

Essential Ocean Variables for biogeochemical observations in the deep ocean

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Significance of deep-ocean biogeochemistry

Ocean biogeochemical (BGC) processes are fundamental for key ocean ecosystem functions and services: chemical uptake and biological fixation of CO2 and its transport to depth remove anthropogenic carbon from the atmosphere and counteract global warming. Nutrient regeneration upon organic matter remineralization in the interior and at the bottom of the oceans sustains productivity and, ultimately, supply with seafood. Ocean observations have to include deep-ocean biogeochemistry to quantify the contribution of the ocean to element cycling and to identify possible changes. In order to join forces and build the most efficient global observing system, a general agreement on Essential Ocean Variables (EOVs) for biogeochemical observations and how to observe and report them is fundamental. The Deep Ocean Observing Strategy DOOS is supporting GOOS in complementing the set of EOVs and their specifications to match requirements of the full global ocean from surface to the deep seafloor.

Why a DOOS revision of EOVs?

During an international workshop, EOVs as specified by GOOS were compared to those suggested in the 'Consultative Report' on the Deep Ocean Observing Strategy (DOOS). This lead to the formation of DOOS task teams (TT) on (1) physics & climate, (2) deep-sea life and habitats, and (3) biogeochemistry) to revise the appropriateness of GOOS EOVs for the deep ocean. The TT-leaders liaise with deep-ocean observation experts as well as with the GOOS EOV panels. Where variables seem missing, new EOVs are specified, adopting the Framework for Ocean Observing and the structure of the GOOS EOV specification sheets. Acknowledging that most phenomena to observe are interdisciplinary in nature (Fig. 1), TT leaders regularly exchange on their activities.

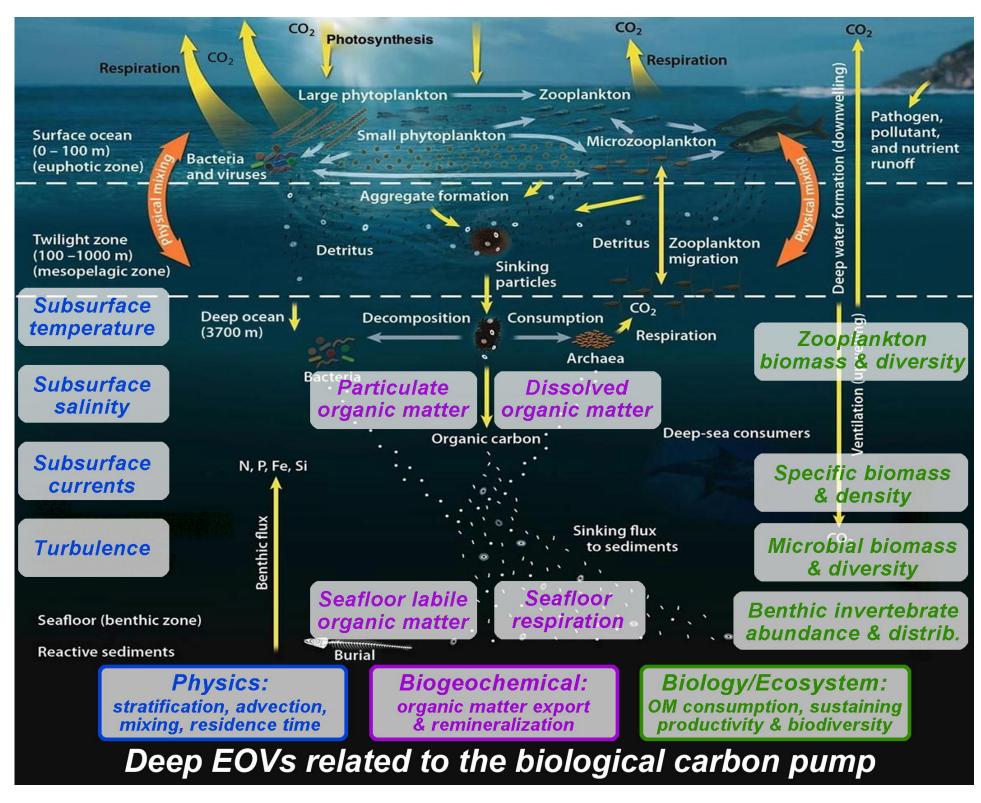


Fig. 1: Scheme of the processes with relevance for the biological pump – a 'biogeochemistry-centered' ocean process. A comprehensive assessment requires observations in any oceanographic discipline including physics (blue fields), biogeochemistry (violet fields), and biology/ecosystem (green fields). From Levin et al. 2019, doi: 10.3389/fmars.2019.00241.

Team members and expertises



Clare Reimers Oregon State University Seafloor respiration



Damian Arevalo-Martinez Nitrous oxide



Douglas Wallace Dissolved oxygen



Frank Wenzhöfer Alfred Wegener Institute Seafloor respiration



Hermann Bange Nitrous oxide



Ian Salter Particulate organic matter



Matthias Haeckel Seafloor methane efflux



Peter Brown National Oceanography Centre Inorganic Carbon



Sinhue Torres-Valdes Alfred Wegener Institute



Thorsten Dittmar Oldenburg University Dissolved organic matter



Thomas Soltwedel Alfred Wegener Institut Seafloor labile organic matter

Reviewing BGC EOVs: approach and status

Most GOOS BGC EOVs are also relevant for deepocean observations but may need modification to cover deep-ocean specificities. The bottom of the sea, however, clearly requires additional attention. 'Seafloor labile organic matter' and 'seafloor respiration' are candidate variables to be added to the current set of EOVs (Fig. 2). These are essential

of deep-sea sed:

Significant

to quantify rates of supply and remineralization of organic matter at the seafloor – with strong implications for the preservation of benthic biodiversity, sequestration of anthropogenic carbon, and nutrient recycling. More EOVs, e.g., seafloor methane efflux, are under consideration. Online questionnaires have been prepared to facilitate an expert revision of GOOS BGC EOV that will

Fig. 2: Excerpt of the draft specification sheet for the suggested BGC-**EOV 'Seafloor** labile organic matter'.

start soon (Fig. 3).

Get involved!

Experts on deep-ocean biogeochemistry are invited to provide their expertise on variables that are essential for the deep ocean. The revision covers all aspects including target phenomena to observe and their spatiotemporal scales, the relevant observing platforms and networks, and the specific requirements of observations. The input will be compiled and transformed into community-suggestions for uptake by the responsible GOOS panels.



For more information:

deepoceanobserving.org

part in shaping the EOVs to match the deep ocean requirements! Or simply express your interest via email to felix.janssen@awi.de.

