Synergistic Observing Networks for Impactful and Relevant Ocean Predictions (SynObs)

(Proposal of a UN Decade Project)

Foreword

The United Nations (UN) share the conviction that to achieve sustainable development is a crucial challenge for our society. In addition, it proclaimed that the UN Decade of Ocean Science for Sustainable Development starts from 2021 to mobilize ocean science resources to contribute to solving this crucial challenge. The ocean has a potential to provide us with graceful resources for sustainable development although it has brought a variety of disasters. To minimize the risk of oceanic disasters, and to manage the ocean resources in a safe, sustainable, and efficient manner, it is essential to know the past, the present, and accurately predict the future state of the ocean.

We need to observe the ocean in order to determine the ocean state. However, it is impossible to simultaneously observe every aspect of the ocean. An In-situ platform observes the ocean only at the position at which it is located. A satellite platform may be able to cover a large area, but it can obtain information near the sea surface alone. In addition, we can observe only a limited number of the ocean properties. Thus, we need to synthesize those observation data and supplement the insufficient information with our knowledge of the ocean physics, incorporated in numerical ocean models, through data assimilation in order to generate an overall understanding of the ocean, and predict its future variations.

Several operational centers and research institutes have been investing substantial efforts on developing and regularly operating ocean prediction systems, which synthesize various observation data and numerical ocean models, and facilitate prediction of the future ocean state under the initiative of Global Ocean Data Assimilation Experiment (GODAE), GODAE OceanView, and their current follow-on programme, OceanPredict. Ocean observations play an essential role for enabling ocean prediction systems to monitor and to predict the ocean variations.

OceanPredict promotes the effective use of current and future ocean observation data, and its task teams make a variety of contributions to support this purpose. At the same time, OceanPredict aims to construct close relationships with ocean observation communities to improve the quantity, quality, and effectiveness of data provided by ocean observation networks. The OceanPredict observing system evaluation task team was established to provide scientific evaluations of the impact of the ocean observations on ocean prediction systems, and to guide the future evolution of the ocean observation networks.

The observing system evaluation task team believes a better understanding and an increase of the synergy among the various components of the ocean observation network through data assimilation methodologies will improve our ability to predict the ocean dramatically, and make a transformative contribution to achieve the sustainable development of the human society. The task team is thus proposing “**Synergistic Ocean Observation Networks for Impactful and Relevant Ocean Predictions (SynObs)**” as a project to the UN Decade of Ocean Science for Sustainable Development.

Background

The UN Decade of Ocean Science for Sustainable Development began on 1 January, 2021. This UN proclamation intends to transform ocean science so that it can be effectively used for the protection and sustainable use of the ocean, and it makes a decisive contribution to the implementation of Sustainable Development Goals (SDGs) proposed in the 2030 Agenda adopted by the UN in 2015. One of the outcomes the "UN Decade" aims to achieve is to generate "a predicted ocean," because knowing the current ocean state and predicting its future variations are essential for the protection and sustainable use of the ocean. Another expected outcome of the UN Decade is "a productive ocean" that provides food and other resources for sustainable development. The UN Decade also aims to generate "an accessible ocean" because easy access to ocean data is essential for utilizing oceanic resources effectively.

Ocean observations are essential to characterize the current state of the ocean (Here, sea ice and biogeochemical (BGC) properties are considered as part of the ocean). However, only a limited portion of the ocean state can be determined through observations alone, as the spatial and temporal distribution of observational data are inevitably sparse. The current available ocean observations are very sparse compared to their counterparts in the atmosphere. Additionally, observations alone cannot be used to predict future ocean states. Therefore, to achieve a comprehensive and realistic depiction of the present ocean state and forecast future conditions, ocean prediction systems blend observations with numerical models that represent our best understanding of the ocean behavior. A numerical ocean prediction system is, thus, composed of a numerical ocean model and a data assimilation scheme. In this framework, the numerical ocean model is used for estimating the future evolution of the ocean, and the data assimilation scheme is used for capturing observed information and combining it with the ocean state estimated by the model. In the case of ocean-only models, atmospheric forcing is also needed from an atmospheric model or an atmospheric reanalysis system. GODAE, GODAE OceanView, and OceanPredict led the initiative for more than 2 decades to develop and to regularly operate such ocean prediction systems. OceanPredict is now proposing a UN Decade Programme entitled "ForeSea: The ocean prediction capacity of the future" in order to advance the ocean predict capability. In addition, "CoastPredict" is proposed as another UN Decade Programme in order to promote, particularly, development of coastal sea prediction systems.

Here, it is noted that the ocean is a component of the earth system, and, therefore, its variations are intrinsically coupled with those of other components, including the atmosphere and land variations. Thus, long-range forecasts of ocean variations have been performed along with forecasts of atmospheric and land variations using numerical coupled prediction systems based on coupled atmosphere-land-ocean models (or earth system models) and data assimilation techniques. More recently, shorter-range forecasts of ocean variations have been performed with coupled atmosphere-land-ocean prediction systems. Oceanic fields of the coupled prediction systems are usually initialized using ocean data assimilation systems, which are equivalent to ocean prediction systems. However, development of so-called "coupled data assimilation" techniques, that is, the technique of assimilating both oceanic and atmospheric observational data into a numerical coupled model are currently on-going at several weather and climate prediction centers, many of which are represented in this proposal.

We can typically categorize ocean observation data into two groups, that is, in situ and satellite data. They generally have a complementary relationship. In situ observation data are obtained by observing ocean properties at the observation point directly. However, the spatial distribution of in situ observation data is usually sparse in comparison with satellite data. On the other hand, satellite observation data have relatively dense spatial coverage, but have higher observation errors because they are an indirect estimation of ocean properties. Ideally, ocean prediction systems (and recent coupled prediction systems) have the capacity to extract effective information from the combination of in situ and satellite data. However, in reality, how effectively an ocean prediction system extracts meaningful information from the combination highly depends on the complexity of its data assimilation scheme and error statistics that the scheme applies. Thus, upgraded sophistication of data assimilation systems for more effective use of the combination of in situ and satellite data, or for drawing synergy from their combination, is an essential challenge to improve our ability to monitor the ocean state and to predict its future variations. In addition, exploring methods to extract the largest benefits or synergy from different in situ or satellite platforms can make invaluable contributions to improving the ability of ocean prediction systems. In particular, drawing on the synergy between open ocean and coastal sea observation platforms will provide substantial support for developing coastal ocean prediction systems.

Constructing in situ observation networks requires considerable human and financial resources, as well as continuing current satellite missions and supporting new ones. Therefore, we need to design in situ observation networks and satellite missions before deployment or launch, in order to obtain optimal benefits from limited resources. It is also required to evaluate the observing systems continuously and to suggest more efficient designs for modifications. Therefore, observing system evaluations have been conducted using a variety of ocean and coupled prediction systems, and for the monitoring and prediction of various oceanic phenomena. Those evaluations often target only specific in situ or satellite data, and the complementary effect between in situ and satellite observations, between open ocean and coastal sea observations, or among different in situ or satellite platforms has not been sufficiently considered so far. However, because the modern ocean observing network is always composed of a variety of in situ and satellite observation platforms, we need to consider these platforms as a unified ocean observing network and determine a comprehensive design.

Monitoring the BGC state of the ocean and the marine ecosystem and predicting their variations are also essential to achieving “a productive ocean”. On an operational basis, information on the BGC state is provided by satellite ocean colour observations and recently by BGC Argo floats. However, it is necessary to synthesize those data since individual observations provide information only on a single parameter (for ocean colour) or limited locations (floats). The BGC state is inevitably affected by the physical conditions of the ocean. Thus, the synthesis can be best achieved by assimilating those data into a numerical ocean model which predicts BGC variations along with variations of physical parameters. In order to perform the synthesis and predict future variations of the BGC state effectively using data assimilation systems, it is necessary to develop the methods that efficiently assimilate satellite ocean colour observations along with BGC and physical observations obtained by Argo floats, as well as further development of BGC ocean models.

The improvement of data assimilation techniques for the efficient use of both in situ and satellite data and to improve the design of the comprehensive ocean observing network will have wide-ranging benefits. Such developments will dramatically improve our capacity to monitor and predict the ocean evolution and will transform ocean prediction science for protection of the ocean, disaster prevention, planning, and decision making for industrial activities in and near the ocean.

Objectives of the project and Key Scientific Questions

This project mainly seeks the way to extract the maximum benefit or synergy from various combinations of different platforms in the ocean observing network, typically of in situ and satellite observations, for ocean state (including sea-ice and BGC properties) monitoring and predictions using ocean prediction systems. More specifically, this project has two main objectives. First, to design and to adopt an optimal combination of in-situ and satellite observations in the ocean observation network with limited cost from which ocean prediction systems can draw effective information synergistically from both in-situ and satellite observations. Second, to optimize assimilation methods to draw synergistic benefits from the combination of in-situ and satellite data. In addition, we also aim to explore the synergy among different ocean observation platforms in the coastal and open ocean (the coastal region is characterised by enhanced focus on observing the high frequencies and small scales). A goal is to identify the optimal combination of different ocean observation platforms and optimize assimilation methods that can draw on the synergy between the combination of different platforms.

This project will address the following key scientific questions.

- What is the optimal combination of satellite and in-situ observations? More specifically, what is the best density and sampling strategy for satellite and in-situ observations for efficient and well-balanced data assimilation? This item also includes what kind of in-situ observation data can support the effective assimilation of satellite data and what improvements to the in-situ network would be necessary to extract the greatest benefit from satellite data. The combination of satellite radiance (sea surface temperature and salinity), radar and laser altimetry and ocean colour data within situ temperature, salinity and BGC observations will be explored.
- What synergistic effects are expected when satellite and in-situ data (typically, altimetry and TS profiles) are assimilated simultaneously? And how can we capitalize on the synergy between satellite and in-situ observation data effectively? This includes whether use of low-level processed satellite data (that is, so-called direct assimilation) increases the synergy of the satellite and in-situ data.
- What are the benefits of collocated satellite and in situ observations? Can we use the collocated observation data effectively, especially in a coupled data assimilation system?
- What combination of coastal, open-ocean and satellite observations are optimal for coastal predictions via down-scaling approaches?
- What combination between physical and BGC observations improve the ability of ocean prediction systems to represent biogeochemical properties of the ocean?

It is important to reflect the experiences and opinions of the people who operate ocean and coupled prediction systems in the design of the ocean observing system. In order to achieve that, close communication between the ocean prediction community and the ocean observation community is required. This project also aims to build up a positive feedback cycle between ocean and coupled prediction system operating centers and ocean observation communities. Thus, this project will collaborate with the UN decade programme proposed by GOOS, “Ocean Observing Co-Design,” as a common comprehensive project belonging to the GOOS programme, ForeSea, and CoastPredict.

It should be also noted that this project aims to redesign the ocean observation network to a more efficient one from an integrated point of view and to develop methods to use observation data effectively. Thus, this project aims to extract more benefit from the ocean observation networks maintained with limited cost. The achievement of the project will be even more valuable in the Covid-19 pandemic in which it is preferable to reduce the cost and human involvement to maintain the observation network.

Strategy

This project aims to optimize various combinations of different platforms in the ocean observation network and to maximize the synergy from different platform combinations when assimilated in ocean prediction systems. We will consider the following combinations as the main targets, although we do not restrict the target to only these combinations and it is possible to add other combinations to the target during the period of the project.

1. Satellite Altimeters (including conventional and wide-swath altimeters), satellite ocean current observations (SKIM) and Argo floats

Sea surface height anomalies observed by satellite altimeters effective data to monitor the activity of western boundary currents (e.g., the Gulf Stream, Kuroshio, etc.) and meso-scale eddies. They are also useful to monitor equatorial wave activities and the warm water accumulation preceding El Niños. However, sea surface height anomaly only includes information integrated over the water column, and in situ temperature and salinity profiles are necessary to accurately estimate the vertical stratification. Thus, how to effectively combine satellite altimeters and Argo floats is key to represent the western boundary currents and mesoscale eddies accurately, as well as to predict basin-scale variations of equatorial oceans including El Nino Southern Oscillation (ENSO) in the Pacific Ocean, the Indian Ocean Dipole (IOD), and Atlantic-Niño. Wide-swath altimeters will be operational in the near future and sea surface height anomaly data will be available with a much higher spatial resolution. Increasing the density of Argo floats in a few regions is also proposed as Argo2020 design. It is thus very valuable to explore how to effectively combine Argo floats and the new and conventional types of altimeters, and to optimize the distribution of the floats. In addition, there is a high possibility that the SKIM satellite, which will be able to observe sea surface ocean currents, will be launched in this decade. The satellite current data will be complementary to the altimetry data. Thus, we also aim to explore methods to effectively use the satellite current data with Altimeter and Argo float data.

2. Satellite radiometers (for SST observations), near surface in situ observations (from Mooring buoys and Argo floats, etc.), and sea surface atmospheric parameters

Accurately estimating SST is essential to reproduce ocean-atmosphere interaction and improve coupled predictions. Satellite SST is estimated from brightness temperature observed by satellite radiometers. But the SST estimated from brightness temperature is the temperature near-surface and has large high-frequency variations affected by the atmospheric status. Because the frequency of radiance observations is not enough to resolve the high-frequency variations, it is necessary to predict the SST variations using physical models. It is necessary to know the air-sea flux, and the interior ocean state to predict the SST variation. Thus, simultaneous observations of the brightness temperature with near surface ocean temperature profiles and sea surface atmospheric parameters are essential for such prediction. In addition, brightness temperature is affected by atmospheric parameters, and these data can be used more effectively together with the collocated atmospheric data in coupled data assimilation systems, which are currently under development. In this project, we aim to identify the best combination of those observation data for representing SST variations, and we will develop methods to extract synergy from the combination of those data. Particularly, we seek the combination of data and the assimilation methods that facilitate recovering the diurnal SST cycle and the variation of SST caused by tropical storms.

3. Satellite Sea Surface Salinity (SSS) observations and near surface in situ observations

Observations of SSS from satellites have been available in the last decade. However, these data have much larger errors than in situ observations and include large systematic errors. Thus, the satellite SSS data should preferably be used in combination within situ observation data and after careful treatment for removing the systematic errors. But the satellite SSS data have a potential to represent the influence of precipitation and the river run-off and improve the capacity of simulating the oceanic variations of tropical oceans and coastal seas. This project aims to explore methods to effectively combine satellite data within situ observations, and to demonstrate the effectiveness of the satellite data.

4. Satellite ocean colour observations and in-situ (Argo) observations

Satellite ocean colour observations provide constraints on phytoplankton chlorophyll at the near-surface of the ocean (first optical depth) only and are insufficient to constrain the BGC state of the ocean. However, the rapidly evolving BGC Argo program is beginning to provide in-situ information on six essential properties and is expected to expand significantly in the next 3 to 5 years. Assimilation of satellite ocean colour in combination within situ observations from BGC Argo holds promise for attaining data assimilation systems that resolve the BGC variability in the ocean. Since the BGC variations are strongly affected by the oceanic physical state, especially current and temperature, it is necessary to reproduce the physical and BGC states simultaneously. In this project, we will explore methods to assimilate satellite ocean colour observations with Argo observations of physical and biogeochemical parameters, carry out observing system design experiments to determine the optimal investment in BGC Argo given metrics specific to different user needs, and to identify the best combinations of biogeochemical and physical observations.

5. Observations of sea ice concentrations and sea ice thickness

It is essential to represent sea ice status for predicting the variations of polar oceans. Although there is a long history of sea ice concentration observations, it is only recently that sea ice thickness has been systematically observed. It is indispensable to use both sea ice concentration and thickness observations effectively in order to represent the accurate sea ice status. This project aims to propose the best combination of sea ice concentration and thickness platforms and to develop methods to draw synergy from the combination of sea ice concentration and thickness data.

6. Coastal ocean radars and sensors, Gliders, Drones, Satellite remote sensing, and Argo floats

The number of available observation data in coastal seas is usually not sufficient if we consider small-scale and high-frequency variability in coastal seas, Thus, it is important to design efficient observation networks and use observation data effectively in order to detect the small-scale and high-frequency phenomena in coastal seas. In this project, we will explore how to combine all available observation streams in the coastal environment effectively. Typical coastal sea observations include ocean radars, coastal sensors such as tide gauges and other types, but also draw heavily on suitably processed satellite remote sensing data and Argo floats when available. Wide-swath altimetry promises to provide high resolution data in the coastal seas, as well as in the open ocean. In addition, adaptive and versatile platforms, such as ocean gliders and waveriders, are valuable data streams, which allow targeted observations. This project will explore ways to maximize the synergy between the diverse observing networks that characterize coastal ocean environments.

In order to explore the methods that effectively combine data from various platforms as described above, and to ensure that the results of the project are reflected in the future ocean observation network, the following collaborative experiments and tasks will be implemented.

1. Multi-System observing system experiments (OSEs), observing system simulation experiments (OSSEs), and evaluation based on observation impact and sensitivity diagnostics to identify the optimal combination of in situ and satellite data. The OSEs and OSSEs will be conducted for the monitoring and prediction of targeted ocean phenomena. Experiments will be conducted using multiple systems, because the results will have a strong dependency on the numerical model and data assimilation method adopted in the ocean prediction system. The robustness of the evaluation will be increased by averaging the results from multiple systems and canceling out the systematic errors induced by the aforementioned dependency.

2. Development of improved data assimilation schemes which can extract additional

benefits from the combination of in situ and satellite observation data, including assimilation of low-level processed satellite data, incorporation of the background error covariance between the atmosphere and the ocean, and assimilation schemes for coupled data assimilation systems. The project will support such developments by promoting information sharing through the internet and workshops.

3. Collocated satellite-in situ observation campaigns to identify the synergy between in situ and satellite data, and to support the development of data assimilation systems that can exploit this synergy effectively. This task is especially relevant for developing effective methods to combine satellite radiometer and near-surface temperature observations.
4. Development of best-practices for evaluating the performance of ocean observing networks composed of various observing platforms. This development will facilitate regular evaluation of the ocean observing systems and contribute to the maintenance and reconstruction of these systems.
5. Construction of a real-time ocean observation impact monitoring system. Such systems facilitate the quick evaluation of the ocean observing systems when a critical change of the system status occurs due to some planned or accidental event.
6. Publishing the Observation Impact Annual Report. This report will include feedback from the ocean and coupled prediction centers to the ocean observation community. It will also be a tool to promote the communication between the two communities. We also plan to organize international workshops or symposiums in the first year and in the reviewing process after the project is finished. Achievement of the project will be presented to the wide ocean science community in the workshops or symposiums.

Scientific Outcomes

Scientific outcomes that are expected to be achieved are as follows.

1. Optimal and efficient ocean observing networks in which various in situ and satellite observation platforms are distributed effectively to improve the accuracy of ocean predictions.
2. Advance of data assimilation capacity, including effective assimilation methods of in situ and satellite observation data allowing synergistic improvement, effective design of the background covariance matrix between the atmosphere and the ocean, methods for assimilating satellite observation data more directly, coupled ocean-atmosphere data assimilation techniques, effective methods to assimilate coastal and open ocean observations simultaneously in coastal sea prediction systems, and effective methods to represent the oceanic biogeochemical state through assimilation of both physical and biogeochemical parameters.
3. Improved ocean and coupled atmosphere-ocean monitoring and predictions of various lead times for various areas, including short range ocean prediction, weather prediction, subseasonal-to-seasonal prediction, prediction of the tropical oceans, prediction of mid-latitude oceans, and prediction of polar oceans and sea ice. These improvements will also contribute to the prevention of oceanic and coastal disasters, the protection of the ocean ecosystem, the maintenance of a productive ocean, and marine safety.
4. Several useful tools for managing the ocean observing systems. It will provide justification to sustain in situ ocean observation networks and satellite missions. It will guide the future evolution of in situ and satellite observation networks. It will also provide the means to diagnose the status of the ocean observing system at near real time, which facilitates a quick reaction against a critical loss of a particular ocean observing system.
5. Systematic mechanism to make a feedback on the observation data impacts from ocean

prediction centers to observational communities and to reflect the experiences from ocean prediction specialists in the evolution of the ocean observing systems. This includes a framework for evaluating ocean observing systems based on the collaboration among various operational centers. It will also enhance the communication between operational centers and observational agencies and contribute to strengthen the positive feedback cycle between operational centers and observational agencies.

6. Improvements on our understanding of the ocean phenomena and ocean-atmosphere interaction.
7. Intellectual capacity building to train a continuing generation of scientists from developing and developed nations that will continue observing system monitoring and design into the future beyond the UN Decade time horizon.

Contributions to the Sustainable Development Goals (SDGs)

This project is mainly expected to contribute to the following three SDGs.

9. Industry, innovation, and infrastructure: The improvement of ocean/coupled predictions that will be achieved in this project will support industries such as fishing management, offshore oil exploitation and arctic shipping route management.
13. Climate Action: The optimal ocean observing system and the improved ocean/climate predictions that will be brought by this project will increase the capacity of monitoring the current climate status and predicting its future change.
14. Life below water: The improvement of ocean predictions that will be achieved by this project will facilitate the protection of the ocean environment and the protection and management of the ocean ecosystem.

The project will also make secondary contributions to the following SDGs.

2. Zero hunger: This project will improve our capacity to monitor and predict the ocean state and variations, which will facilitate protection and management of the oceanic ecosystem and food production.
3. Good health and wellbeing: The improvement of ocean predictions that will be achieved by this project will facilitate the prediction of harmful algae blooms. It will also facilitate the management of pollutants from shipwreck and inland outlaws.
7. Affordable and clean energy: The improvement of ocean predictions that is expected to be achieved by this project will generate opportunities to produce electric power effectively using wind plants on the ocean and through tidal current and ocean wave power generations.
8. Decent work and economic growth: The improvement of ocean/coupled predictions that is expected to be achieved by this project will support various industries and economic activities, including the merchant services, oil companies, marine leisure, etc. By improving the effectiveness of the ocean observing systems, economic growth will be facilitated.
11. Sustainable cities and communications: The improvement of the capacity of ocean predictions that is expected to be achieved by this project will facilitate the prevention of ocean and coastal disasters.
17. Partnership for the goals: This project intends to enhance collaboration on the evaluation and maintenance of the ocean observing system in order to contribute to SDGs.

Contribution to the UN Decade of Ocean Science for Sustainable Development

- This project aims to use ocean prediction science to improve efficiency and effectiveness of the ocean observing network. We develop novel data assimilation methodologies with which we can effectively extract synergy from various combinations of different platforms. We also seek a design of the ocean observing network that provides us the maximum benefit. These attempts will transform the methods to design the ocean observing network and enable us to provide scientific validity to maintain or modify the existing network. In addition, they have the potential to bring transformative improvements of ocean prediction skills, including the skill of predicting coastal sea disasters, variations of marine ecosystems, and future states of the open ocean and coastal seas, along with their influence on the atmosphere and other earth system components, as well as climate. Thus, this project will surely contribute to the vision and mission of the UN Decade.
- This project mainly contributes to Outcome 6, a predictable ocean. This project is expected to improve the ability of ocean prediction systems by improving the design of the ocean observation network, so that the largest benefit or synergy can be extracted from the combination of various observation platforms, and by developing data assimilation schemes with which we can effectively draw synergistical effects from the various combinations of observation data.
- This project mainly contributes to Challenge 7 (sustainable ocean observing system), but also contributes to Challenges 5 (ocean climate nexus) and 6 (multi-hazard early warning service). This project contributes to building a sustainable ocean observing system, because it aims to design observing systems that are effective for improving ocean prediction systems, and to contribute to the optimization of the observing system. The project also explores the impact of ocean data on climate predictions and supports the construction of multi-hazard early warning systems by improving the capacity of ocean predictions.
- This project mainly contributes to the Decade objective 2 (Build capacity and generate comprehensive knowledge and understanding of the ocean including human interactions, and interactions with the atmosphere, cryosphere and the land sea interface). This project aims to increase our capacity of understanding the ocean variations by improving the skills of ocean and coupled atmosphere-ocean predictions. In order to increase the prediction skill, we aim to improve the ocean observation network so that it can provide more effective observation data to ocean prediction systems. It also aims to develop methods with which ocean prediction systems can use observation data more effectively.
- This project mainly contributes to the decade sub-objectives 2.4 (Improve prediction services and increase predictive capability for oceanic hazards or events including extreme weather and climate.) This project aims to design ocean observation networks so that they improve ocean and coupled atmosphere-ocean predictions using ocean prediction systems. It also aims to develop data assimilation schemes with which observation data are more effectively used and more effectively improve the forecast skills.
- This project intends to accelerate the generation or use of knowledge and understanding of the ocean, with a specific focus on knowledge that will contribute to the achievement of the SDGs, especially SDGs 9, 13, and 14, and complementary policy frameworks and initiatives. This project is expected to increase our knowledge of the ocean and coupled atmosphere-ocean variations through improving our capacity of ocean predictions. In addition, the project uses the knowledge of ocean prediction science to optimize ocean observation networks.

- This project is also co-designed or co-delivered by the observational and OceanPredict communities, and it facilitates the uptake of science and ocean knowledge for policy, decision making, management and innovation. It plans to perform scientific assessments of the ocean observation networks and provides useful information for managing and redesigning the ocean observation networks to the people who administer it. The project is also expected to provide the government and ocean industries with scientific information on the current ocean state and its future variations, which are useful for decision making.
- This project aims to strengthen partnerships between observational and OceanPredict communities in order to evaluate and improve the effectiveness of the ocean observation networks on ocean and coupled atmosphere-ocean predictions.

Coordination / Management Structure

- The project mainly belongs to ForeSea, but will be managed as a common comprehensive project belonging to all ForeSea, CoastPredict, and the GOOS programme “Ocean Observing Co-Design”.
- The project is mainly led by the OceanPredict Observing System Evaluation Task Team (OP OS-Eval TT), but supported by the OceanPredict Science Team (OPST), other task teams of OceanPredict, especially the data assimilation task team, the coastal ocean and shelf seas task team and marine ecosystem analysis and prediction task team, and GOOS. For instance, new metrics or new methodology for observation impacts will be considered with those partners. We will also collaborate with operational centers that perform coupled weather and seasonal predictions in which the ocean state is initialized with ocean prediction (or coupled atmosphere-ocean data assimilation) systems.
- The project will organize the steering team. The team will be led by the OP OS-Eval TT co-chairs. The members will be invited from OP OS-Eval TT, OPST, the data assimilation task team, other task teams of OceanPredict, and GOOS. The steering team will make communication mainly through web meetings.
- The project will have a couple of international collaborating subprojects. It may also have several subprojects conducted in national or regional groups.
- The project will take place over 4 years and will be reviewed in the following year. The project will be likely to have a relevant international workshop or symposium in the first and the reviewing years of the project.
- The project will ask the OceanPredict Project Office to manage administration tasks.