Ocean Predict

SYMPOSIUM OP'24

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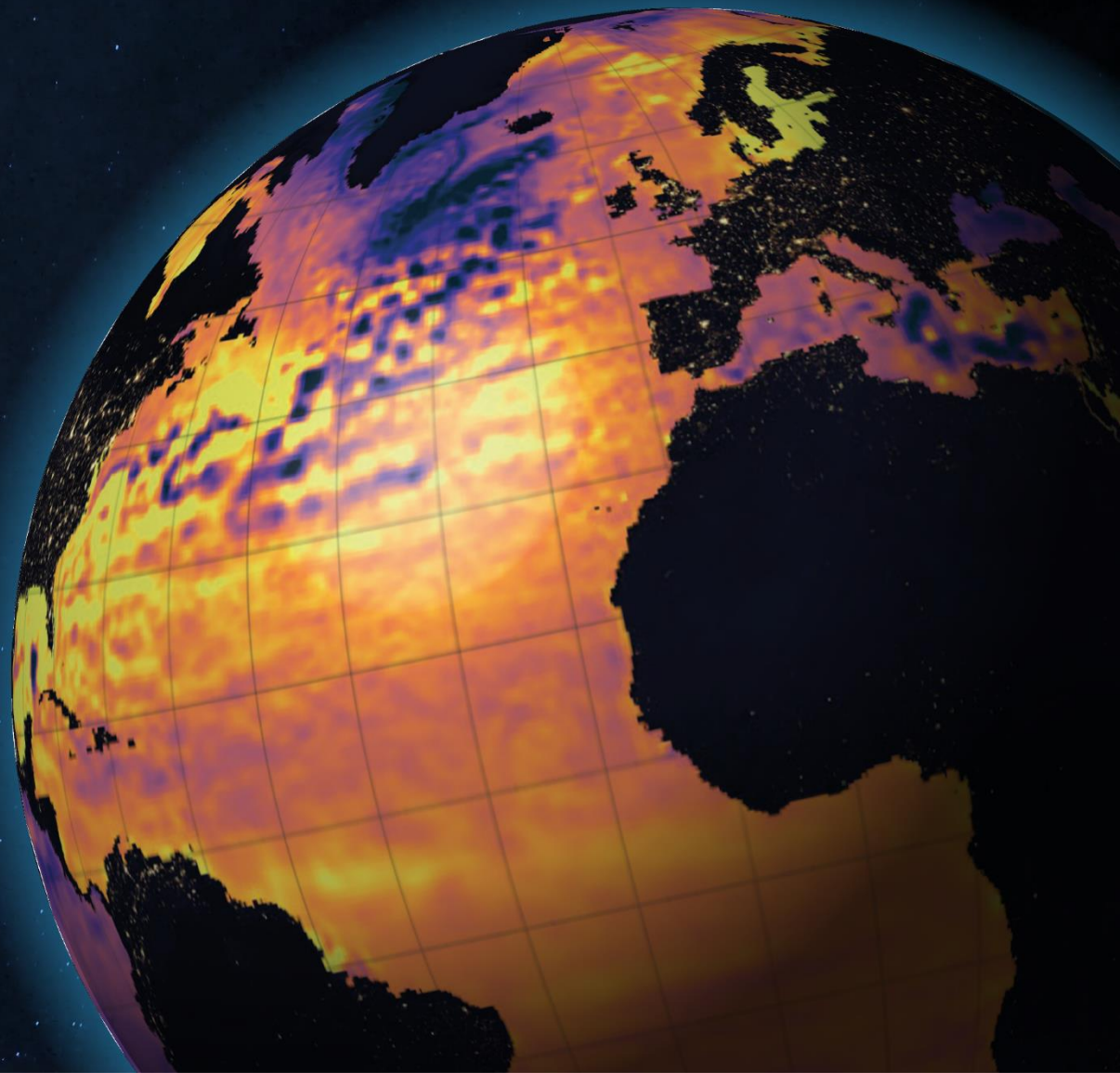
2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Outcomes of the OP'24 symposium



Marie Drevillon, Fraser Davidson, Eric Chassignet, Pierre-Yves Le Traon, Eric Bayler, Kirsten Wilmer-Becker, Stéphanie Cuven

on behalf of the scientific organising committee and of session chairs and rapporteurs

outline

The (ocean prediction) science we need …

- Reports from the 7 symposium's themes…

… for the (digital) ocean we want (access to!)

- Reports from the forum on international mobilization
- and many discussions, connexions

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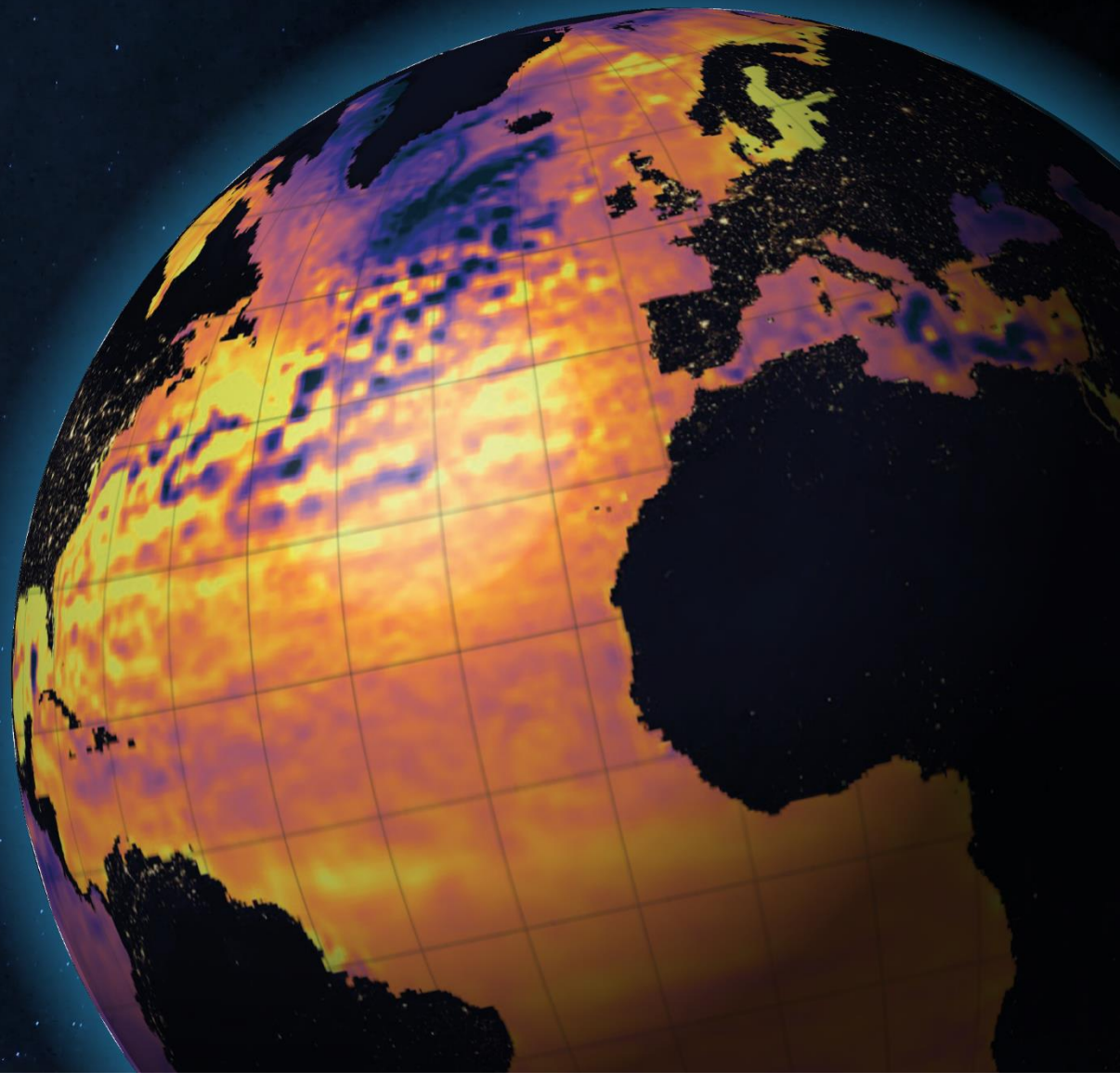
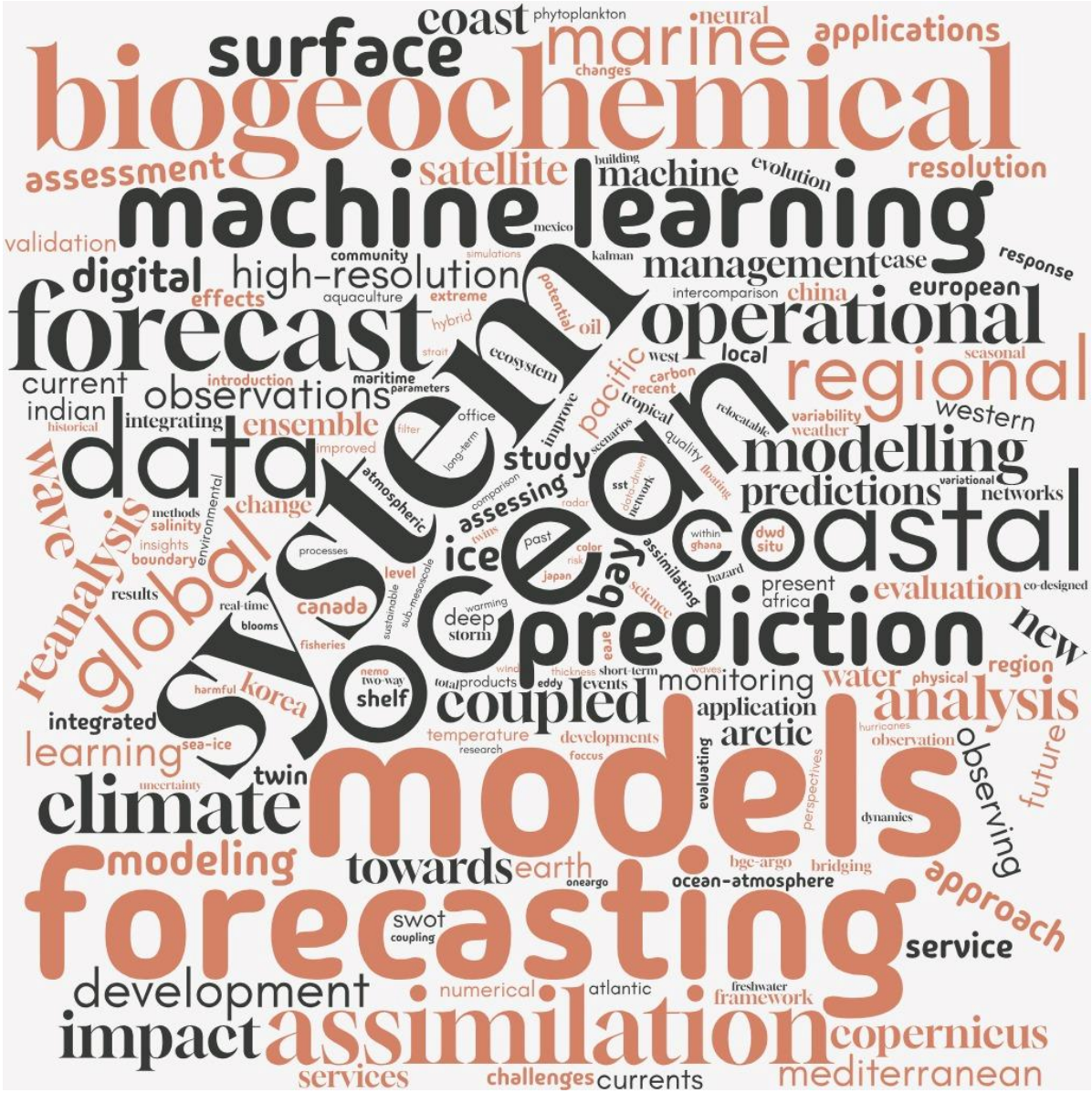
The (ocean prediction) science we need …

Highlights from OP'24



Obtained from OP'24 abstract titles



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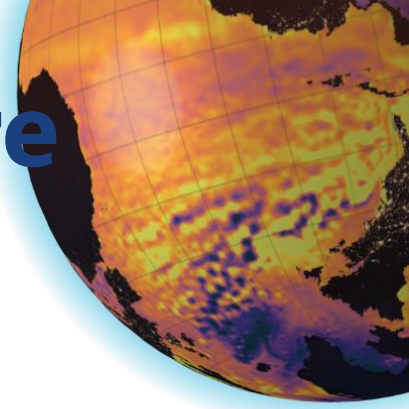
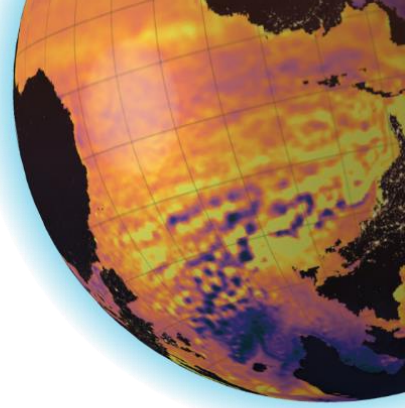
Ocean prediction: past, present and future



- Structuring of international collaborations to best align science, services, governance, and innovation to best deliver "the ocean we want"
- AI: game changing opportunities and challenges
- creating and operating ocean digital twins,
- Fast evolving field: Need to be nimble and adapt (governance, frequent communication, adaptation / adjustment to opportunities)
- In private/public collaborations, focus on areas of overlapping interest, and look forward
- Communication & co-design are critical for ensuring effective operational ocean prediction systems
- inclusivity going forward is vital

Coastal and Regional Ocean Prediction



Most heavily used and impacted ocean areas with diverse human pressures

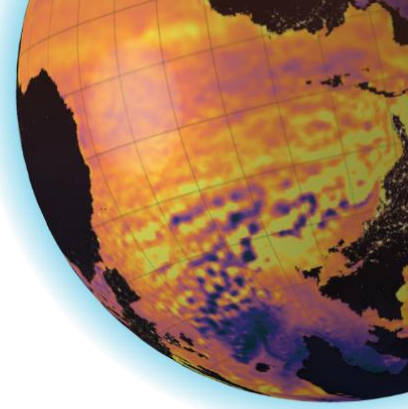
Diversity of challenges and approaches:

- Complex geometries, high resolution, nonlinear flows,
- Interaction of many relevant processes: circulation, waves, atm, bgc, ice, sediment transport …
- Complex model and data error budgets (essential for DA)

Novel approaches:

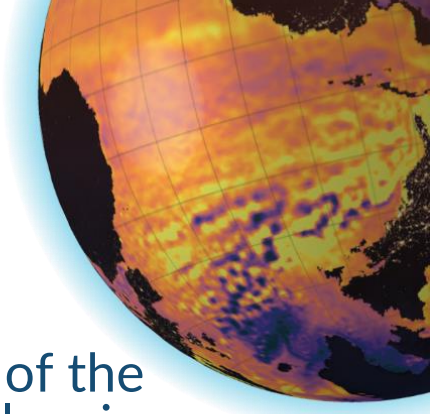
- Coupling of ocean and hydrological models (compound floods)
- Multiscale: unstructured meshes to represent flows on 1-10 m to 100 km scales
- Need for coupled physical BGC data assimilation: multispectral data
- AI: Probabilistic forecasting, Bias correction, High res mapping

Polar ocean and sea ice



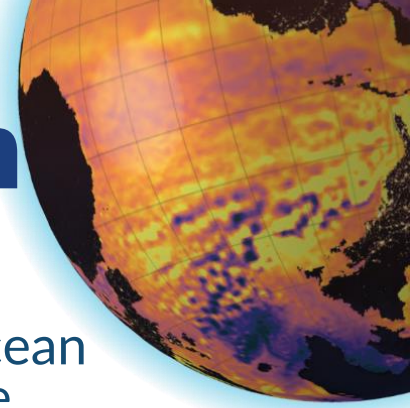
- Arctic Ocean changes: predictions for additional ocean parameters are needed T,U,V, storm surge, waves, sea ice, bgc...
- Arctic Modelling Challenges: small scales of mesoscale dynamics, important sub-mesoscale circulations, ice-wave interactions,
    - sensitivity of ocean-ice-atmosphere heat, moisture, and momentum fluxes in changing marginal ice zone
- Observing and Modeling salinity is critical due impact of freeze point, stratification, and overturning circulation.
- Addressing sea-ice thickness is crucial: influence on freshwater inputs, ocean stratification, heat budget and momentum transfer.
- Operational modeling and prediction for the Arctic need to address the blue and green oceans in addition to the white ocean;
    - particularly given increasing ice-free periods and extent and the poleward migration of species due to global warming.

Global and basin scale ocean prediction



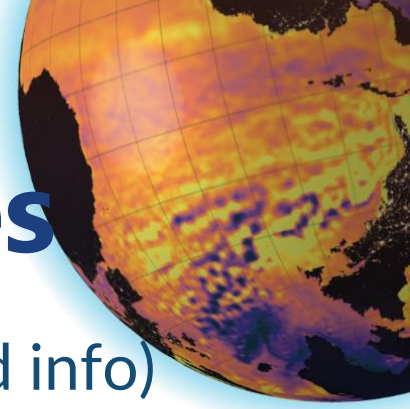
- Ensemble forecast benefit: reliability with uncertainty provision and range extension of the predictability compared to deterministic approach-> useful for risk assessment and planning
- Geoengineering solutions are being explored by industry -> Operational ocean community need to engage in evaluating the proposed solutions
- There is an increasing discussion on Marine heatwaves, need for exchanges in the community (definition, predictability).
- An ensemble of simulations is to assess the mid-century basin and regional climatic trend uncertainty and their impact for ecosystem. Model response uncertainty can be as important as the scenario choice.
- Evolution of global basin scale system: toward more coupling, towards ensemble method and hybrid (var + ensemble + AI)
- Evolution of coupled system: toward shorter (6h window) in data assimilation to facilitate coupled DA, ensemble method

New developments in ocean prediction



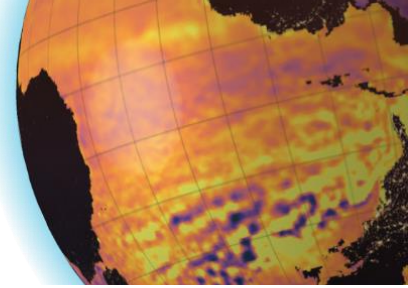
- The scope of this theme is broad and includes many topics on new developments in ocean predictions, such as: measurements/observations, modeling, data assimilation, machine learning/AI, digital twins, etc.
- We had more than 100 presentations (talks and posters).
- Topics ranged from recent advances in operational systems (adoption of new models such as MOM6 ocean, SI3 sea ice models, increasing resolution/coupling, etc; observations such as SWOT altimeter; new techniques such as wavelet based observing operators; trials with machine learning, etc).
- Overall, this theme provided a platform for models, data assimilators (physical, bio-geo-chemical), modelers and observationalists to meet and exchange information/advances/ideas. Further discussion is hoped to happen at a finer level via individual task teams' interaction.
- Future recommendations include (not limited to following): increased collaboration across agencies, exchange of information, ideas and possibly datasets, establish and share best practices, encourage participation and involvement from the next generation.

Ocean prediction systems and services



- Consider value cycle and user link importance (reliable, tangible, trusted info)
- INCOIS and SAEON systems, example of emerging operational systems to watch
- Effective hazard communication both modern (whatsapp …) and traditional
- Efforts in training and building strong trust relationship with users
- Locally optimised systems co-designed with local stakeholders, ensures engagement, partnership and/or financial support
- Services require solid infrastructure : Information management systems, open data repositories, user friendly access.
- Service is about communication/empathy/ubuntu

User applications and societal benefits



Diplomacy for science: 'Facilitating international science cooperation'

Science for diplomacy: 'Using science cooperation to improve international relations between countries'

Science in diplomacy: 'Informing policy objectives with scientific advice'

G7 FUTURE OF THE SEAS AND OCEAN INITIATIVE

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GEO BLUE PLANET

Example: Inspired by the collective vision of marine debris scientific community, the integrated marine debris observation System (IMDOS) aims to provide coordination and guidance to lead the marine debris community in establishing a sustainable global observing system and facilitating open access to data.

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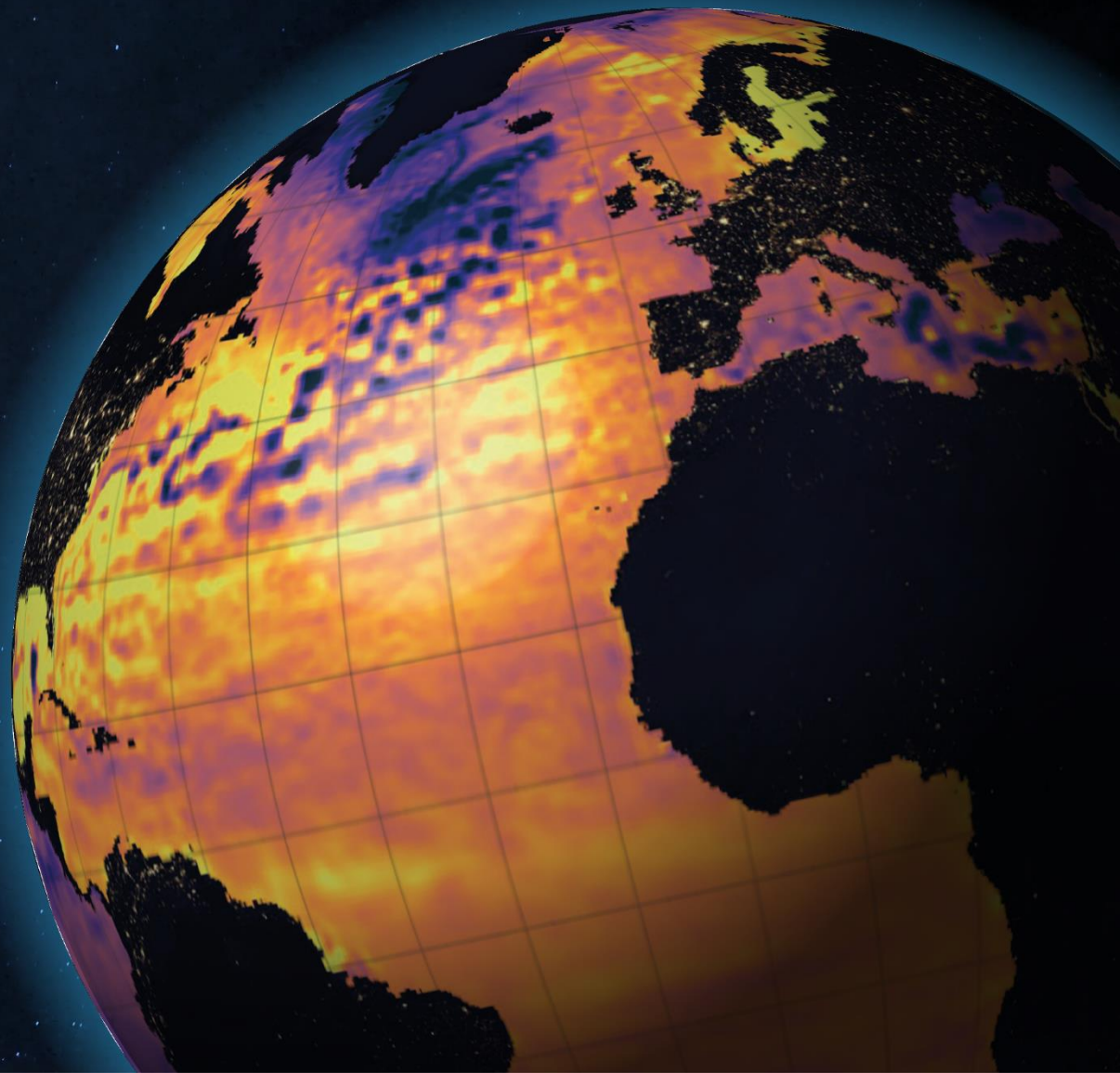
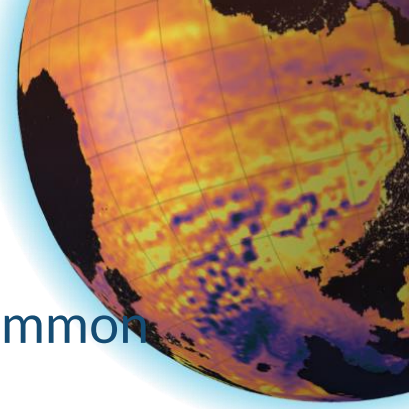
… for the (numerical) ocean we want

Highlights from the discussions on ocean prediction community's contribution to achieve UN decade challenges



The (numerical) Ocean we want : challenge 8 of the UN decade

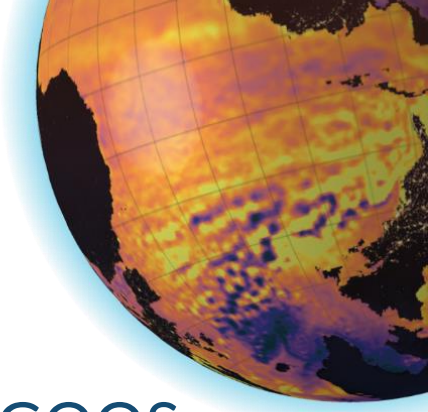


- The UN decade programmes of the UN Ocean Data Ecosystem aim at developing a common vision to move forward towards a common service
  - Open, accessible ocean and predictions for the worlds oceans with interoperable interfaces linking to big data services
  - Empower coastal forecasting centres to provide info coastal community needs on issues they face
  - Provide actionable ocean data in a changing climate earth system
  - Socio economic / blue economy predictions
  - Test ocean impact from climate change scenarios and climate change mitigation actions
  - Operational Ocenography Literacy for public and policy makers

Ocean Prediction DCC is our coordinator, needs to be sustained beyond 2030

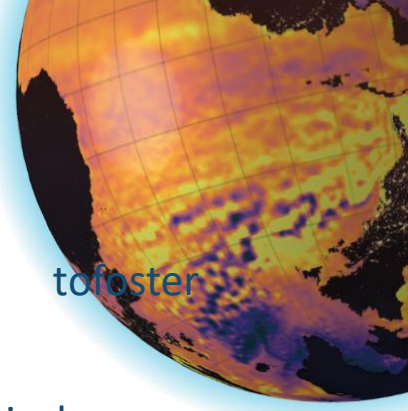
-> Provides recommendations, tools and methods to advance towards the objective (ETOOFS guide, ORL, architecture…)

The common infrastructure we need



- More in situ observations are needed and the advancement of coastal GOOS is key, as well as more automated data management systems (ODIS).
- We need a set of achievable practical implementations (examples/examplars, benchmarks) to collaborate and gather some of the best practices
- We need to improve communication and transparency, and to foster collaboration between structures with different levels of infrastructure
- We need to put in place a regular system assessment, rolling review of requirements, following WMO's example (and setting up the dialogue with WMO)
- What we do is very specific and complex, but we need to be able to change our mindsets and exploit the new opportunities

The international cooperation we need



- Essential role **of international partnerships** (from observations, predictions to applications and users) to foster advancements of fit for purpose Ocean Prediction capabilities.
- Urgent need to **strengthen the global ocean observing system** to build a sustained and sustainable critical ocean observing infrastructure. Cooperation of space agencies is key to to ensure a long-term satellite ocean observing system. Need to expand activities to assess the impact and support the design of an integrated observing system.
- The **OceanPrediction DCC** now provides the framework to link the different ocean prediction initiatives in the UN Decade and expand these very much needed partnerships. Interactions between OP DCC with the WMO Implementation of Earth System approaches is an opportunity to capitalise on the combined strengths of the ocean, weather, climate communities.
- Need to enhance **connection between ocean observations, ocean forecasting and applications to answer to societal needs**. Future interactions between GEO Blue Planet and OceanPredict/ForeSea in the framework of the OceanPrediction DCC will be key to ensure the development of fit for purpose ocean prediction capabilities
- **Need a global mobilization all along the ocean information value chain**. The UN **Ocean Conference (UNOC) will be an opportunity to promote a call for action for this global mobilization** building on the outcomes of the OP'24 symposium.

Let's engage with end users

Let's engage in existing UN decade actions

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Ocean Prediction UN DECADE COLLABORATIVE CENTRE

SCAN ME

Put your system on the OP-DCC atlas

Ocean Predict

SCAN ME

Participate in the ocean digital pavillion at UNOC 2025

United Nations

2025 UN OCEAN CONFERENCE

June 2025, France

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OP'24
At UNESCO

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Thank you UNESCO, IOC, Mercator Ocean chief organisers!! ☺

Réjane

Vincent

Phanie

Kirsten

SYMPOSIUM OP'24

ADVANCING OCEAN PREDICTION SCIENCE FOR SOCIETAL BENEFITS

Thank you!

Thank you local support team: Réjane, Enrique, Alexandra, Phanie, Vincent, Kirsten, Corinne, Veronique, Andreia, Stephanie, Gratianne, Valentina, Quentin H , Quentin G, Charly, Sylvain, Laurence, Karen, Coralie, Renaud, Fabrice, Cedric, Valentin, Olivier and many more!!

Thank you chairs and rapporteurs, organising and scientific committee members

European Commission

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