

Title: Traceable oceanic carbon cycle measurements

Abstract

The ocean is a key factor in climate change as it acts as a carbon “sink” and in order to successfully manage carbon for climate purposes, traceable oceanic carbon cycle measurements are required. This goal can be achieved by improving the metrological framework for the measurement of the key parameters used to assess the oceanic carbon cycle (i.e. partial pressure of carbon dioxide (pCO₂), pH, salinity and Chlorophyll a), therefore new assessment methods need to be developed, that are focussed on the particular conditions in the marine system as well as new and innovative instruments and sensors which improve the inter-comparability of the data.

Keywords

Oceanic observables, acidification, carbonate system, climate change, on-site testing platform, offshore farms, data comparability, salinity, pH, CO₂, chlorophyll a, carbon cycle

Background to the Metrological Challenges

The oceanic carbon cycle plays a key role in climate change. Due to this the EU Marine Strategy Framework Directive 2008/56/EC (MSFD) requires that Member States address shared maritime challenges, and Annex III of the MSFD specifies physical and chemical variables that need to be addressed, such as

- spatial and temporal distributions of salinity
- pH, pCO₂ profiles or equivalent information used to measure marine acidification,

However, despite their importance, nearly all these variables lack effective procedures to ensure full metrological coherence, mainly because of the specificities of the seawater matrix, the complexities of operating in the marine environment, the variety of measuring techniques and instrumentation, the multiplicity of calibration methodologies in use, and the lack of reference materials.

CO₂ uptake by the oceans is mainly governed by physico-chemical processes following the dissolution of CO₂ in seawater as well as by biological processes such as primary production and the microbial loop. However, the actual rates of air-sea CO₂ fluxes are largely unknown, and the magnitudes and relative importance of physical and biological controls of CO₂ fluxes are currently inadequately described. Therefore, the variables pCO₂, pH, salinity, and Chlorophyll a are key parameters to globally describe both physico-chemical and biological processes related to carbon fluxes.

Further to this, strengthening the metrological framework for the measurement of these variables will improve the inter-comparability of measurement data, enhancing their potential as a multiple-use resource and supporting best practice for oceanic carbon cycle measurements.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on the traceable measurement and characterisation of key parameters required to assess the oceanic carbon cycle.

The specific objectives are

1. To develop traceable and validated methods to measure of the marine data trends in seawater salinity and acidity, as well as measurement protocols with uncertainties smaller than the natural variation of the parameters (typically 0.002 g/kg in seawater salinity, 0.003 pH for seawater acidity).
2. To develop validated methods for use in both the laboratory and in marine conditions that are independent from the measurement instrument used. In addition, to develop traceable reference materials for use with pCO₂ measuring instrumentation.
3. To design and validate new oceanic carbon cycle sensors with sound metrological performance, including salinity measurements using electrical conductivity to better than 0.01 % and salinity measurements at high pressures.
4. To produce Best Practice Guides and recommendations for in-house calibration and testing of instruments used for oceanic carbon cycle measurements.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by standards developing organisations (such as those linked to the MSFD 2008/56/EC) and end users (such as the Joint European Research Infrastructure for Coastal Observatories (JERICONext), Integrated Carbon Observation System-Ocean Thematic Centre (ICOS-OTC), European Marine Observation and Data Network (EMODnet)).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the research, the involvement of the appropriate user community such as industry, standardisation and regulatory bodies is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art, and explain how their proposed research goes beyond this. In particular, proposers should outline the achievements of the EMRP project ENV05 OCEAN and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 2.0 M€, and has defined an upper limit of 2.3 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 35 % of the total EU Contribution to the project.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the oceanographic and marine sectors.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.