



Consultation on Ocean Observations -Sharing Responsibility

Feedback from the project H2020 Blue-Action

Who are we

Observational oceanographers are integral to the Blue-Action consortium that is funded under Horizon 2020, the EU Framework programme for Research and Innovation. The consortium in various forms has a lineage of funding through two projects funded by the Research Framework Programme 7, THOR and NACLIM. One of the major impacts of European funding has been the organisation of ocean observations on a supra-national level. Within the above mentioned FP7 projects a part of the observations and instrumentation were funded by the European Union, while now the majority of the funding comes directly from funding bodies within the individual nations, but a framework for collaboration and coordination is provided by European funding. In that sense, **the consortium is an exemplar of what can be achieved with European coordination.**

Sustainability

There would be a distinct benefit of a European directive for sustainability of ocean observing. This would need to allow flexibility to respond to changing scientific and societal needs. A focus of Blue-Action is a cost-benefit and optimisation analysis of the RAPID and OSNAP Transport Mooring Arrays (TMAs) which close an observational gap. These TMAs are integral to sustained observations of the Atlantic Meridional Overturning Circulation (AMOC) or Gulf Stream System but there is a fundamental difference between programs such as Argo¹, to which countries make committed contributions, and projects such as RAPID, OSNAP and other TMAs, which are **driven by individual scientists** requesting funding for scientific projects in 2 to 5 year increments. **Both types provide essential data**, only one can be called sustainable at this time. **Similarly, one is automated and real-time and "easy" to incorporate in large-scale programs, such as the Digital Twin of the Ocean, the other is not.**

In this sense, the ocean is grossly under-observed: we lack the observations (in space and time) necessary to constrain regional changes and relate these back to large integrated systems such as the AMOC/Gulf Stream System. Further work here begins with more observations. Flexibility to expand to emerging technology would be supported by the Blue-Action ocean observing community. Expansion of TMA observations to cover parameters relevant to fisheries, biogeochemistry (deoxygenation, ocean acidification) or linking with deep Argo is also a challenge as sustenance of the core observations absorbs so much effort that it limits the expansion possibilities. This would also enable these TMA systems to properly serve as early warning systems for important societal threats such as an AMOC collapse. AMOC collapse is still the tipping element in the earth system with the most immediate disruptive potential

¹ <https://argo.ucsd.edu/science/argo-and-the-modeling-community/>

(climate and society). Assessment of the risk of collapse, and distance to thresholds is something to know about. Whether emergent constraints based on current observations and (overly) stable models will tell us about non-linear transitions is a question that needs a coordinated response to address.

Planning and sharing

The planning of observations, data sharing and compliance with FAIR (Findable, Accessible, Interoperable, and Reusable) data management is agreed in the Blue-Action consortium at the outset. Partners usually are flexible and open to changes in the planning. This is a useful framework. **However, it is limited to project scale.** Even within the project, no observations are funded directly by Blue-Action, but most observations are openly accessible for added value in the project and for the wider community. **The sharing of data to the scientific community and a wide range of stakeholders, public or private, still is complex and not a uniform process for all observers.**

Within Blue-Action **WP2 Lower latitude drivers of Arctic changes**, we explore optimization and coordination of existing Transport Mooring Array (TMA) systems, improved data delivery for predictions and identification of gaps. One focus² is specifically on optimization of the Greenland-Scotland Ridge TMAs. This is an effort that was initiated in the FP7 NAACLIM project and has been intensified in Blue-Action. The aim of the suggested optimization is:

- to optimally combine in situ and satellite data in order to provide better data products;
- to investigate which and how many moorings can provide reasonable transport estimates, after several years of dense monitoring;
- to explore alternative/new technologies in order to reduce cost and uncertainty.

This effort is an example of an effective action that resulted in the optimisation of an investment. Again, it is on a project-scale.

Maximising the Data

The transparency and reusability of data under the FAIR principles is essential. The cost and effort of gathering ocean observations can fail to be recouped/value extracted due to inconsistent data practices and lack of visibility of available data. The way data is shared may differ from one country to another. Some data providers are obliged to submit (meta) data to the National Data Center, while others submit to larger international centers (e.g. CMEMS, EMODnet, PANGEA). Most observers agree that the submission of observations should be as simple as possible for the observer and that the data provider should only be obliged to submit data to one “data body”. But the regulations vary and are often complex resulting in data submission being a tedious task for the data provider. According to the Horizon Europe “Mission Starfish 2030: Restore our Ocean and Waters”, a EU Ocean and Water Agency, to be established by 2030, will service the EU-wide Ocean Observation System with fully integrated infrastructure assets capable of delivering and ensuring open data for all data for key societal requirements (climate change, oceanography, meteorology, pollution, ecosystem valuation, seabed mapping).

² <https://zenodo.org/record/4276045>

Recommendations

- Long term sustained observations of the AMOC at basin scale is needed to inform climate predictions.
- We wish to understand the full complexity of ocean changes—that is, if we see basin integrated AMOC change, how this relates to regional circulation changes.
- The regional changes can have significant impacts for weather/climate/predictability/blue economy and the society in those regions. Argo is the most critical observing system for initialising seasonal forecasts.
- Cross-pollination with other communities e.g. Argo and glider, would benefit from a forum or framework for collaboration. The concept of a EU Ocean and Water Agency is a step forward in this direction, but if a European version of the Digital Twin of the Ocean needs to be available by 2025, the infrastructure of the agency needs to be in place well before 2025.
- Social impacts, breaking silos between communities would be beneficial for multiple ocean observation communities.

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About the project Blue-Action “Arctic Impact on Weather and Climate”

“We are all facing a changing climate. Businesses, policymakers, and local communities need to access reliable weather and climate information to safeguard human health, wellbeing, economic growth, and environmental sustainability. However, important changes in climate variability and extreme weather events are difficult to pinpoint and account for in existing modelling and forecasting tools. Moreover, many changes in the global climate are linked to the Arctic, where climate change is occurring rapidly, making weather and climate prediction a considerable challenge. Blue-Action evaluates the impact of Arctic warming on the northern hemisphere and develops new techniques to improve forecast accuracy at sub-seasonal to decadal scales. Blue-Action specifically works to understand and simulate the linkages between the Arctic and the global climate system, and the Arctic’s role in generating weather patterns associated with hazardous conditions and climatic extremes. In doing so, Blue-Action aims to improve the safety and wellbeing of people in the Arctic and across the Northern Hemisphere, to reduce the risks associated with Arctic operations and resource exploitation, and to support evidence-based decision-making by policymakers worldwide.”

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