ForeSea – UN Decade programme submission

15 January 2021

Provided by OceanPredict

1. Lead Institution:

OceanPredict

2. Lead Institution type:

International Expert Group

3. Lead institution physical address

c/o Fraser Davidson, Fisheries and Oceans Canada, 80 East Whitehills Rd., St. John's, NL, A1C 5X1, Canada

4. Contact Person:

Fraser Davidson

5. Contact Details:

fraser.davidson@dfo-mpo.gc.ca

6. Partner Details:

ForeSea co-chairs

Eric Chassignet	Florida State University	USA
Fraser Davidson	Fisheries and Oceans Canada	Canada
PN Vinayachandran	Indian Institute of Science	India

National representatives

Gary Brassington	Bureau of Meteorology	Representing Bluelink	Australia
Clemente Tanajura	UFBA	Representing REMO	Brazil
Gregory Smith	Environment Canada	Representing CONCEPTS	Canada
Guimei Liu	NMEFC	Representing NMEFC	China
Yann Drillet	Mercator Ocean	Representing Mercator Ocean	France
Abhisek Chatterjee	INCOIS	Representing INCOIS	India
Giovanni Coppini	CMCC	Representing MFS	Italy
Goro Yamanaka	MRI-JMA	Representing MRI-JMA	Japan

Do-Seong Byun	Korea Hydrographic and Oceanographic Agency	Representing KOOFS/KOOS	Republic of Korea
Laurent Bertino	NERSC	Representing TOPAZ	Norway
Matt Martin	Met Office	Representing FOAM	UK
Kristian Mogensen	ECMWF	Representing ECMWF	UK/Europe
Patrick Heimbach	U. of Texas	Representing ECCO/ECCO II	USA
Pat Hogan	NOAA	Representing HYCOM	USA
Avichal Mehra	NOAA	Representing RTOFS	USA

OceanPredict task teams

Task Teams	Co-Chairs	Affiliation	Countries
Coastal and Shelf Seas	Pierre De Mey-Frémaux Villy Kourafalou	LEGOS University of Miami/RSMAS	France USA
Coupled Prediction	Chris Harris Hal Ritchie	Met Office Environment Canada	UK Canada
Data Assimilation	Matt Martin Andrew M Moore	Met Office University of California Santa Cruz	UK USA
Marine Ecosystem Analysis and Prediction	Katja Fennel Stefano Ciavatta	Dalhousie University PML	Canada UK
Intercomparison and Validation	Fabrice Hernandez Gregory Smith	Mercator Ocean Environment Canada	France Canada
Observing System Evaluation	Elisabeth Remy Yosuke Fujii	Mercator Ocean MRI-JMA	France Japan

Others

Aquarius (and other missions)	Tong Lee	JPL/NASA	Representing remotely sensed salinity observation missions
Argo	TBC	UCSD	Representing Argo science team
EUMETSAT	Francois Montagner	EUMETSAT	Representing EUMETSAT
Group for High Resolution Sea Surface Temperature (GHRSST)	TBC	University of Leicester	Representing GHRSST
Expert in operational oceanography	Andreas Schiller	CSIRO	Former co-chair of GODAE OceanView

Expert in operational oceanography	Hall Ritchie	ECCC	Coupled systems
Expert in operational oceanography	Jim Cummings	NRL/NOAA retired	Data assimilation

7. Title:

The Ocean Prediction Capacity of the Future

8. Acronym:

ForeSea

9. Summary Description of proposed Decade Program

ForeSea's vision is for strong international coordination and community building of an ocean prediction capacity for the future. The overarching goal are to (1) improve the science, capacity, efficacy, use, and impact of ocean prediction systems and (2) build a seamless ocean information value chain, from observations to end users, for economic and societal benefit. These transformative goals aim to make ocean prediction science more impactful and relevant.

10. Start and End Date:

2021-2030

11. Estimated total budget:

This is an estimate of the yearly cost for the international coordination of ForeSea, some of it may be provided in kind by the participating partners, including OceanPredict. Many of the core activities are already funded, a rough estimate is 50% existing or likely to be committed.

	Per year (in US $)
Staff	
1 Scientific Coordinator	90,000
1 Communication Specialist	75,000
1 Technical (1/2 time)	45,000
Meetings	
Annual assembly (100 participants)	25,000
Organizational meeting (10 people)	10,000
Total	245,000

12. Percentage of estimated total budget secured:

0

13. Secured funding sources:

None specifically for ForeSea, but the following agencies are supportive of ForeSea and many support OceanPredict.

The **Bureau of Meteorology** is Australia's national weather, climate and water agency.

CNES is the Centre National d'Etudes Spatiales, the French government space agency.

The **Government of Canada** is represented in OceanPredict by CONCEPTS, the Canadian Operational Network of Coupled Environmental Prediction Systems

---

CSIRO is the Commonwealth Scientific and Industrial Research Organisation, Australia.

ESA is the European Space Agency, shaping the development of Europe's space capability.

EUMETSAT is the European Organisation for the Exploitation of Meteorological Satellites.

Ifremer is the French Research Institute for Exploitation of the Sea.

INCOIS is the Indian National Centre for Ocean Information Services.

IOC is the Intergovernmental Oceanographic Commission of UNESCO.
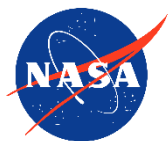

The **Met Office** is the UK's National Met Service, with responsibility for weather (including ocean) forecasting and climate services

Mercator Ocean International is a leading Global Ocean Analysis and Forecasting company operating the EU Copernicus Marine Service
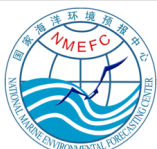

NASA is the National Aeronautics and Space Administration, the agency of the United States government.

NERSC is the Nansen Environmental and Remote Sensing Center, Norway.

NMEFC is the National Marine Environmental Forecasting Center of State Oceanic Administration (SOA).

NOAA is the National Oceanic and Atmospheric Administration, a US federal agency.

REMO is the Brazilian effort in physical oceanography and operational oceanography.

14. Do you require support to find additional resources for your Decade Programme?

Yes.

15. Would you like to be put in touch with partners working on similar issues?

Yes, we are already in touch with CoastPredict, GOOS, DITTO, etc.

16. Countries in which the proposed Decade Programme will be implemented:

All countries interested in ocean prediction. We currently have as partners representatives from USA, Canada, Europe (CMEMS), Australia, Brazil, India, China, Japan, South Korea, and South Africa.

17. Ocean Basins in which the proposed Decade Programme will be implemented:

All world oceans

18. What is the high-level objective(s) of your proposed Decade Programme?

ForeSea's vision is to extend and transform the current ocean prediction capacity with the following high-level objectives:

- **Coordinate ocean prediction world-wide** in a sustainable manner towards maximum societal benefits
- **Maximize the benefits of ocean observations** for ocean predictions and societal impact
- **Support development and maturation of the full-length operational oceanography value chain,** from observations to end users, by using best practices and coordinating **the integration of existing and new partners** (international science initiatives and intergovernmental organizations)
- **Advance the science behind ocean prediction** and its connection to the other components of the earth system, including the atmosphere, land, cryosphere, continental hydrology, etc.
- Make ocean prediction science more impactful and relevant by collaborating with socioeconomic experts and stakeholders to **quantify the impact and utility of ocean prediction** for science and society, especially in coastal areas (in collaboration with CoastPredict)

It is important to note that, while this programme will be hosted by OceanPredict, this is not business as usual. The aim is to build on OceanPredict capacity to address challenges by 2030 that encompass a much broader community than Oceanpredict and cannot be achieved by OceanPredict alone.

19. What are the key expected outcomes of your proposed Decade Programme?

1. An operational oceanography information value-chain where verified/certified information and knowledge are exchanged freely and enable all operational oceanographic components, integrated from the open ocean to the coastal areas, to contribute effectively together

2. A continuously optimized ocean observing system integrated from the open ocean to the coastal areas that provides maximum information benefit with manageable cost.
3. An ocean information delivery system that provides the right information at the right time for facilitating marine decisions in support of human safety and environmental safety, and an efficient and sustainable blue economy.
4. Improved extended range forecasting capabilities for ocean prediction systems.
5. Better assessment and prediction of the ocean state (including reliable uncertainty estimates) and ocean impact on forecasts of other earth system components (e.g., atmosphere, ice, waves, marine ecosystems, estuaries, etc.).
6. An informed ocean literate society and global economy
7. Coordinated capacity building across all elements of the operational oceanography value chain to sustain production and delivery of ocean prediction.
8. Demonstrated impact and value of predictions for coastal communities.
9. Effective use of ocean prediction technologies for weather and climate predictions

Established connections between OceanPredict with GOOS, WMO, IOC, JCOMM, Argo, GRHSST, GEO, GEO BluePlanet, etc. will facilitate realization of the expected outcomes. This will also be facilitated by collaborations identified with the following proposed UN decade programmes:

a) The GOOS-supported Integrated System Design UN Decade Programme will coordinate the design and the implementation of observing networks, their interface with the open ocean systems and sets standards for forecasting and predictions at the different scales
b) CoastPredict will demonstrate the value added of the global ocean analyses and forecasts to the coastal ocean
c) DITTO will establish and advance a digital framework on which all marine data, modelling and simulation will form a new globally shared capacity to access, manipulate, analyze and visualize marine information.
d) GEOS - Global Ecosystem for Ocean Solutions will help to use the new scientific knowledge and the ForeSea technology prototypes to advance solutions and involve stakeholder communities
e) Equisea - Ocean Science Fund for All is dedicated to equitable education dedicated to equitable education that will work in synergy with ForeSea to co-finance and co-implement projects that build the capacity of under-resourced regions to monitor, understand, and predict their coastal ocean
f) OceanCorps, a unifying concept for inspiring sustained, long-term education and research collaborations between scientists from under-resourced nations and scientists from the US and other higher-resourced nations

20. Please describe the activities that will be implemented as part of the proposed Decade Programme

ForeSea activities will be separated into two themes ("*Catalyzing transformative ocean prediction science solutions for sustainable development, connecting people and ocean prediction*" and "*Increasing impact and relevance: Improving science and science capacity for the ocean we want*") which will be realized through projects to make ocean prediction science impactful and relevant.

1. Integrated forecasts of ocean hazards with socioeconomic forecasts to quantify impacts and guide policy and management for preparedness, mitigation and restoration (Theme 1)

2. Community description of historical ocean conditions (i.e. reanalysis) at high resolution (Theme 1)
3. Improved descriptions of surface and near-surface ocean conditions (Theme 1 and 2)
4. Improved forecasts for extreme events (tropical cyclones, harmful algal blooms, oil spills, etc.) to address "safety of life at sea" considerations (Theme 1)
5. Development of an integrated description of the 4D biogeochemical state of the ocean based on satellite and in situ observations that informs society on key issues related to ocean health and the management of marine resources (to be carried out jointly with the development of a global BGC Argo array) (Theme 1 and 2)
6. Biogeochemical (BGC) nowcasts and ecological forecasting as area for transformative progress addressing from stakeholder needs ranging from carbon accounting to ecosystem health (Theme 1 and 2)
7. Maximizing the impact and value of observations - see supporting document in section 41 on the proposed project entitled "*Synergistic Observing Networks for Impactful and Relevant Ocean Predictions (SynObs)*" (Theme 1)
8. Guiding the evolution of ocean observing systems based on scientific assessment of their impacts and efficiency in ocean predictions – also included in SynObs (Theme 1)
9. Advancing use of ocean prediction technologies in weather and climate predictions, including use of earth system models (ESMs) and coupled data assimilation techniques (Theme 2)
10. Coupling of open ocean systems with coastal/land systems (partnership with CoastPredict) (Theme 2)
11. Integrated short-term and sub-seasonal to seasonal predictions in the coastal zones (including probabilistic products) that can assist institutional and private services towards sustainable management of marine resources, preparedness and response to hazards, marine safety and search and rescue operations (collaboration with CoastPredict) (Theme 1 and 2)
12. Development of limited area ESMs with appropriate coupling between the meteorological, hydrological, ice, and ocean components, to serve as test-beds to address the above issues, to improve model predictability and provide more reliable forecasts in the ocean component (collaboration with CoastPredict) (Theme 2)
13. Contribution to a digital ocean (Theme 1)
    o Optimizing user value
    o Coordinated approach for digital ocean and digital atmosphere
14. Extending the forecast range and ensemble approaches (Theme 2)
15. Capacity building and training (Theme 1)

21. Please describe the theory of change that underpins your proposed Decade Programme i.e. how will the activities being carried out achieve the outcomes and objectives that you envisage

The theory of change underpinning the proposed ForeSea programme is building the ocean prediction capacity of the future and making it relevant. ForeSea will engage in a range of capacity building activities that bring together experts in the field from leading operational centers, research institutions, groups from academia, UNESCO-IOC programs, and WMO infrastructures in a shared dialog about the current state-of-the-art, and common challenges faced by the ocean community.

22. Will your proposed Decade Programme enhance the sustainability of ocean science initiatives, including infrastructure or individual / institutional capacity, in light of the current Covid-19 pandemic?

Yes

23. If yes, how will your proposed Decade Programme enhance the sustainability of ocean science initiatives, including infrastructure or individual / institutional capacity, in light of the current Covid-19 pandemic?

In light of the Covid-19 pandemic, we need to be aware of the interaction between the environment and human health. Having a good understanding of the oceans, and their interaction with human health, will be important in any future human health disasters. The improved integration of observations and models will allow science, policy and civil organizations to understand the oceans role in health impacts, especially under a changing climate There are several areas where ForeSea will have an impact in a post-pandemic COVID-19 research environment, but one emphasis will be on making the ocean predictions and reanalyses easily accessible to the community at large via a central repository.

24. Please describe the coordination/management structure for the proposed Decade Programme

The structure will be parallel to that of OceanPredict, but will differ in its composition and goals (see figure below). The ultimate goal is a reinforced governance and coordination with new strategic partnerships (observations, users, society) building on OceanPredict. The ForeSea projects will be enacted in close collaboration with OceanPredict task teams and entrain scientists not currently involved in OceanPredict.

1) **Executive committee**: Comprising approximately 10 members, led by the co-chairs, and chosen from the community at large to be representative of international ocean prediction activities – it will define the strategy in consultation with the science team
2) **Science team**: Contributes to the strategy and assesses the project developments; a subgroup will ensure that early career members are mentored and promoted
3) **Advisory committee**: Consists of experienced members that provide external assessments of the programme
4) **Project team members**: Responsible for the project implementations
5) **Management and communication office/secretariat**: Coordinates all activities and communication to the community at large
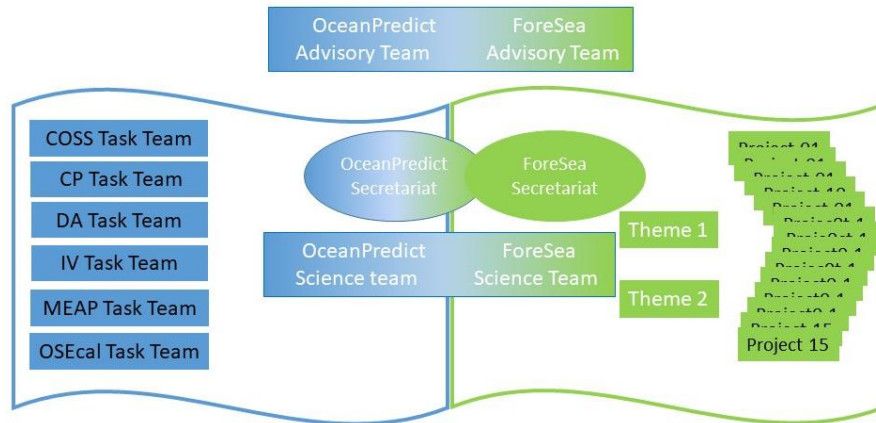
25. To which Sustainable Development Goal(s) (SDG) will your proposed Decade Programme contribute? Please select a maximum of three SDGs

GOAL 9:   Industry, Innovation and Infrastructure
GOAL 13: Climate Action
GOAL 14: Life Below Water

26. How will your proposed Decade programme contribute to the SDGs selected? Please Explain

GOAL 9: Industry, Innovation and Infrastructure: Prediction system development and improvement will provide basic environmental information and predictions from days to months, which will be exploitable by industry for developing value added services for the blue economy. Contributing to a digital ocean will be key in enabling industry, governments and businesses to provide efficient, safe marine activity and respond to incidences effectively.

GOAL 13: Climate Action: ForeSea provides for enhanced climate change adaptation through the use of short-term forecasts and reanalyses. The recreation of historical conditions for the last 30 years provides context and launching points for climate prediction. Additionally, tracking the state of the ocean from year to year, through reanalysis and year-in-review work, will highlight important changes assessed in a given year. This programme, through provision of ocean/marine predictions, enables enhanced ship routing and carbon-footprint accounting and reduction. Additionally, information produced will enable effective risk management and increased incident response effectiveness.

GOAL 14: Life Below Water: ForeSea provides physical and biogeochemical descriptions of present and forecasted water properties at all depths, enabling end users, scientists, policy makers and other stakeholders to use this crucial information for informed decision making, planning and sustaining blue growth in a healthy ocean

27. How will your proposed Decade Programme contribute to the vision and mission of the Decade?

The ForeSea program's two theme groupings are aligned with the UN Decade's vision, "*the science we need for the ocean we want*", and the UN Decade's mission to catalyze "*transformative ocean science solutions for sustainable development, connecting people and our ocean*".

ForeSea's first theme, "Catalyzing transformative ocean prediction science solutions for sustainable development, connecting people and ocean prediction", will enable mechanisms for ocean prediction science to work with other components to build a global international operational oceanographic capacity. This capacity further enables, in conjunction with WMO activities, the creation of marine environmental prediction services that will further develop the blue economy. Ultimately, this theme advances the implementation of science in ForeSea into sustained prediction services in partnership with other program elements of the Decade (observing systems, digital ocean, etc.).

ForeSea's second theme, "Increasing impact and relevance: Improving science and science capacity for the ocean we want", will advance the science needed to evaluate its impact on prediction systems, enabling focus on and enhancement of relevant capabilities and efforts.

Emphasis will be on advancing the science in key areas to:

1. Determine how best to capture the precision and utility of ocean prediction systems and
2. Develop research and develop methodologies to routinely optimize the ocean observing system for maximum impact on prediction skills

28. To which Decade outcome(s) will your proposed Decade Programme contribute?

Outcome 4: A predicted ocean where society understands and can respond to changing ocean conditions.

Outcome 5: A safe ocean where life and livelihoods are protected from ocean-related hazards.

Outcome 6: An accessible ocean with open and equitable access to data, information and technology and innovation.

29. How will your proposed Decade Programme contribute to the Decade outcomes selected?

Outcome 4 is enhanced through ForeSea's improvements in the science behind ocean prediction. Outcome 4 is further enabled by ForeSea co-creation of an international structure to support research, development and operations for operational ocean forecasting systems as elements of the full operational oceanography value chain, spanning: needs, observations, data management, analysis, ocean prediction, dissemination via digital ocean, and information service delivery, culminating in end use. In a modern context, this is achieved in conjunction with WMO and IOC groups.

Outcome 5 is enabled by applying ForeSea ocean prediction outputs and it is further strengthened through tuning end user feedback, increasing output standardization , and further enabling accessibility to marine environmental prediction output by operational

response groups (environmental incident response, search and rescue, etc.) and regulatory groups.

Outcome 6 is an integral component of ForeSea. ForeSea relies on other groups to design a digital ocean (collaboration with UN Ocean Programme DITTO), while ForeSea aims to populate such digital ocean environments with marine environmental prediction output for past, present and future conditions. The ForeSea data, consequently, enables access to predicted ocean information that society can exploit in a changing environment to achieve Decade outcomes. The predicted ocean information, if accessible to all, enables society in general as well as all Decade programmes to better achieve the desired outcomes.

30. To which Ocean Decade Challenge(s) will your proposed Decade Programme contribute?

Ocean Decade Challenge 7: Ensure a sustainable **ocean observing system** that delivers timely data and **information** accessible to all users on the state of the ocean across all ocean basins.

Ocean Decade Challenge 8: Develop a comprehensive **digital representation of the ocean**, including a dynamic ocean map, through multi-stakeholder collaboration that provides free and open access to explore, discover, and visualize past, current, and future ocean conditions.

Ocean Decade Challenge 9: Ensure comprehensive **capacity development and equitable access to data, information, knowledge and technology** across all aspects of ocean science and for all stakeholders regardless of geography, gender, culture, or age.

31. How will your proposed Decade Programme contribute to the Decade Challenges selected?

Ocean Decade Challenge 7: ForeSea will contribute to the sustainable ocean observing system by developing and implementing tools needed to evolve observations into knowledge for informed decisions and then making that knowledge accessible.

Ocean Decade Challenge 8: The outputs from the ForeSea multi-stakeholder collaboration will contribute to the comprehensive digital representation of the ocean by populating the analysis and prediction fields for past, present, and future states.

Ocean Decade Challenge 9: ForeSea will contribute ocean analysis and prediction science, system development, and implementation knowledge for capacity development and equitable access, regardless of geography, gender, culture, or age.

32. To which Decade Objective(s) will your proposed Decade Programme contribute?

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.

33. How will your proposed Decade Programme contribute to the Decade Objective(s) selected?

While the ForeSea programme will focus on the science that underpins ocean prediction, it will also co-develop the infrastructure needed for international collaborations on addressing the full value chain for ocean predictions systems, from observation requirements to the end use of comprehensive operational descriptions (analyses) and predictions of ocean conditions. The programme will contribute the oceanic component to the future WMO Seamless Global Data Processing and Forecasting System (S/GDPFS) framework, which, along with the IOC, will help ensure a structured approach comprising all necessary defined standards. The ForeSea contributions will facilitate value-added services in efficiently initiating and integrating to provide specific end users with the ocean information they need in the manner and timing they need. Building this end-to-end framework for ocean analysis and prediction information also will enable feedback for continuously researching and improving operational prediction capacities, such that ocean-related decisions are made with the best available descriptions of the physical and biogeochemical ocean environment.

34. With respect to the Decade Objectives selected above, to which Decade Sub-Objective(s) will your proposed Decade Programme contribute?

2.4: Improve existing, and develop new generation ocean models for improved understanding of the past, current and future states of the ocean, including human interactions.

2.5: Improve prediction services and increase predictive capability for oceanic hazards or events including extreme weather and climate.

2.6: Expand cooperation in ocean-related education, training, capacity development and the transfer of marine technology.

35. How will your proposed Decade Programme contribute to the Decade sub-objectives selected?

2.4: ForeSea's activities will directly improve ocean modelling capabilities, ocean data assimilation capabilities, as well as their linkages to meteorological, wave, and ice components. While the focus is on improving the ocean components of ocean prediction, the coupling with other marine environmental elements is vital for improvement. Modelling and data improvements will occur through targeted research projects.

2.5: ForeSea will integrate science improvements in modelling and data assimilation into operational predictions systems. Outreach and interaction with various applications sectors, such as E-NAVIGATION and search and rescue, will provide guidance for further improving relevant science and operational prediction systems to ensure optimal impact on improving safety at sea, with better lead times and understanding of extreme marine events.

2.6: ForeSea will improve ocean literacy by making the prediction output available, as well as accessible, via central repositories and user interfaces (e.g., in collaboration with digital ocean programmes like DITTO). Additionally training opportunities for the next generation of scientists, including those from developing countries, will improve intellectual capacity,

as will leading workshops to improve ocean prediction literacy, for augmenting end use and end use benefit of the ocean prediction systems (collaboration with Equisea).

36. Please check which of the following criteria are relevant to your proposed Decade Programme as far as they are relevant to your proposal:

X 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 and complementary policy frameworks and initiatives.

X Is co-designed or co-delivered by knowledge generators and users, and does it facilitate the uptake of science and ocean knowledge for policy, decision making, management and/or innovation.

X Will provide all data and resulting knowledge in an open access, shared, discoverable manner and appropriately deposited in recognized data repositories consistent with the IOC Oceanographic Data Exchange Policy[1] or the relevant UN subordinate body data policy. If you check this criteria, please provide in the question below details of where data will be deposited and where it exists, attach a data management plan.

X Strengthen existing or create new partnerships across nations and/or between diverse ocean actors, including users of ocean science. Contribute toward capacity development, including, but not limited to, beneficiaries in Small Island Developing States, Least Developed Countries and Land-locked Developing Countries.

X Overcome barriers to diversity and equity, including gender, generational, and geographic diversity.

37. How will your proposed Decade Programme contribute to the Decade criteria selected?

X *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 and complementary policy frameworks and initiatives.*

The main goal in the Decade for ForeSea is integration of ocean forecasting/prediction efforts with all other affiliated efforts and other components of the operational oceanography value chain. The challenge we currently have in operational oceanography, is that we do not have a body or a system to approach it as a whole (observations, data management, prediction, dissemination, service desks, value added service providers, and end users) which enables: (1) feedback through the whole chain and (2) ensures that enhancements in individual chain components benefit the whole operational oceanography chain. This will be achieved by ForeSea through coordination, setting standards and clear exchange mechanisms between elements/components of the operational oceanography value chain. Practically, this will be realized through joint projects that span several Decade programmes. In chaining up the above systems, improvements in the science of prediction, when integrated into operations, can quickly lead to better meeting the end user requirements for ocean information. The advances in prediction science lead more effectively to contribute to end user needs as they are rolled into operations, and communicated via standardised files, on common repositories with user interfaces (API's Webservers) that enable democratisation of prediction and observations output.

Additionally, broadcasting research efforts through the Decade, will enable engagement with other disciplines, to enhance research on observations, data management, ocean digital twin as well as end user applications. The integration of the ocean prediction science with weather prediction, sea ice prediction, prediction of extreme event, etc. will be further enabled in the decade. Overall, the Decade will enable integration of ocean prediction systems into the full Environmental Marine Prediction Chain (UN and IOC) as well as enable integration of the science behind ocean (physics + BGC) prediction with the science behind meteorological, ice and wave prediction. The aim is to have ubiquitous use of ocean prediction, societal literacy of ocean prediction uses, and long-term commitments by various countries to keep investing in core operational oceanography capacity (observations, prediction, digital ocean, end use and value-added service cultivation etc.) in support of the blue economy.

X Is co-designed or co-delivered by knowledge generators and users, and does it facilitate the uptake of science and ocean knowledge for policy, decision making, management and/or innovation.

ForeSea will play a leading role in enabling the setup infrastructure to connect up the full operational oceanography value chain. This will be achived by increasing communication across groups to collectively build a full operational oceanographic capacity across IOC/WMO member states that enable science improvements to impact operational generation of ocean conditions in real time, and longer term future to enable policies, decisions at sea, integrated management and enable industry to provide value added services.

X Strengthen existing or create new partnerships across nations and/or between diverse ocean actors, including users of ocean science. Contribute toward capacity development, including, but not limited to, beneficiaries in Small Island Developing States, Least Developed Countries and Land-locked Developing Countries.

OceanPredict nurtures active communication between nations via national representatives and forecasting centres world-wide irrespective of the geographical location or economic positioning. The partnership paves easy access towards creating opportunities for further development in capacity building and support for early career development. Any advance in science flows through to operational prediction systems and hence the end users thus passing on the benefits to the society. The high resolution forecasts that are envisaged in ForeSea will benefit even small nations and the policy of open access to all products and knowledge system would contribute towards use as well as development in nations of all economic positions.

X Overcome barriers to diversity and equity, including gender, generational, and geographic diversity.

OceanPredict and ForeSea advocate equal partnership in all of it activities irrespective of gender, generational, and geographic diversity.

Communications

ForeSea will take advantage of the broad OceanPredict network that includes individual scientists, research institutions, academia, national centers and groups/associations/forums. ForeSea will reach out to the larger community as follows.

Annual Meetings: ForeSea annual programme meetings will be take place together with the regular meetings of OceanPredict (e.g., oceanpredict19.org) by expanding the range of topics to cover ForeSea's objectives. OceanPredict19 was attended by about 200 participants with the capacity to lead or impact the decision making process of development and implementation of ocean forecasting across various agencies. These meetings will be conducted in different countries each year. For each meeting, there will be a dedicated local science day, which will be a special event highlighting the local scientific community.

Dissemination via web page: A dedicated ForeSea web page will be used for posting information regarding new events, publications, projects etc. This webpage will also be used for distributing online documents, announcements etc.

Workshops: Interaction across levels, ranging from individual scientists to institutions, will be promoted through workshops. These workshops will provide a platform for assessing the programme's progress, exchanging ideas with partners, addressing and managing issues, developing new partnership, and enhancing ongoing collaborations to higher levels.

Summer schools: Greater involvement by students, particularly youth in general, in the activities of ForeSea projects is important. ForeSea will organize summer schools, focusing on the themes that are relevant to ocean prediction science and applications.

Social Media: ForeSea will exploit widely used social media to reach out to larger audiences in all parts of the globe.

Webinars: ForeSea is planning to run regular webinars promoting programme progress and findings

Newsletter: ForeSea plans to regularly disseminate newsletters to provide updated information on ForeSea events.

No - The ForeSea programme will develop its communications strategy when the programme initiates.

Supporting Documentation

41. Please attach any relevant supporting documents to your submission that will aid in its evaluation e.g. project log frame, research proposal, high-level budget, data management plan, communications strategy, or letters of support. Please note that none of these documents are obligatory, but can be provided at the discretion of the proponent if they feel it will help in the understanding of their request.

SynObs project description

42. Please confirm that you have completed your form submission