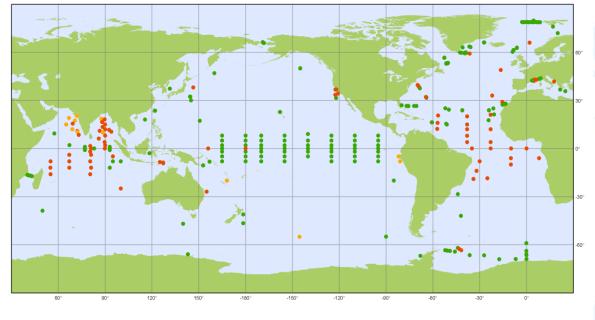
• Checked sea surface temperature and salinity as well as other BGC parameters (oxygen, nutrients)

The operational activities are particularly important for our US partners (NOAA) given the <u>COP26</u> <u>commitment</u> to support a globally "operational" Surface Ocean CO₂ Reference Network.

CO₂ observations in collaboration with commercial partners

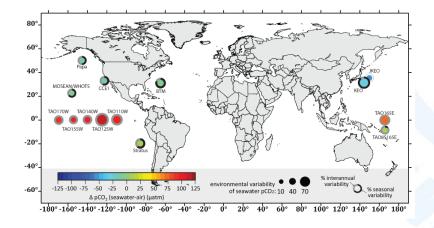


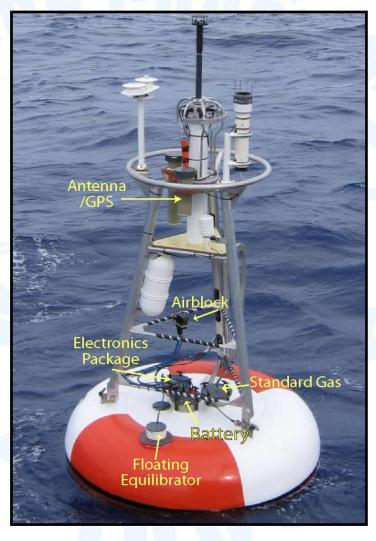
Biogeochemical Time Series



● REGISTERED ● OPERATIONAL ● INACTIVE ● CLOSED

OceanSITES





MapCO₂ system

Decadal Repeat Hydrography - http://www.go-ship.org/

W.GO-SHIP.ORG	THE GLOBAL	Ocean Ship-Based Hydrographic Investigations Program	GO-SHIP inventorie tracers, co to bottom)
GO-SHIP COMMITTEE NCE SECTIONS QUIREMENTS PLANS CRUISE RECTORY MANUAL		GO-SHIP Sources a Sustained Global Survey of the Ocean Interior GO-SHIP brings together scientists with interests in physical oceanography, the carbon cycle, marine biogeochemistry and ecosystems, and other users and collectors of hydrographic data to develop a globally coordinated network of sustained hydrographic sections as part of the global ocean/climate observing system. GO-SHIP is a major contributor to WCRP's Climate Variability and Predictability. Experiment (CLIVAR) and International Ocean Carbon Coordination Project. GO-SHIP is part of the Global Climate Observing System / Global Ocean Observing System (GCOS / GOOS).	detect the The GO-S (1) unders distrib (2) addres inorga experi global
INTS	NEWS		
RAPHY	8 December 2022	JAMSTEC is calling for an EOI for auxiliary projects on P14N in 2023	
E EMAIL LIST		JAMSTEC is calling for an expression of interest for auxiliary projects onboard R/V Mirai on he	
т	9 October 2022	GO-SHIP Science Committee Teleconference The Minutes of the last Science Committee Teleconference (9 Sep) are now available <u>here</u> .	
	9 September 2022	Japan on P9	
	5 June 2022	Japan is presently underway on section P9. GO-SHIP Science Committee Teleconference The Minutes of the last Science Committee Teleconference (12 May) are now available here.	

HOME

SCIENCE

REFEREN

DATA RE

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JOIN A C

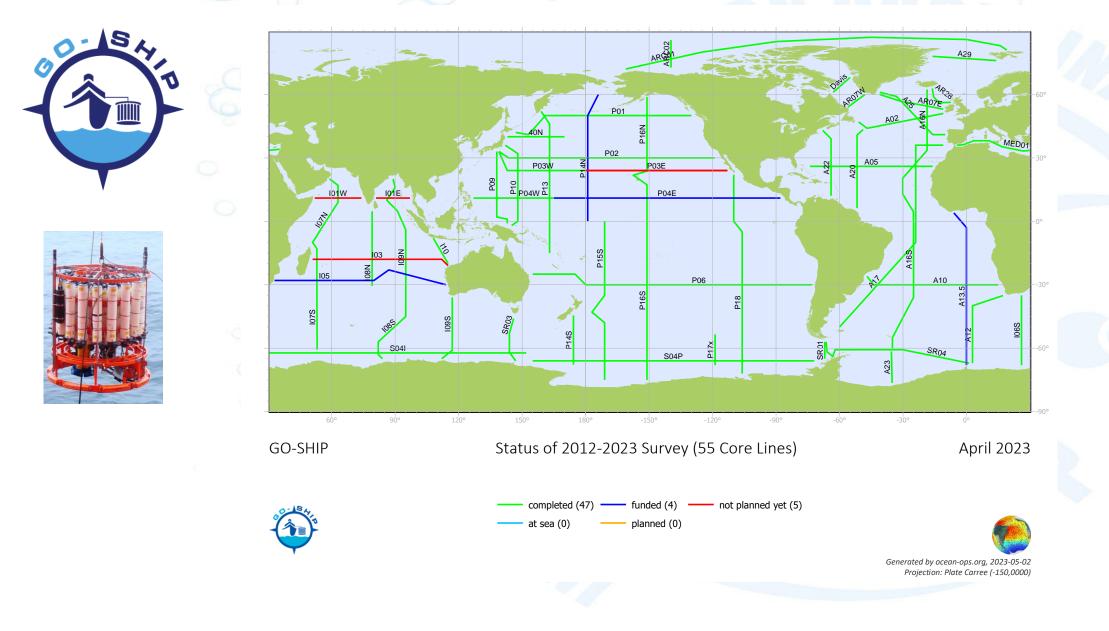
DATA DI HYDRO M DOCUMEI BIBLIOG JOIN THE CONTACT GO-SHIP provides approximately decadal resolution of the changes in nventories of heat, freshwater, carbon, oxygen, nutrients and transient cracers, covering the ocean basins from coast to coast and full depth (top to bottom), with global measurements of the highest required accuracy to detect these changes.

The GO-SHIP principal scientific objectives are:

- (1) understanding and documenting the large-scale ocean water property distributions, their changes, and drivers of those changes, and
- addressing questions of a future ocean that will increase in dissolved inorganic carbon, become more acidified and more stratified, and experience changes in circulation and ventilation processes due to global warming and altered water cycle.



Decadal Repeat Hydrography - http://www.go-ship.org/





Ocean carbon synthesis products

Surface Ocean CO₂ Atlas (SOCAT)

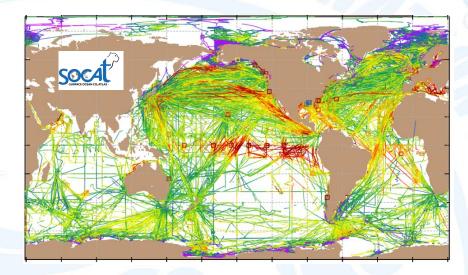
- In situ, surface ocean CO₂ measurements
- 33 million CO₂ values (1957-2020)

Global Data Analysis Project (GLODAP)

- Interior ocean carbon and other observations
- 946 cruises (1972-2019)

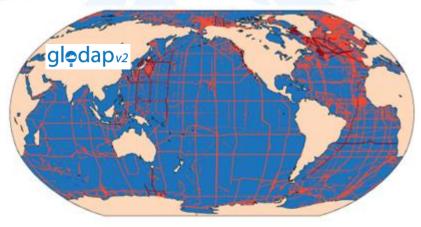
SOCAT and GLODAP

- Quality-controlled synthesis products of ocean carbon measurements for the global oceans
- Standardized procedures
- (Bi-)Annual public releases
- Used in >500 scientific publications and reports
- Community-led, volunteer, fragile, short-term funding



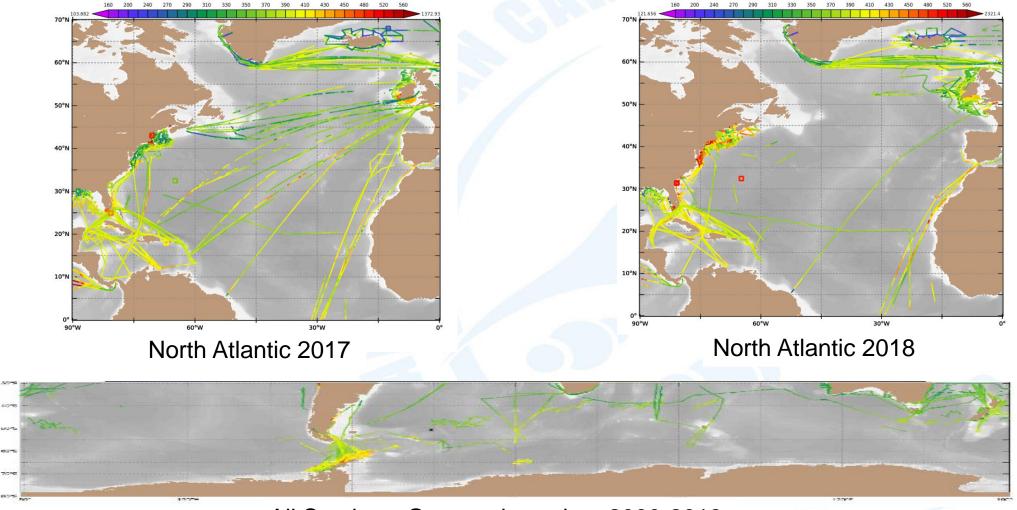
glodapv2

www.glodap.info



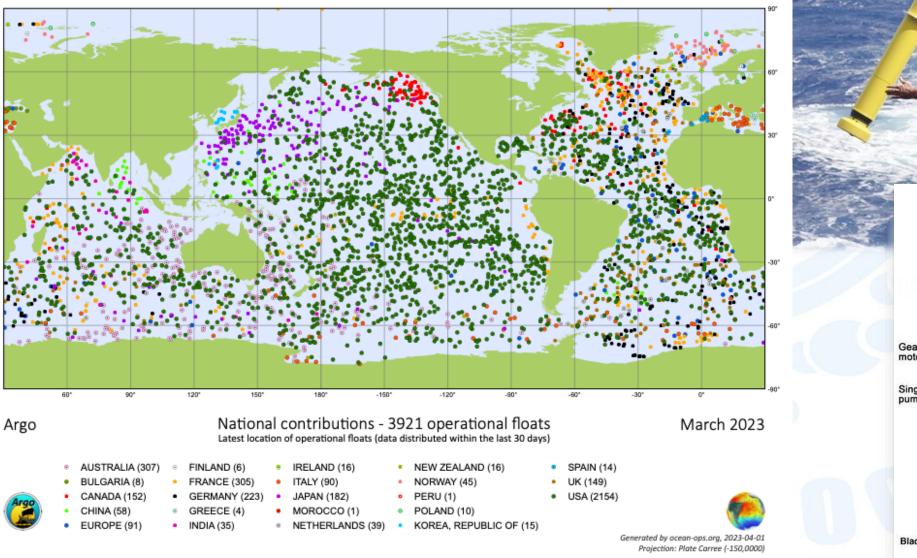
pCO₂ data from surface observations

It's actually sparse, and subject to funding short-termism

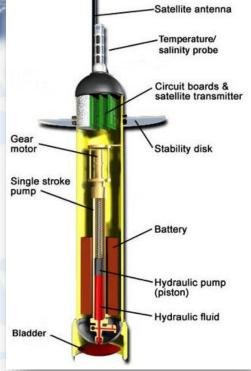


All Southern Ocean winter data 2000-2018

Profiling floats help filling the gaps







Biogeochemical floats - http://biogeochemical-argo.org

Research topics

- Carbon uptake
- OMZs and nitrate cycling
- Acidification
- Biological carbon pump
- Phytoplankton communities

Management topics

- Living marine resources
- Carbon budget verification

biogeochemical

Biogeochemical-Argo Science & Implementation Plan

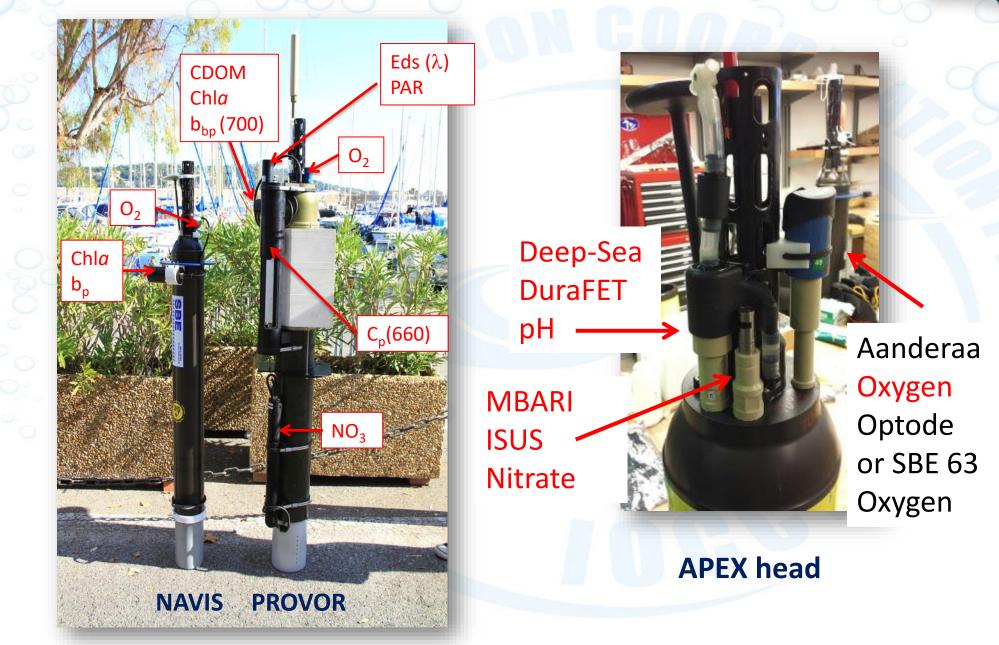


Edited by Ken Johnson & Hervé Claustre

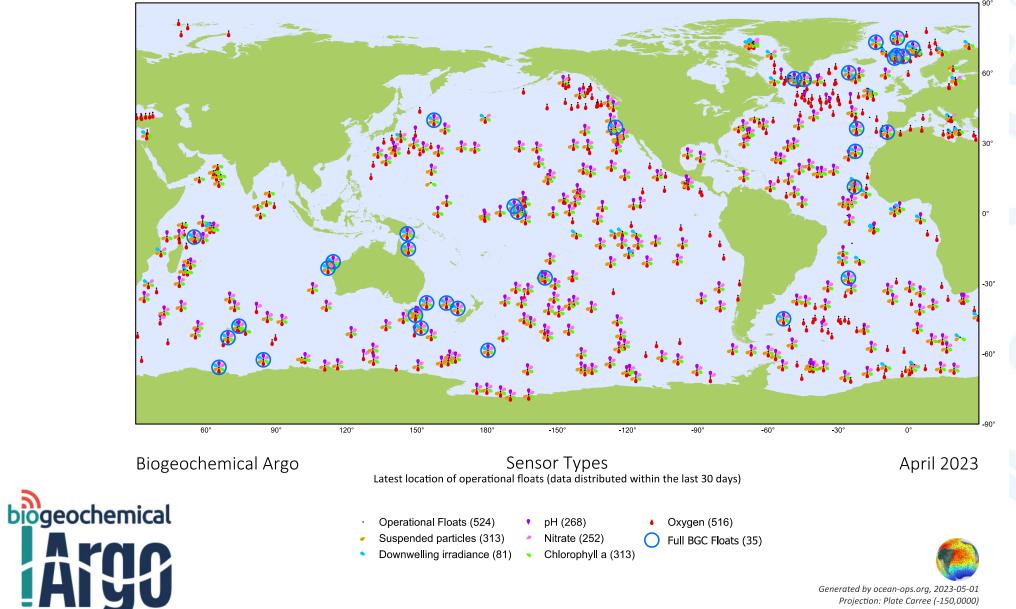
Complexity in biogeochemistry

Core Variables:

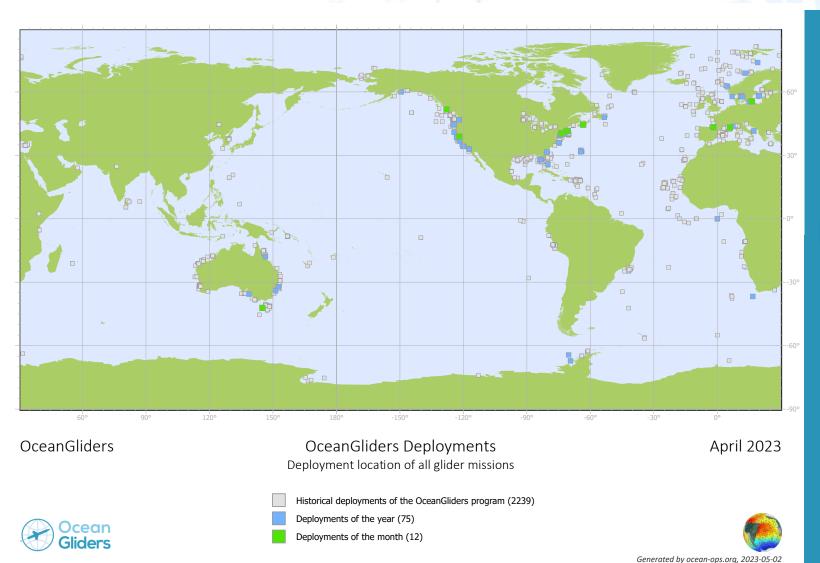
- O₂
- NO₃
- pH
- Chla
- Suspended particles
- Downwelling irradiance



Floats need biogeochemical sensors



Ocean gliders help filling the gaps





https://www.oceangliders.org/

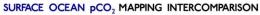


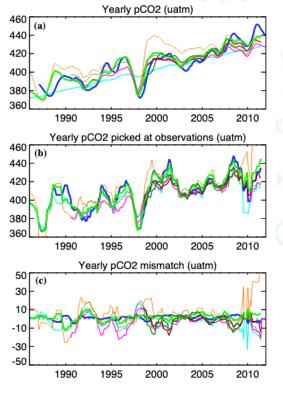


Projection: Plate Carree (-150,0000)

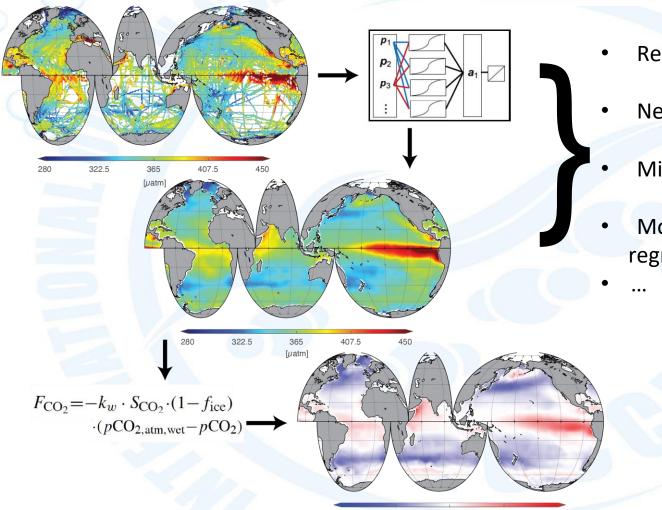
Surface ocean carbon mapped fields







Comparison of selected mapping methods over selected region



-2.5 0 2.5 5 [mol m⁻² yr⁻¹]

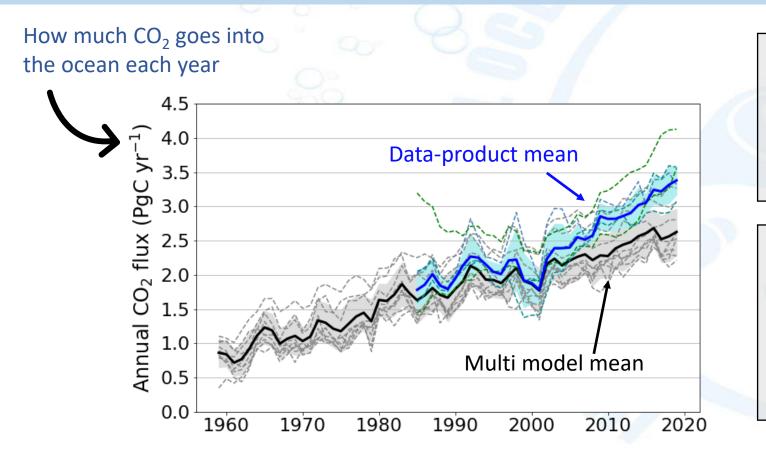
- Regression models
- Neural networks
- Mixed layer scheme
- Model-informed regression

Global Carbon Budget

GLOBAL CARBON PROJECT

Global Carbon Project:

- Combining and synthesizing information on CO₂ emissions and sinks
- Around 40 (ocean) co-authors contributing ocean CO₂ observations, data-products and models
- Based on best scientific knowledge by being rooted deeply in the scientific community



Estimated from a suite of **global ocean biogeochemical models**

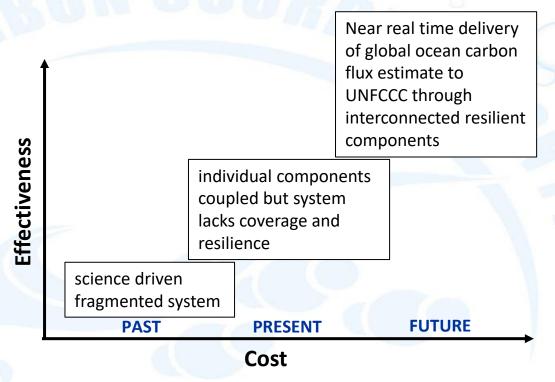
robust to estimate the **global** ocean **mean** sink and anthropogenic trends

Compared to data-products (statistical mapping of pCO_2 observations; 98% gap-filling)

key strength: assess interannual and multi-year variability

Current challenge: Operationalizing the value chain of Surface Ocean Carbon Observations

- We have all the components of the value chain and when they occasionally work together, they have a demonstrated ability to estimate surface ocean CO₂ 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.
- 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.



Effectiveness of operational value chain

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

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





A communication and coordination service for marine biogeochemistry

www.ioccp.org



Educational, Scientific and Cultural Organization

Thank You!



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