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Advancing the science of ocean prediction

Coastal Ocean and Shelf Seas Task Team (COSS-TT)

COSS-TT strategy meeting
Main theme: the COSS-TT in the UN Ocean Decade

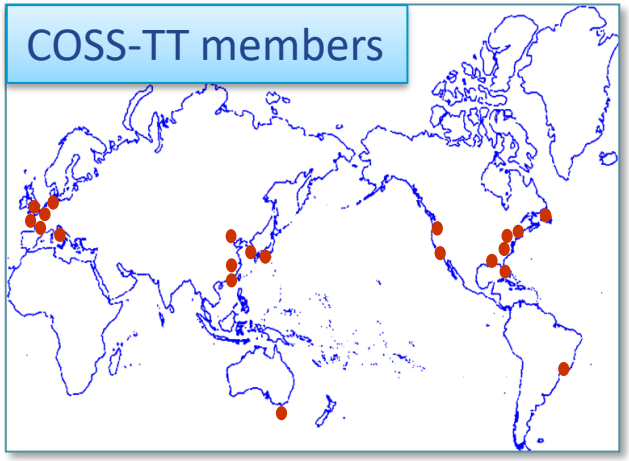
DAY 1

9-11 June 2021, virtual (MS Teams)

(Kirsten Wilmer-Becker’s announcements)

What is the COSS-TT?

- **OceanPredict** (OP) (formerly known as GODAE OceanView) is an international research and development network to accelerate, strengthen and increase the science and impact of ocean prediction >>>
  - GODAE started in 1999
- Within OP, the Coastal Ocean and Shelf Seas Task Team (**COSS-TT**) aims to foster international collaboration to advance science and expertise in support of regional/coastal ocean forecasting >>>
  - 33 members + COSS community
  - 6 international meetings so far



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What we will try to achieve in this meeting

(and beyond, between now and the 2022 COSS-TT Montréal meeting)

Pierre De Mey-Frémaux (LEGOS, France), COSS-TT co-chair 7’

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Common threads of this meeting

- Discuss the Task Team's involvement in the UN Decade of Ocean Science
  - Programmes (both accepted within UN Decade): ForeSea & CoastPredict
  - Projects: SynObs, etc.
- Discuss areas where we should set strategic objectives for TT in decade years
  - Strategic Objective (SO) = **What we will do** to fulfill our mission
  - First list of 4 main science & expertise themes defined by your co-chairs
    - Participation of Decade project leaders and invited external experts
    - Active participation by all **required** in the discussions
    - Discuss in particular opportunities and gaps
  - Try to reach agreement on:
    - Main areas of strategic objectives
    - Calendar up to Montréal 2022
- Consider evolution of the list of TT members – as needed for new actions

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Thematic topics

1. Observing infrastructure in the coastal seas, integration with models and with forecasting
2. Integration of coastal ocean and estuaries/inland waters/coastal cities
3. Seamless integration of coastal and larger-scale estimates
4. Climate projections, coastal vulnerability and resilience

Discuss UN Decade involvement and areas of **Strategic Objectives** per topic, and identify **current gaps**.

Revisiting TT Strategic Objectives for the Decade yrs

Envisaged process: (open for discussion)

1. **Your contribution needed at this meeting:**
   - Assess new environment of COSS-TT and CoastPredict: Decade, relevant programmes, projects, experts, GOOS, etc.
   - Review important topics for TT and areas where we should set strategic objectives
   - Prioritize and participate in discussions (day 3, if format allows)
2. **OPST-4** later in June: OceanPredict-wide equivalent of 1., harmonize w/other TTs
3. **Later this year:**
   - Ensure representation of TT in decision-making circles in Decade programmes
   - Help make projects more concrete
   - Elaborate Strategy Note for TT, with priorities set
4. **At the next general COSS-TT meeting** (Montréal, April 2022)
   - Discuss/endorse
   - Adjust TT membership as needed

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

The UN Decade of Ocean Science

(and why the Decade is important for us)

Villy Kourafalou (U. Miami, USA), COSS-TT co-chair, CoastPredict co-chair
7’


2021
2030
United Nations Decade
of Ocean Science
for Sustainable Development
https://youtu.be/deqwrTvkqLw

Decade Vision & Mission

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Vision

The science we need for the ocean we want

***

Mission

Transformative ocean science solutions for sustainable development, connecting people and our ocean.

DECADE GOALS: FOCUS ON SOCIETAL OUTCOMES

A Clean Ocean

Eliminate pollution at the source, mitigate harmful activities, remove pollutants from the ocean, and support the **transition of society into a circular economy**

A Healthy and Resilient Ocean

Co-design tools and services which build resilience, recognize thresholds and avoid ecological tipping points, for the health and wellbeing of society and the planet as a whole.

A Predicted Ocean

More relevant and integrated understanding and accurate prediction of ocean ecosystems and their responses and interactions for a dynamic and **adaptive ocean management**.

DECADE GOALS: FOCUS ON SOCIETAL OUTCOMES

A Safe Ocean

Life and livelihoods are protected from ocean-related hazards at the coast and at sea.

A Sustainable Productive Ocean

The **provision of food supply** and alternative livelihoods are secured.

A Transparent and Accessible Ocean

Quality controlled and **relevant ocean knowledge** available to scientists, governments, educators, business and industry, and the public through accessible products

DECADE GOALS: FOCUS ON SOCIETAL OUTCOMES – #7 - NEW

An Inspiring and Engaging Ocean

Highlight the ocean as a place of **wonder and inspiration,** thus also influencing the next generation of scientists, policy makers, government officials, managers and innovators.

Equity, inclusiveness, respect, fairness and scientific integrity are core principles of the Decade. Need to identify and dismantle barriers to achieving **gender, cultural, geographic and generational balance so that no one is left behind.** Everyone should be able to contribute to and benefit from ocean science, including **Small Island Developing States, Least Developed Countries, and Land-locked Developing Countries.**

Decade Action Framework

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Decade Action Hierarchy

Tangible initiatives that will be implemented by a wide range of Decade stakeholders and identified through Calls for Decade Actions.

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Decade programme

- Global or regional in scale
- Fulfils one or more of the Decade objectives.
- Long-term (multi-year), interdisciplinary and typically multi-national.
- Includes component projects, and enabling activities.

Decade Project

- Discrete and focused undertaking of a shorter duration.
- Will typically contribute to an identified Decade programme

Decade Activity

- In support of an outcome, objective, programme, or project.
- Typically a one-off standalone activity
- Can form part of a programme or project or can relate directly to a Decade objective.

Decade Contribution

- Supports the Decade through provision of a necessary resource
- Can be either for costs related to the implementation of a Decade Action or for coordination costs.

Decade Outcomes

Describe the 'ocean we want' at the end of the Decade.

1. A **clean ocean** where sources of pollution are identified, reduced or removed.
2. A **healthy and resilient ocean** where marine ecosystems are understood and managed.
3. A **productive ocean** supporting sustainable food supply and a sustainable ocean economy.
4. A **predicted ocean** where society understands and can respond to changing ocean conditions.
5. A **safe ocean** where life and livelihoods are protected from ocean-related hazards.
6. An **accessible ocean** with open and equitable access to data, information, and technology and innovation.
7. An **inspiring and engaging ocean** where society understands and values the ocean in relation to human wellbeing and sustainable development.

Decade Challenges

Describe the most immediate and pressing priorities for the Decade.

1. Pollution and Marine Debris
2. Ecosystem Protection, Restoration
3. Food Security, Sustainable Seafood
4. Economic development
5. Ocean-Climate Nexus
6. Multi-Hazard Warnings
7. Ocean Observing Systems
8. Digital Ocean Map and Data Portal
9. Capacity Development
10. Social & Behavioral Barriers to Change

Central to the Ocean Decade is the notion of transformation

Where we are	→	*Where we would like to be*
• Science largely competent for problem diagnostic		• Science providing solutions and motivating action
• Observing system for climate and emerging data service		• Ocean data and information system for past, present, and future
• Major knowledge gaps, weak ocean literacy		• Ocean literate and well-informed decisions
• Funding base mostly in research mode		• Clear value chain leading to resourcing and commitment
• Hugely uneven capacity, especially in developing countries/SIDS		• Capacity Development/Transfer of Technology: no one left behind

The Decade, both in terms of action and outcomes, needs to move beyond business as usual to a true revolution in ocean science

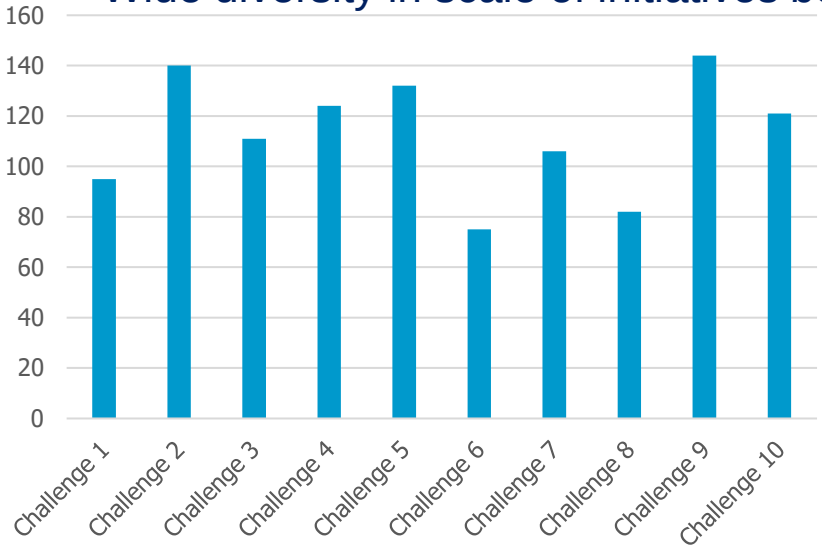
The transformative nature of the Decade will promote and facilitate Ocean Science that:

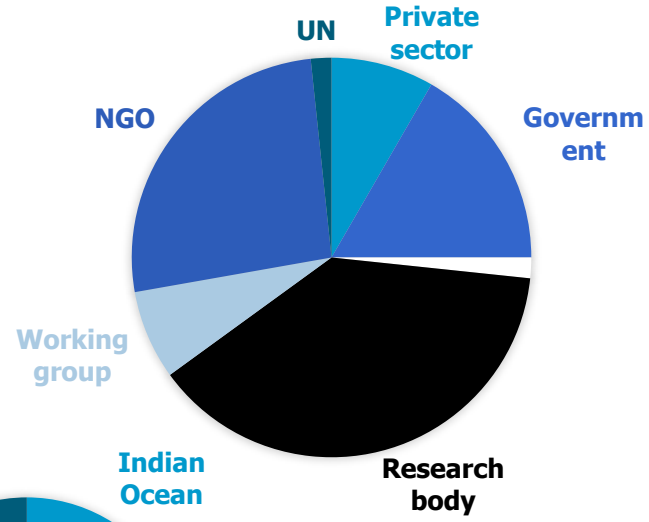
- Uses the 2030 Agenda as a central framework to identify and address the most pressing societal questions;
- Spans across disciplines and actively integrates natural and social science disciplines;
- Embraces local and indigenous knowledge as a key knowledge system;
- Communicates in forms that is widely understood across society and triggers behavior change
- Is shared openly and available for re-use
- Strives for generational, gender and geographic diversity and inclusion in all its manifestations.
- Is co-designed and co-delivered in a multi-stakeholder environment to be relevant and responsive across the entire value chain;

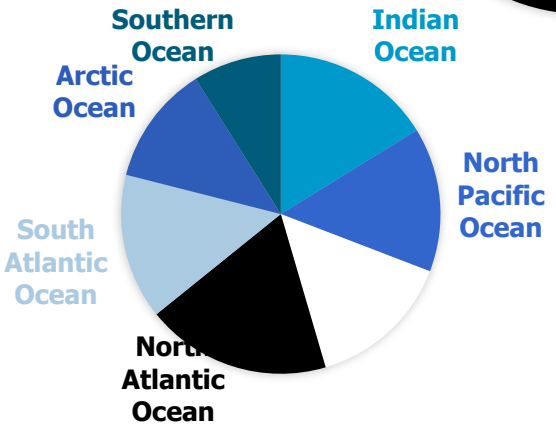
Overview of Submissions Received

214 program submissions and 27 contribution submissions:

- Very robust and detailed submissions - high understanding of, and alignment with, Decade priorities
- Diversity of proponents, geographies and themes
- Wide diversity in scale of initiatives being proposed







Programmes and Clusters

‘Stand-alone’ programmes:

- are led by a group of partners that have defined and submitted the programme for endorsement together
- clear leadership and coordination structure in place from the outset, although they are necessarily open to new partners both at the programmatic level, and via projects
- cannot be in a cluster at this stage because they are the only programme submitted for a particular theme – may cluster at a later stage!

‘Clusters’ of programmes:

- made up of several standalone programmes submitted independently by different partners but which have strong thematic or geographic synergies
- clustering of these programmes and creation of operational and collaborative links between them will lead to a greater collective impact
- each of these programmes has its own leadership and coordination structure, but an additional light layer of communication and coordination will be needed with other programmes in the cluster

Both of these types of programmes will be comprised of, and will coordinate, numerous projects. Some programmes have already identified some of their associated projects, however the majority of projects will emerge throughout the course of the Decade via Calls for Decade Actions at the project level.

UN Ocean Decade: Endorsed Programs (28 total)

https://www.oceandecade.org/resource/166/Announcement-of-the-results-of-the-first-endorsed-Decade-Actions-following-Call-for-Decade-Actions-No-012020

- Programmes:

- **Blue Climate Initiative - Solutions for People, Ocean, Planet** Lead: Blue Climate Initiative (sponsor:Tetiaroa Society)
- **CoastPredict - Observing and Predicting the Global Coastal Ocean** Lead: Alma Mater Studiorum, University of Bologna
- **Deltas associated with large rivers: Seeking solutions to the problem of sustainability** Lead: The State Key Laboratory of Estuarine and Coastal Research (SKLEC), East China Normal University
- **Digital Twins of the Ocean – DITTO** Lead: GEOMAR Helmholtz Center for Ocean Research Kiel and Kiel University
- **ForeSea - The Ocean Prediction Capacity of the Future** Lead: OceanPredict
- **Global Ecosystem for Ocean Solutions (GEOS)** Lead: Ocean Visions, Future Seas
- **Global Estuaries Monitoring (GEM) Programme** Lead: State Key Laboratory of Marine Pollution, City Univ. of Hong Kong
- **Marine Life 2030: A Global Integrated Marine Biodiversity Information Management and Forecasting System for Sustainable Development and Conservation** Lead: Smithsonian Institution
- **Ocean Biomolecular Observing Network (OBON)** Lead: The Partnership for Observation of the Global Ocean (POGO)
- **Ocean Cities, an international network of cities in harmony with the marine environment** Lead: Mediterranean Center for Marine and Environmental Research (CMIMA-CSIC), Institut de Ciències del Mar (ICM-CSIC), Unitat de Tecnologia Marina (UTM-CSIC)

UN Ocean Decade: Endorsed Actions (6 total)

Decade Actions of United Nations Entities

- **Ocean Observing Co-Design: evolving ocean observing for a sustainable future**

  Lead: The Global Ocean Observing System (GOOS) through lead sponsor of the Intergovernmental Oceanographic Commission of UNESCO

- **Observing Together: Meeting Stakeholder Needs and Making Every Observation Count**

  Lead: The Global Ocean Observing System (GOOS) through lead sponsor of the Intergovernmental Oceanographic Commission of UNESCO

- **Ocean Practices for the Decade**

  Lead: International Oceanographic Data and Information Exchange (IODE) & the Global Ocean Observing System (GOOS) of UNESCO

FUNDING: UN/IOC does not provide a direct funding mechanism.
However, endorsement is expected to be a strong driver for funding from government, agencies, foundations,…through already identified **Contributions** and continuous actions of collaborations/leveraging and fundraising.

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UN Ocean Decade: Contributions (31 total)

- **AGU: Mentoring365: UN Decade of Ocean Science** (AGU)
- **A Transformative Decade for the Global Ocean Acidification Observing System** (NOAA)
- **Bertarelli Foundation Marine Science Programme (Bertarelli Foundation)**
- **Committee on Earth Observation Satellites - Coastal Observations, Applications, Services, and Tools (CEOS COAST)** – NOAA
- **Flourishing Oceans - Plastics and Human Health (**The Minderoo Foundation)
- **France's Priority Research Program "Ocean of solutions"** (IFREMER, CNRS)
- **GEOTRACES** (US NSF)
- **Integrating Coastal Wetlands Data into Greenhouse Gas (GHG) Inventories for Developing Countries: A New International Blue Carbon Initiative** (US Dept of State and NOAA)
- **NASA Sea Level Change Science Team** (NASA)
- **NSF Coastlines and People** (US NSF)
- **Reef Recovery 2030 (**Great Barrier Reef Foundation)

Introduction to meeting – "live" discussion (~5')

- (Pierre) Decade funding – endorsement – how?
- (Vinay) Requests for proposals? Look for direct funding.
- (Fraser) Need for secretarial support?

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Introduction of UN programmes: CoastPredict

(including what the programme expects from the COSS-TT)

Villy 15’ + 5’

CoastPredict

Observing and Predicting the Global Coastal Ocean

A PROGRAMME under the UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

https://www.coastspredict.org/

Revolutionising Global Coastal Ocean observing and forecasting, co-designing the needed infrastructure and offering open and free access to coastal information

CoastPredict

Observing and Predicting the Global Coastal Ocean

Lead Contacts: **Nadia Pinardi** nadia.pinardi@unibo.it
Villy Kourafalou vkourafalou@miami.edu
Joaquin Tintore jtintore@socib.es

Theme: A predicted global coastal ocean where society understands and can respond to changing ocean conditions

Synergistic Partners: **GOOS, OceanPredict/ForeSea, Ocean Visions/GEOS, Ocean Practices/IODE, CEOS/COAST/BluePlanet,...**

CoastPredict has evolved over many months of consultations

The initial steering Group

Nadia Pinardi – UNIBO (IT)	Burkard Baschek – HZG (DE)
Holger Brix – HZG (DE)	Kim Cobb – GaTech (USA)
Giovanni Coppini – CMCC (IT)	Pierre De Mey – LEGOS (FR)
Emanuele Di Lorenzo – GaTech (USA)	Villy Kourafalou – Univ. of Miami (USA)
Rosalia Santoleri – CNR-ISMAR (IT)	Joaquin Tintore – SOCIB&IMEDEA (ES)

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The basic concept of a Global Coastal Ocean has been defined about a decade ago in five Volumes of The Sea
(Vol. 10 to 14, Harvard Univ. Press)

TRANSFORMATIVE: Coastpredict will re-define the "coastal ocean"

PROPOSED STARTING DEFINITION:

*the coastal ocean - that area, extending **inshore** from the estuarine mouths to river catchments affected by saltwater, to the urban settlements on the one side and on the other side to the **offshore**, from the surf zone to the continental shelf and slope where waters of continental origins meet open ocean currents.*

CoastPredict High Level Objectives

1) A predicted global coastal ocean;

2) The upgrade to a fit-for-purpose oceanographic information infrastructure;

3) Co-design and implementation of an integrated coastal ocean observing and forecasting system adhering to best practices and standards, designed as a global framework and implemented locally.

CoastPredict Main Decade OUTCOMES

1. Integrated knowledge of the **global coastal ocean from events to climate** (*advancing Knowledge*);
2. The design and implementation of an **integrated river/estuarine/coastal/open ocean observing and modelling multidisciplinary** system (*integrated observing and predicting*);
3. **Improved coastal marine forecasting and extended range predictive capabilities for the coastal zone** (*accurate predictions from hours to centuries ahead*);
4. **The development of methods for trusted data/information exchange and interoperability** across the value chain and adopt these as best practices (*open and free access to coastal information*);
5. **Innovative and sustainable applications for coastal solutions/services** that directly benefit local populations, including well-being and human health (*solutions*);
6. **Increased equitable education and capacity** for observing and forecasting in the global coastal ocean (*capacity building*).

CoastPredict co-design with UN programs: GOOS

The Global Ocean Observing System

Observing Together

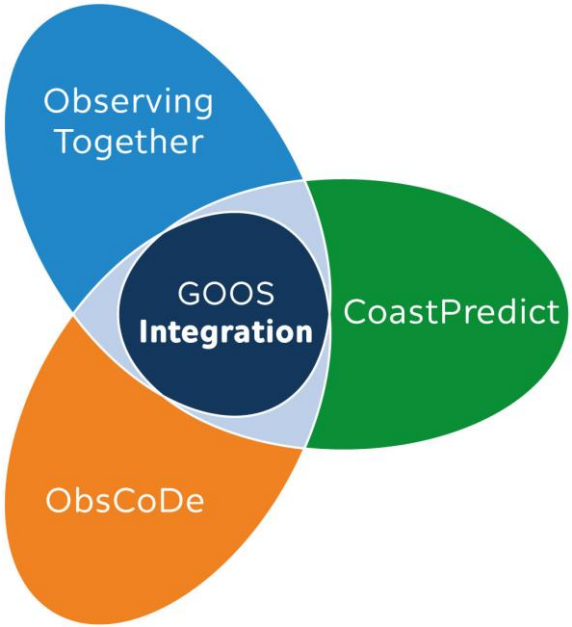
Transforming ocean data access and availability by connecting ocean observers and the communities they serve through enhanced support to both new and existing community-scale projects.

observing_together@goosocean.org

Ocean Observing Co-design

Building the process, infrastructure and tools for co-design, creating an international capacity to evolve a truly integrated ocean observing system, matching agile observing and modelling capability with requirements.

oceanobs_co-design@goosocean.org



CoastPredict

Redefining the concept of the global coastal ocean, transforming the science of observing and predicting the coast.

leads: Nadia Pinardi, Villy Kourafalou, Joaquín Tintoré

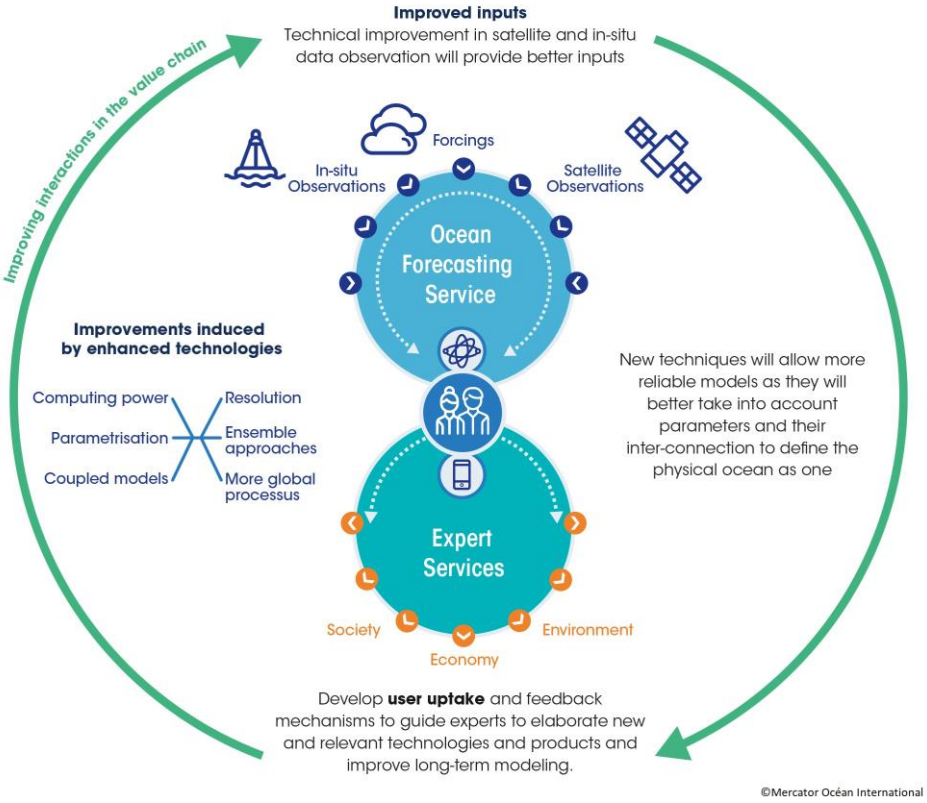
coastpredict.org

CoastPredict international affiliations: ETOOFS

ETOOFS: Expert Team on Operational Ocean Forecasting

Ocean Forecasting Value Chain

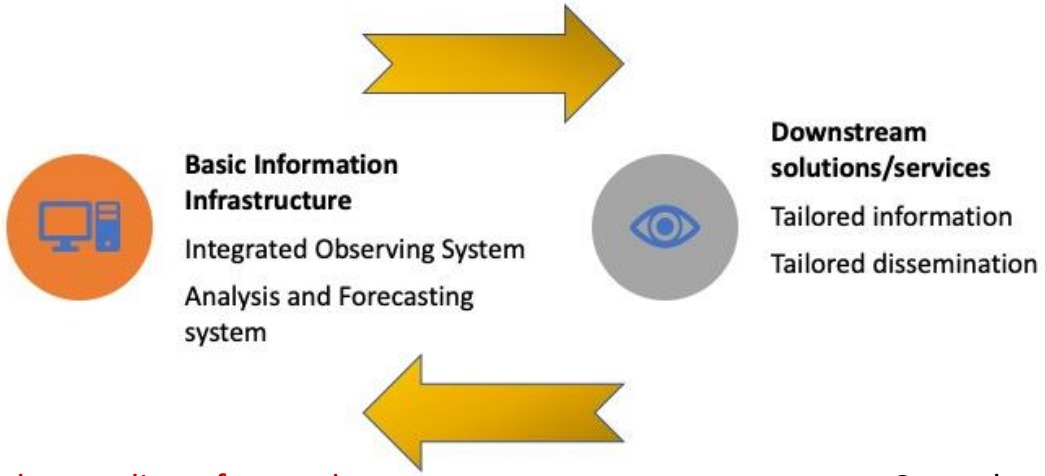
The core mission of the ocean monitoring and forecasting system consists of integrating the richness and variety of ocean observations to **build a state-of-the-art digital description of the ocean environment**, which is multivariable, consistent in space and time, reliable and immediately actionable by expert services.



What is the transformative science in Coastpredict?

- **Re-defining the concept of the Global Coastal Ocean**
- **innovative multidisciplinary observational technologies and fit for purpose observing system in the Global Coastal Ocean,**
- **innovative numerical modelling, data assimilation and data science tools** (including Coastal Earth System Modelling);
- **coastal solutions/services**
- **a virtual information/digital infrastructure**
- a new **Global Coastal Ocean Network**

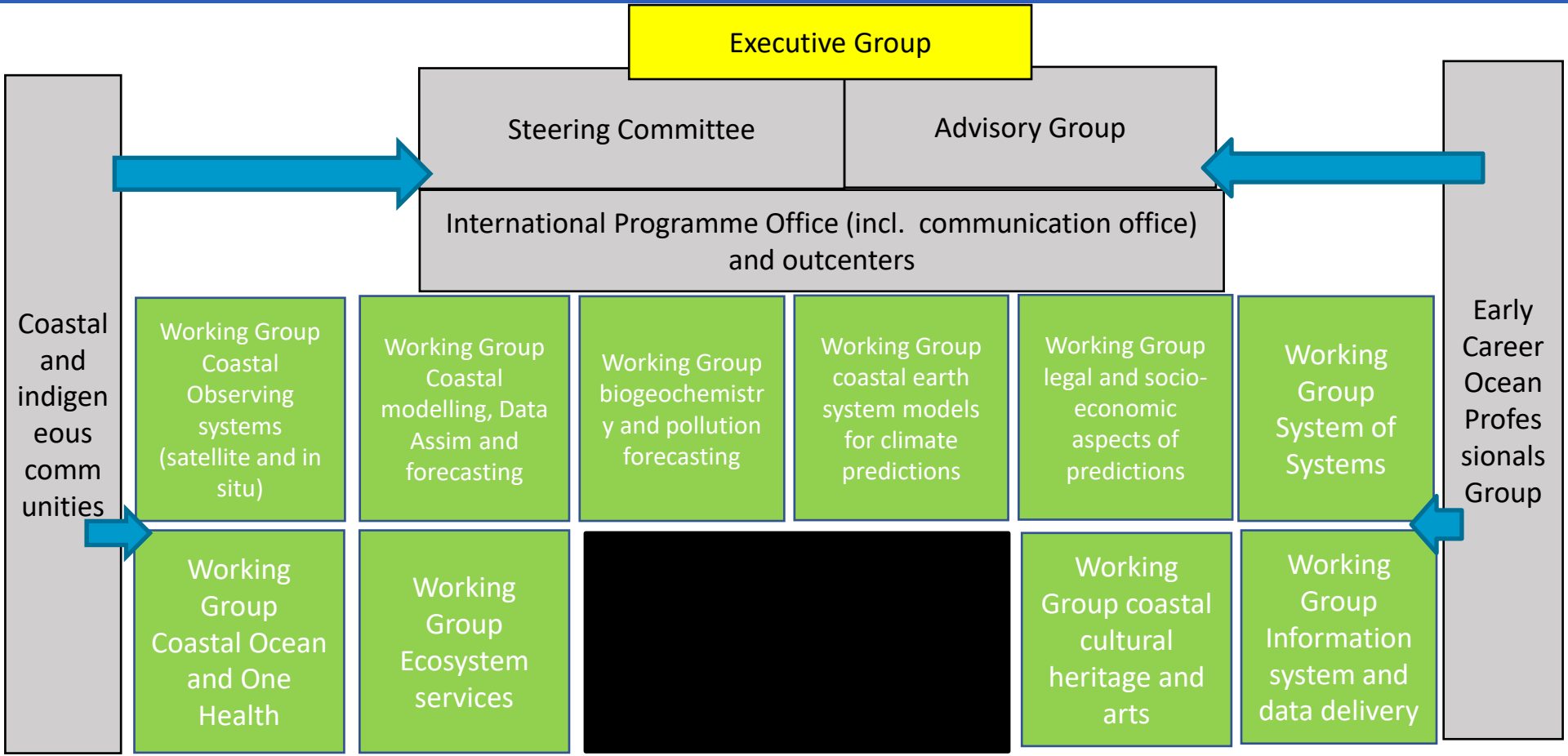
Simplified value chain - Coastpredict main contribution



- 1. Scientific understanding of coastal processes giving rise to Research-to-Operation-to-Research developments
- 2. Integrated open-coastal observing
- 3. Improved (accuracy and time lead)
- and impact-based coastal forecasts
- 4. Best Practices for the Coastal areas

- Coastal areas solutions for Disaster Risk Reduction
- Solutions for Climate change mitigation and adaptation
- Capacity Building

Coastpredict Programme Governance and working structure



Ocean Sciences 2022 (27 Feb-4 March, Honolulu)

OSM Session: Observing and Predicting the Global Coastal Ocean

Co-chairs: Emma Heslop IOC/UNESCO - GOOS, Brandy Armstrong, IEEE, Paul di Giacomo NOAA, CEOS, João De Souza, Metocean.

Abstract authors additional: Nadia Pinardi, University of Bologna, Joaquín Tintoré, SOCIB, Villy Kourafalou, University of Miami, Jay Pearlman, IEEE.

Cross listed tracks from list:
Climate and Ocean Change
Coastal and Estuarine Biology and Biogeochemistry
Ocean Modeling
Ocean Technologies and Observatories

CoastPredict – “live” discussion (~5’)

- (Mauro) Are projects endorsed for the whole decade?
- (Paolo) Wo do we talk to? CP, COSS-TT?
- (Lu) (couldn’t take)
- (Fraser) (chat) I like the working group layout under coastpredict. Will some of these link to WG (or be joint) with other Decade Programms (ie DITTO <-> CoastPredict WG on data access...)?
- (Pierre) (chat) It is essential that the COSS-TT is recognized as a very essential partner of CoastPredict for information passing, decision and participation to steering

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Introduction of UN programmes: ForeSea

(including what the programme expects from the COSS-TT)

Eric Chassignet (COAPS-FSU, USA), OP Co-chair 10’ + 5’

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ForeSea – an OceanPredict contribution to the UN Decade

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.

ForeSea – "live" discussion (~5')

- (Jason) Overlap with CoastPredict?
- (Lu) to Eric: what spatial scale in ForSea? coastal or largerr scale?
- (Kirsten) Project assignment? Cross-programme? Villy: no.
- (Byoung-Ju Choi) Are there any other projects in ForeSea programme for now? Not yet → OPST-4. Link w/TTs.
- (Fraser) One common element between ForeSea and CoastPredict will be frameworks needed to solidify the OO value chain in both coastal and basin/global settings. (Pierre) @Fraser We have a slide along these lines in the day 3 discussions (how we all fit within a larger value chain). But Yosuke's slide is very nice!

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

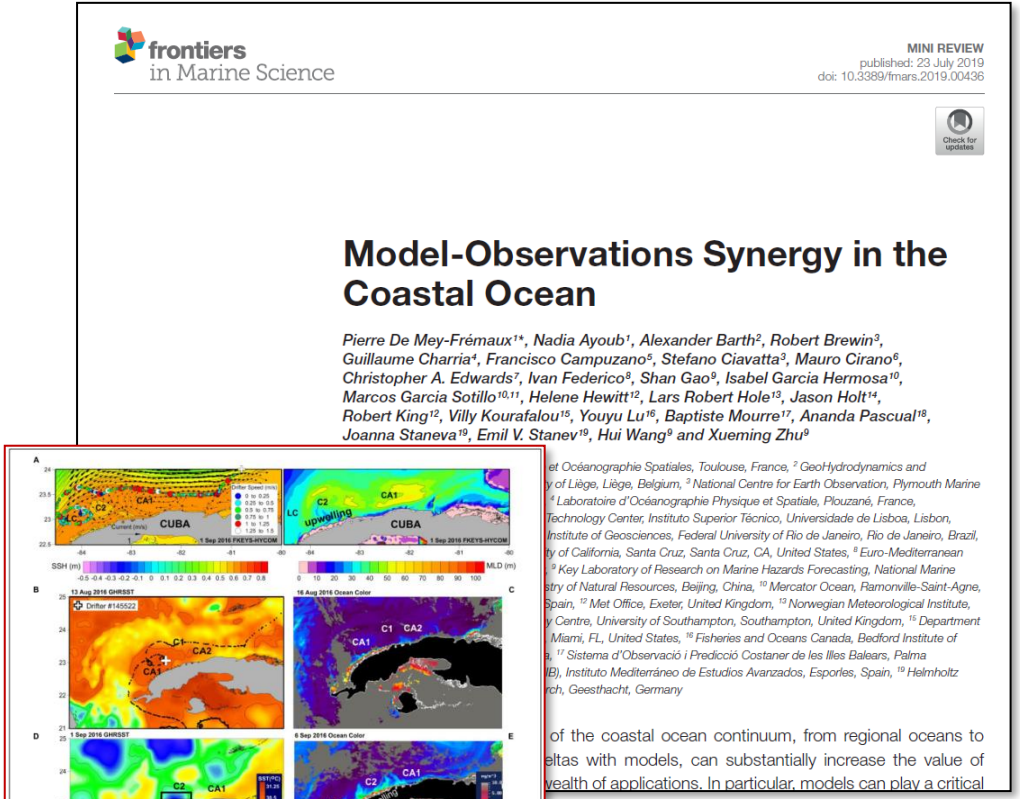
Topic 1

Observing infrastructure in the coastal seas, integration with models and with forecasting

Chair: Pierre 50’ incl. 15’ discussion

De Mey-Frémaux et al. OceanObs19 paper

- Using observations to guide coastal model development and assessment
- Using models to connect and interpret sparse coastal observations >>>
- Using coastal models to synthesize observations (DA, ML)
- Using models to design and optimize coastal observing systems (OSSEs, array design)
- Need to incorporate citizen science-based information



frontiers in Marine Science

MINI REVIEW
published: 23 July 2019
doi: 10.3389/fmars.2019.00436

Model-Observations Synergy in the Coastal Ocean

Pierre De Mey-Frémaux[1], Nadia Ayoub[1], Alexander Barth[2], Robert Brewin[3], Guillaume Charria[4], Francisco Campuzano[5], Stefano Ciavatta[3], Mauro Cirano[6], Christopher A. Edwards[7], Ivan Federico[8], Shan Gao[9], Isabel Garcia Hermosa[10], Marcos Garcia Sotillo[10,11], Helene Hewitt[12], Lars Robert Hole[13], Jason Holt[14], Robert King[12], Villy Kourafalou[15], Youyu Lu[16], Baptiste Mourre[17], Ananda Pascual[18], Joanna Staneva[19], Emil V. Stanev[19], Hui Wang[9] and Xueming Zhu[9]*

et Océanographie Spatiales, Toulouse, France, [2] GeoHydrodynamics and y of Liège, Liège, Belgium, [3] National Centre for Earth Observation, Plymouth Marine [4] Laboratoire d'Océanographie Physique et Spatiale, Plouzané, France, Technology Center, Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Institute of Geosciences, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil, ty of California, Santa Cruz, Santa Cruz, CA, United States, [8] Euro-Mediterranean [9] Key Laboratory of Research on Marine Hazards Forecasting, National Marine stry of Natural Resources, Beijing, China, [10] Mercator Ocean, Ramonville-Saint-Agne, Spain, [12] Met Office, Exeter, United Kingdom, [13] Norwegian Meteorological Institute, y Centre, University of Southampton, Southampton, United Kingdom, [15] Department Miami, FL, United States, [16] Fisheries and Oceans Canada, Bedford Institute of [17] Sistema d'Observació i Predicció Costaner de les Illes Balears, Palma IB), Instituto Mediterráneo de Estudios Avanzados, Esporles, Spain, [19] Helmholtz rch, Geesthacht, Germany

of the coastal ocean continuum, from regional oceans to eltas with models, can substantially increase the value of wealth of applications. In particular, models can play a critical

Florida Keys and Cuba
After Kourafalou et al. (2017)

Ponte et al. OceanObs19 coastal sea-level paper

- Useful for both Topics 1 and 4
- Recommendations for coastal sea-level observing and modeling systems:
  - Observational needs (mostly tide gauges/GNSS stations)
  - Modeling needs (mostly at climatic time scales, e.g. CMIP)
  - Developing future coastal sea-level services

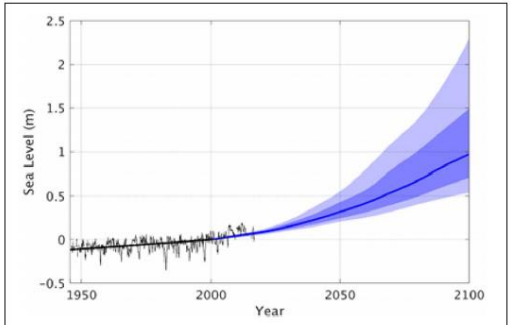


FIGURE 9 | Tide gauge observations (black lines) combined with sea level projections (blue) with RCP 8.5 scenarios at Kwajalein, Marshall Islands (Jackson and Jevrejeva, 2016). The thin black line is monthly tide gauge record, the thick black line is long-term linear trend; the thick blue line is sea level projection at 50% probability, and the dark and light blue shading areas represent 17–83 and 5–95% probabilities, respectively.

frontiers in Marine Science

REVIEW
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doi: 10.3389/fmars.2019.00437

Towards Comprehensive Observing and Modeling Systems for Monitoring and Predicting Regional to Coastal Sea Level

OPEN ACCESS

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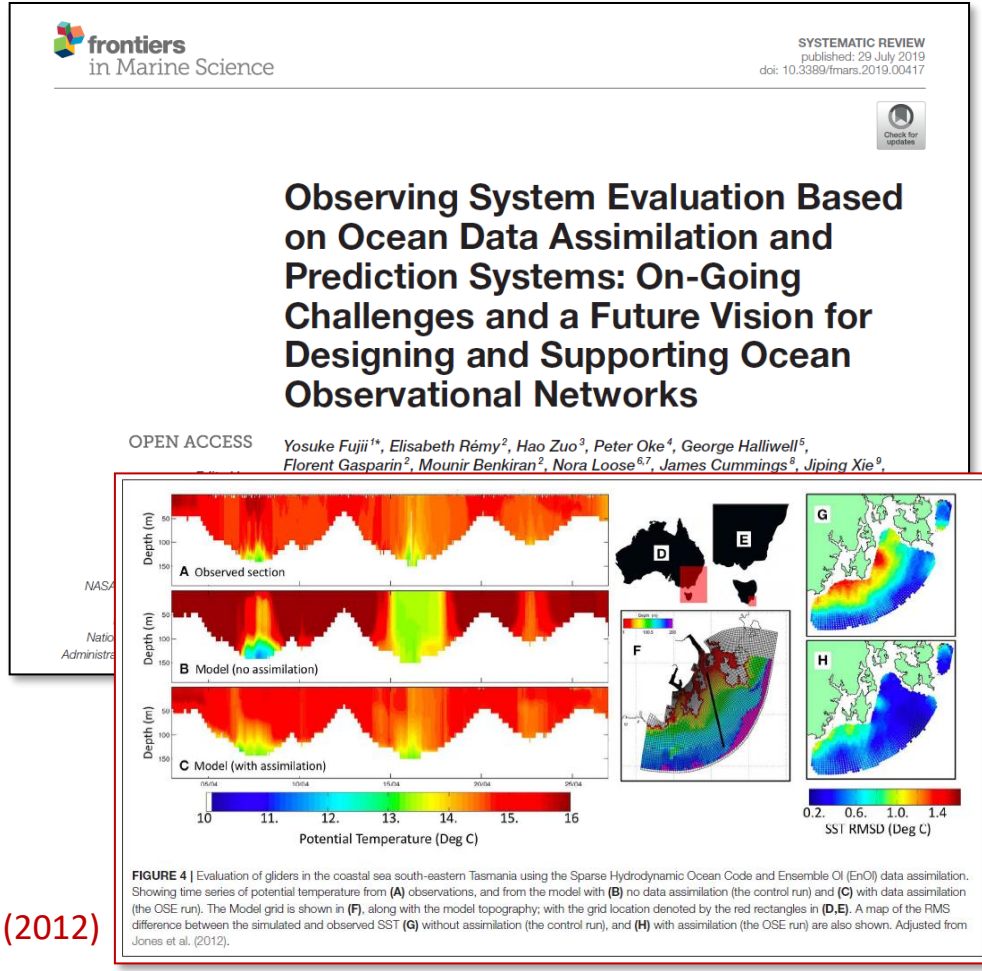
Tide gauges combined with coastal sea-level projections
After Jackson and Jevrejeva (2016)

Fujii et al. OceanObs19 observing system evaluation paper

- Y. Fujii is OSEval-TT co-chair with E. Rémy
- V. Kourafalou is OSEval-TT member
- Large-scale, but not only >>>
- Many ideas also in SynObs Decade project, to be presented next
- Among the paper conclusions:

  *"We should continue the efforts toward new frontiers of the ODAP systems, such as **coastal regions**, the deep ocean, polar regions, coupled data assimilation, and BGC applications, and to contribute the observing systems that underpin those frontiers."*



frontiers in Marine Science

SYSTEMATIC REVIEW
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Observing System Evaluation Based on Ocean Data Assimilation and Prediction Systems: On-Going Challenges and a Future Vision for Designing and Supporting Ocean Observational Networks

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Yosuke Fujii[1*], Elisabeth Rémy[2], Hao Zuo[3], Peter Oke[4], George Halliwell[5], Florent Gasparin[2], Mounir Benkiran[2], Nora Loose[6,7], James Cummings[8], Jiping Xie[9],

FIGURE 4 | Evaluation of gliders in the coastal sea south-eastern Tasmania using the Sparse Hydrodynamic Ocean Code and Ensemble OI (EnOI) data assimilation. Showing time series of potential temperature from **(A)** observations, and from the model with **(B)** no data assimilation (the control run) and **(C)** with data assimilation (the OSE run). The Model grid is shown in **(F)**, along with the model topography; with the grid location denoted by the red rectangles in **(D,E)**. A map of the RMS difference between the simulated and observed SST **(G)** without assimilation (the control run), and **(H)** with assimilation (the OSE run) are also shown. Adjusted from Jones et al. (2012).

Tasmania gliders, after Jones et al. (2012)

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 1

Introduction of relevant projects within CoastPredict:

Project 1: Synergistic Observing Network for Impactful and Relevant Ocean Predictions (SynObs)

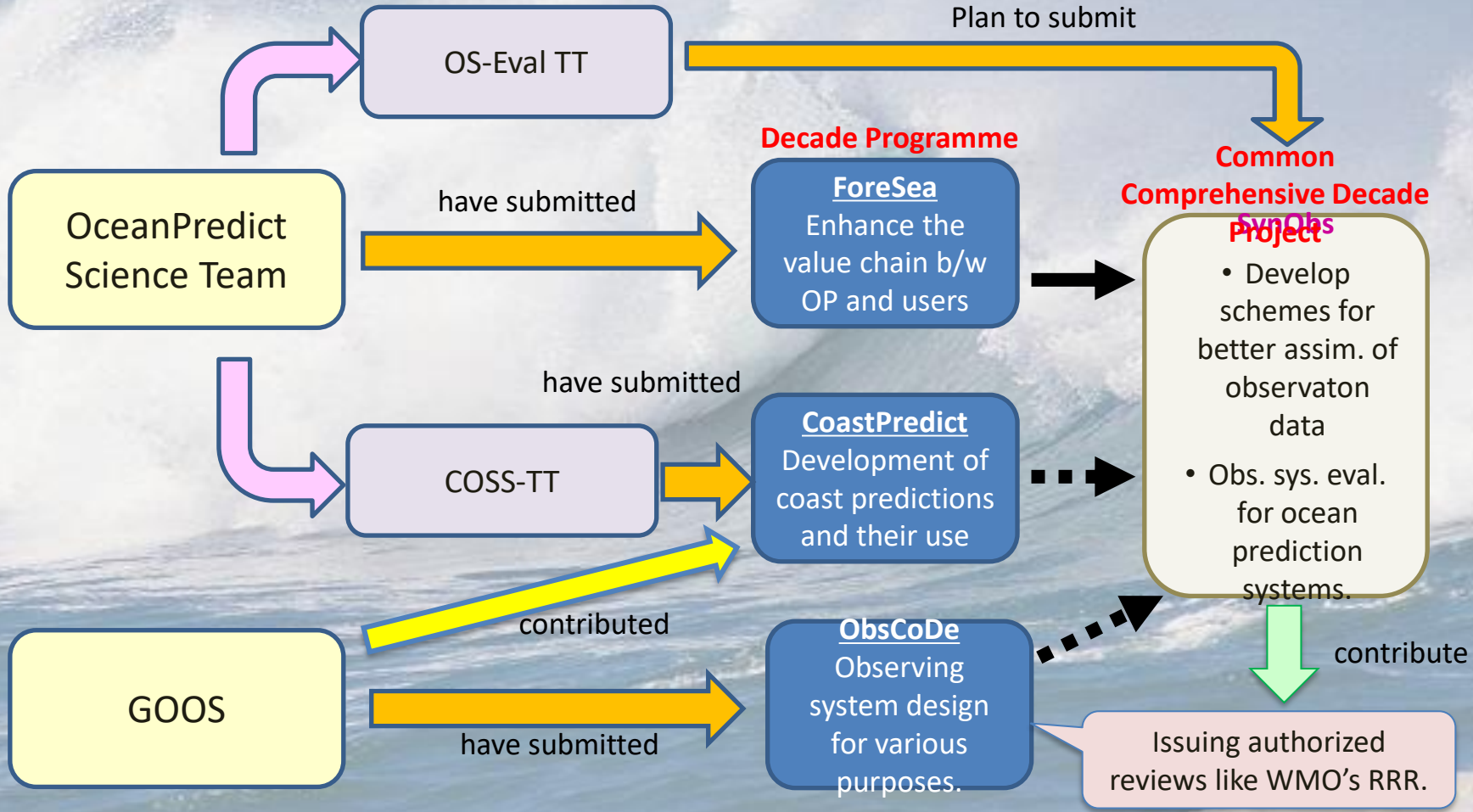
Yosuke Fujii (MRI, Japan), OSEval-TT co-chair 10’ + 5’

COSS-TT Meeting, June 9th, 2021, Online

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

Yosuke Fujii (JMA/MRI, Co-chair of OceanPredict OS-Eval TT)
Elisabeth Rémy (MOI, Co-chair of OceanPredict OS-Eval TT)

★ OceanPredict contributions to the UN Decade of Ocean Science



☆ Decade Project to be submitted by the OS-Eval TT

- **Title**

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

- **Objective**

  SynObs will seek the way to extract the maximum benefit from the combination among various observation platforms, typically between satellite and in situ observation data, or between coastal and open ocean platforms, in ocean (and earth system) predictions.

- **Strategy**

  SynObs aim to identify the optimal combination of different ocean observation platforms through observing system design/evaluation, and develop assimilation methods with which we can draw synergistic effects from the combination.

- **Scope**

  Targets of SynObs include open-ocean, coastal, and biogeochemical (BGC) observing systems (collaboration with DA-TT, COSS-TT, and MEAP-TT）

★ Targeted Combination of Observing Systems

1. Satellite altimeters (including conventional and wide-swath altimeters), satellite ocean current observations (SKIM) and Argo floats
2. Satellite radiometers (for SST observations), near surface in situ observations (from Mooring buoys and Argo floats, etc.), and sea surface atmospheric parameters
3. Satellite Sea Surface Salinity (SSS) observations and near surface in situ observations
4. Satellite ocean colour observations and in-situ (Argo) observations
5. Observations of sea ice concentrations and sea ice thickness
6. Coastal ocean radars and sensors, gliders, drones, satellite remote sensing, and Argo floats

★ Expected Activity in SynObs

1. Multi-system evaluation, including Multi-System OSE, OSSE, and evaluation using various diagnostic based on ensemble statistics or adjoint models.
2. Development of data assimilation schemes for synergy
   - ✓ Assimilating low-level processed satellite data (direct assimilation)
   - ✓ incorporate background error covariance between atmospheric and oceanic elements.
3. Collocated satellite-in situ observation campaigns (e.g., Argo and InfraRed satellite)
4. Development of best-practices for evaluating the performance of ocean observing networks composed of various observing platforms
5. Construction of a real-time ocean observation impact monitoring framework
6. Publishing the Observation Impact Annual Report ⇒ Contribute to ObsCode

★ Scientific Outcomes

1. Synergistic ocean observing network.
2. Advance of data assimilation capacity for extracting the synergy
3. Improved ocean and earth system predictions
4. Several useful tools for managing the ocean observing systems
   - ✓ Justification to sustain in situ ocean observation networks and satellite missions
   - ✓ Guideline for the future evolution of in situ and satellite observation networks
5. Systematic mechanism to make a feedback on the observation data impacts from ocean prediction centers to observational communities
6. Understanding on which ocean phenomena are observable by different observations and which are controllable via data assimilation
7. Capacity building to train a continuing generation of scientists from developing and developed nations that will continue observing system monitoring and design

★ How can we collaborate for coastal predictions in SynObs?

1. Make a big voice to appeal necessity of the development and maintenance of coastal observing systems as a part of the global ocean observing network

   ✓ Showcase of costal observation impacts

   ✓ Collaboration for multi-system evaluation of widely-used observation platforms, such as, ocean gliders, HF radars, etc.

   ✓ Appeal importance of coastal observations to international communities under the collaboration in OceanPredict family.

   ⇒ Contribute to the authorized observation requirement report by ObsCode

★ How can we collaborate for coastal predictions in SynObs? (continue)

2. Exploit open-ocean and BGC observing systems effectively

- ✓ Open-ocean platforms, such as satellite altimeters and Argo floats, can also contribute to coastal predictions. BGC observations are also essential for predictions of coastal marine ecosystems.
- ✓ Develop DA methods to get synergy from those observations in coastal predictions
- ✓ Reflect the requirements for coastal predictions on the designs of open-ocean and BGC observing systems.

◆ The collaboration also brings benefits to open-ocean communities

- Coastal observations can have impacts on open ocean.
- High-frequency phenome related to tides and sea level pressure forcing is already treated in a DA framework in costal systems. Those knowledge can be used for further development of global systems.

★ How can we collaborate for coastal predictions in SynObs? (continue)

3. Establish a best practice strategy of observing system evaluation for costal seas

- ✓ Exchange the knowledge on observing system evaluation methodologies among coastal and open-ocean communities, and find feasible and practical ways for various ocean prediction systems
- ✓ Make it possible to conduct fair and reliable evaluation promptly to support developments of coastal observing systems
- ✓ Make it easy to train new scientists who can conduct the evaluation.

Symposium toward Synergistic Observation Networks for Ocean and Earth System Predictions

~~*10-13 Nov, 2020*~~, *Tsukuba Japan*

30 Nov – 3 Dec, 2021

- Held as the regular face-to-face meeting of OS-Eval Task Team, but jointed with the coupled prediction task team.
- Open for all researchers who are interested in evaluation and effective use of ocean observations in ocean and earth system predictions.
- Also, having a role as the kick-off meeting of SynObs.
- Having a presentation about the evaluation/design of ocean observation networks, DA development for effective use of observations, and earth system predictions.
- It can be postponed again if the pandemic is not enough suppressed.


Thank you

Fujii – "live" discussion (~5')

- (Pierre-Yves) (1) Cost (2) Up to end user?
- (Fraser) Complimenting @Pierre-Yves comment on end user impact evaluation of the observing system vis a vis Synobs: Yosuke mentions in his slide about feeding in to a WMO type RR activity which would address in part this end user impact eval. What will be required though for this RR (Rolling Review activity) is getting the full value chain framework for Operational Oceanography in place to enable these observation end user impact evaluations in an effective manner. (Yosuke) Thank you, Fraser. I agree that SynObs will contribute to enhance the value chain b/w observations and users and the enhancement is necessary for effective evaluation which contribute to observational community,

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 1

Introduction of relevant projects within CoastPredict:

Project 2: Brazilian Coast Monitoring System (SiMCosta)

Project 3: NOAA AX97 High Density XBT Line

Mauro Cirano (UFRJ, Brazil), COSS-TT member 8’ + 2’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 1

Introduction of relevant projects within CoastPredict:

Project 4: A European Integrated Coastal Ocean Observing and Predicting System – E-ICOOPS

Guillaume Charria (Ifremer, France), COSS-TT member 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 1

Introduction of relevant projects within CoastPredict:

Project 5: Advancing global coastal observing and prediction systems

Rafael Schiller (FUGRO, USA), invited 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 1

Next generation of satellite technologies for coastal observation

Fabien Lefebvre (CLS Group), invited 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 1: Observing infrastructure in the coastal seas, integration with models and with forecasting

Discussion on strategic goals for the TT within this Topic, and on possible modes of TT support to Decade projects in CoastPredict and ForeSea

(Also take questions/comments on chat)

Chair: Pierre 15’

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Topic 1: Areas where we (TT) should set strategic objectives

Observing infrastructure in the coastal seas, integration with models and with forecasting

- Advance and promote good COF practices within an integrated downscaling/modelling/observation framework, including:
  - Participation in ET-OOFS guide
  - Definition of suitable coastal *in situ* observing systems (OSE/OSSEs with OSEval-TT & SynObs?)
    - Combinations of coastal observations?
  - Good practices for using future altimetry data in coastal regions (with SWOTST?)
    - Any experimental products that the COSS-TT could review?
- Follow and monitor relevant Decade projects at TT meetings
- Role of ML/DL & obviously DA approaches for sparsely observed coastal regions
- Possible contributions to SynObs
  - Showcase coastal observational impact (could do in some COSS-TT systems)
  - Establish best practice coastal obs strategy (see above)
  - ? (check w/Yosuke)

Topic 1 “live” discussion (15’)

- Add points here

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

COSS-TT strategy meeting
Main theme: the COSS-TT in the UN Ocean Decade

DAY 2

9-11 June 2021, virtual (MS Teams)

Revisiting TT Strategic Objectives for the Decade yrs

Envisaged process: (open for discussion)

1. **Your contribution needed at this meeting:**
   - Assess new environment of COSS-TT and CoastPredict: Decade, relevant programmes, projects, experts, GOOS, etc.
   - Review important topics for TT and areas where we should set strategic objectives
   - Prioritize and participate in discussions (day 3, if format allows)
2. **OPST-4** later in June: OceanPredict-wide equivalent of 1., harmonize w/other TTs
3. **Later this year:**
   - Ensure representation of TT in decision-making circles in Decade programmes
   - Help make projects more concrete
   - Elaborate Strategy Note for TT, with priorities set
4. **At the next general COSS-TT meeting** (Montréal, April 2022)
   - Discuss/endorse
   - Adjust TT membership as needed

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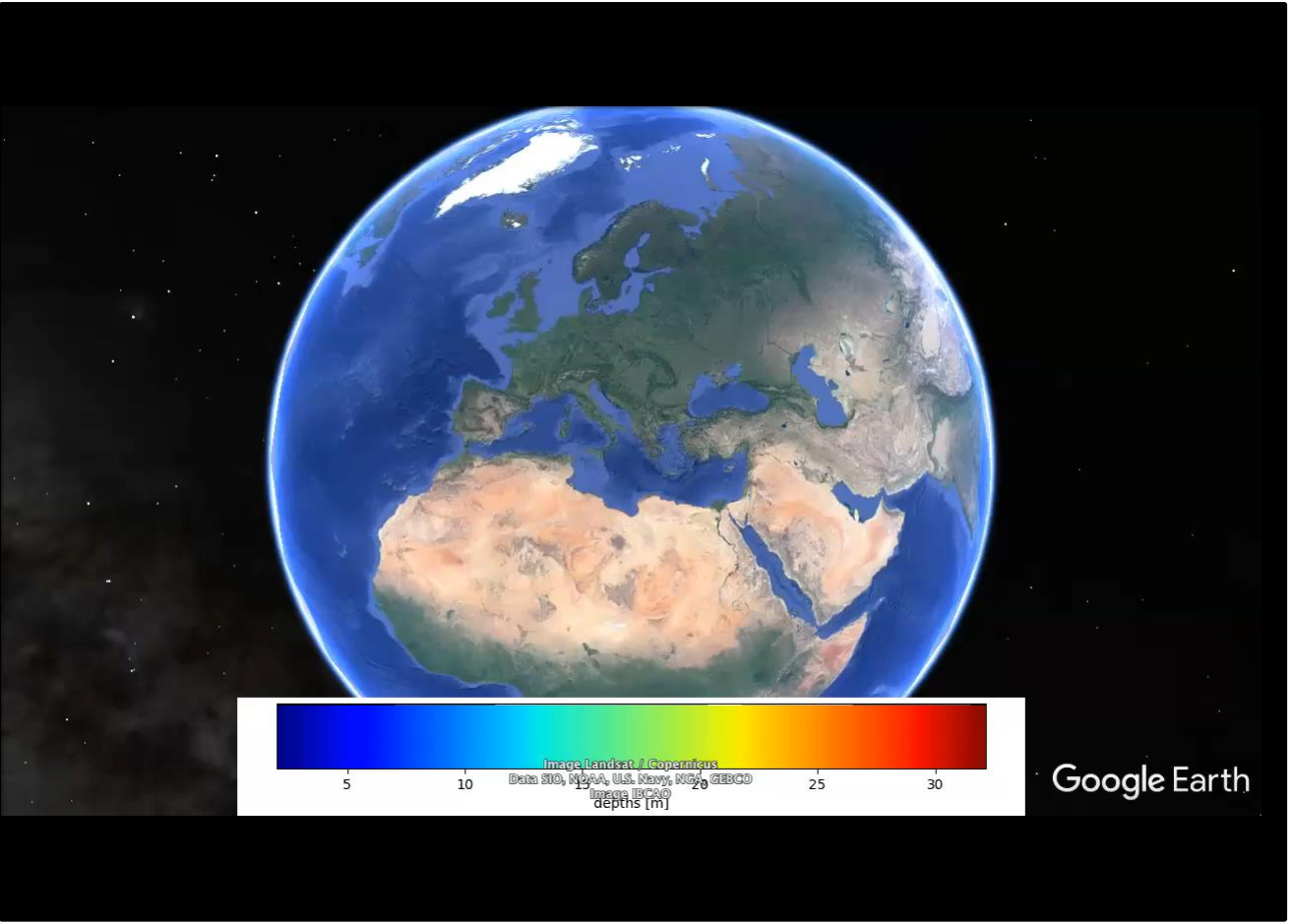
Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 2

Integration of coastal ocean and estuaries/inland waters/coastal cities

Chair: Villy 35’ incl. 15’ discussion

Topic 2: Introduction



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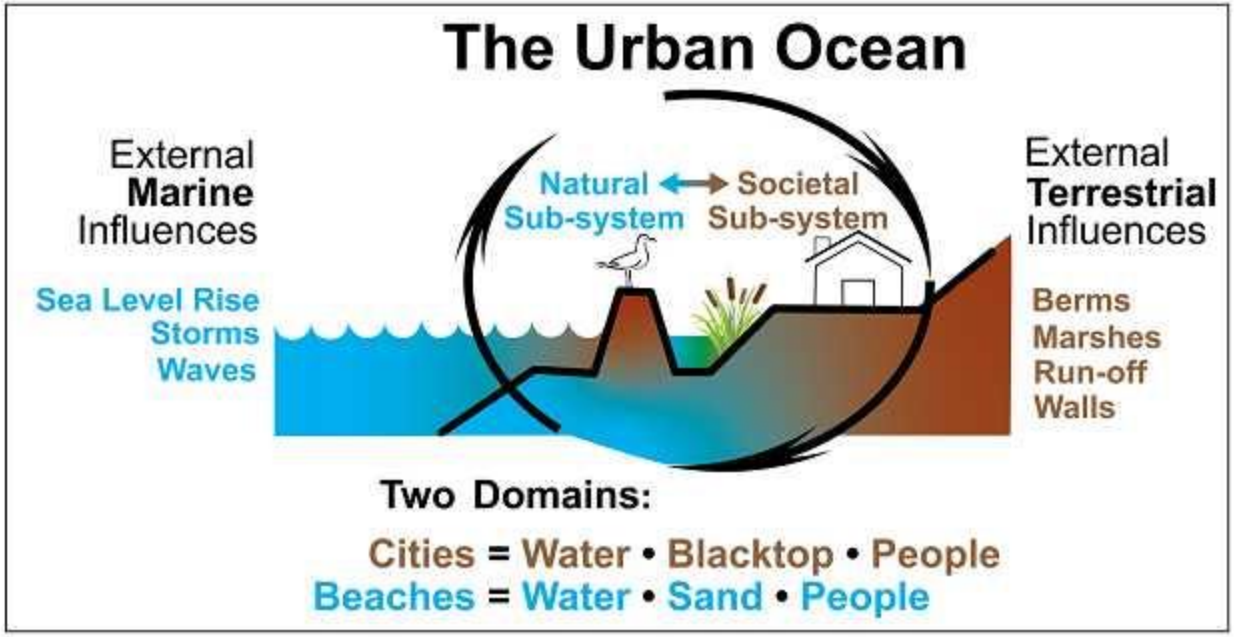
Emanuele **DiLorenzo**
Ivan **Federico**
Nadia **Pinardi**

Georgia Tech

cmcc
Centro Euro-Mediterraneo sui Cambiamenti Climatici

Alma Mater Studiorum Università di Bologna A.D. 1088

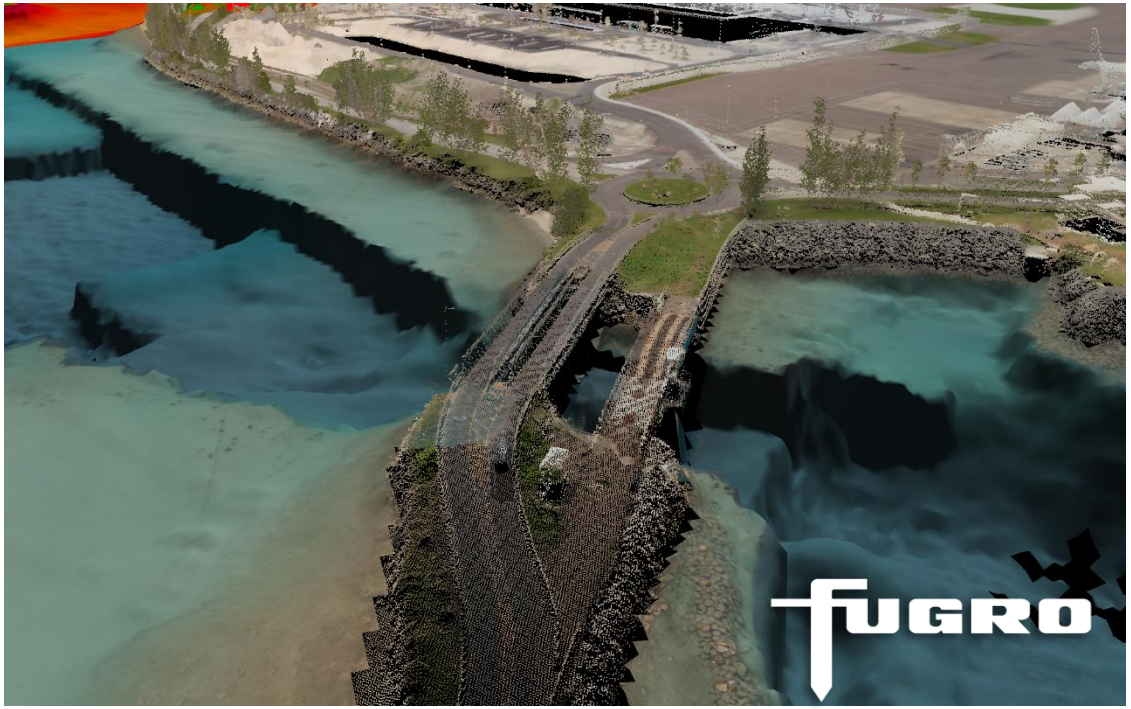
Topic 2: Introduction



PROVIDED BY: Alan **Blumberg**

JUPITER

Topic 2: Introduction



Case study of detailed shoreline-urban mapping to support coastal management, habitat mapping and inundation prediction of a sensitive island nation, using the Rapid Airborne Multibeam Mapping System, a lightweight, easily mobilized airborne lidar bathymetric (ALB) system developed by Fugro and Areté Associates.

PROVIDED BY: Rafael **Schiller**

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 2

Introduction of relevant projects within CoastPredict:

Project 6: PRESTHA [Towards a global PRediction of ESTuarineHAbitat changes under climatic and human pressures]

Project 7: NETFLUX [Towards a global prediction of particulate NET FLUXes between estuaries and coastal oceans under climatic and human pressures]

Guillaume Charria (Ifremer, France), COSS-TT member 8’ + 2’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 2

Introduction of relevant projects within CoastPredict:

Project 8: FULLCONTINUUM: Next-generation of models for a full coupling of the river-estuary -ocean-atmosphere continuum

Marilaure Grégoire (U. Liège, Belgium), invited 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 2: Integration of coastal ocean and estuaries/inland waters/coastal cities

Discussion on strategic goals for the TT within this Topic, and on possible modes of TT support to Decade projects in CoastPredict and ForeSea

(Also take questions/comments on chat)

Chair: Villy 15’

Topic 2: Areas where we (TT) should set strategic objectives

Integration of coastal ocean and estuaries/inland waters/coastal cities (1/2)

- Integration of estuarine, coastal and open ocean observing and modelling systems
- Extend COFS to include estuaries/deltas as an integrated system; intercomparison of coastal systems at different areas of river influence
- Advance the concept of “urban ocean” and methodologies to make COFS relevant for coastal cities
- Follow and monitor relevant Decade projects at TT meetings
- (Paolo) (a) There are still pending challenges on our previous turf; (b) Relaxation of some classic hypotheses for modelling (Bq, hydrostatic, …)
- (Ivan) 2-way nesting: need for design benchmark (at very high resolution: 1km → 100m)
- (Jason) Upscaling. Non-trad approaches: Machine Learning. Role of estuaries in Earth system.
- (Marcos) (a) Bathymetry morphohydrodynamics. (b) Atm forcing, digital terrain models (for surface wind?). (c) ML for improving the wind.
- (Emil) Bathymetric changes. Coherence btw. models and observations. 2-way interactions between open ocean, coastal ocean and estuaries.

Topic 2: Areas where we (TT) should set strategic objectives

Integration of coastal ocean and estuaries/inland waters/coastal cities (2/2)

- (Fraser) For machine learning and ai, these can be used to improve (not necessarily replace) prediction systems ocean models: ie identifying correcting model bias, model parameter estimation, model process estimation ....
- (Mike) Head of estuary fluxes are so important for driving hydro & BGC in estuaries. Hydrological catchment models that predict water quantity and quality can fill this role, but requires a different area of expertise....

Topic 2 “live” discussion (15’)

- Add points here

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 3

Seamless integration of coastal and larger-scale estimates

Chair: Pierre 40’ incl. 15’ discussion

One model for all?

- Should coastal ocean forecasting be treated separately from the large scale?
  - (pro) The inner shelf is driven by surface atmospheric variables, with short time scales and predictability limits.
  - (pro) Coastal features (plumes, upwellings, small eddies etc.) are characterized by very small space scales.
  - (con) The coastal ocean is subject to a mix of local (atm, rivers) and remote forcings (waveguide, biogeochemical connectivity, etc.) and depends on large-scale estimates and forecasts. In turn, the coastal ocean influences large-scale predictability.
  - (pro) Some important coastal features such as internal tides (acting on mixing), shelf fronts or detailed bathymetry interactions require dedicated high resolution, higher-order numerical schemes.
  - (pro) Data assimilation-enhanced prediction is challenging in the coastal ocean because (1) data forcing is competing with the other forcings (in particular atm), and (2) many coastal ocean sites lack adequate in situ observational networks or proper satellite coverage. Therefore advanced methods are needed (EnKF, 4Dvar, hybrid).
  - (pro) There are several additional levels of grid refinement to reach application-worthy scales!
- It seems the answer is yes and no… Separate but communicating approaches?

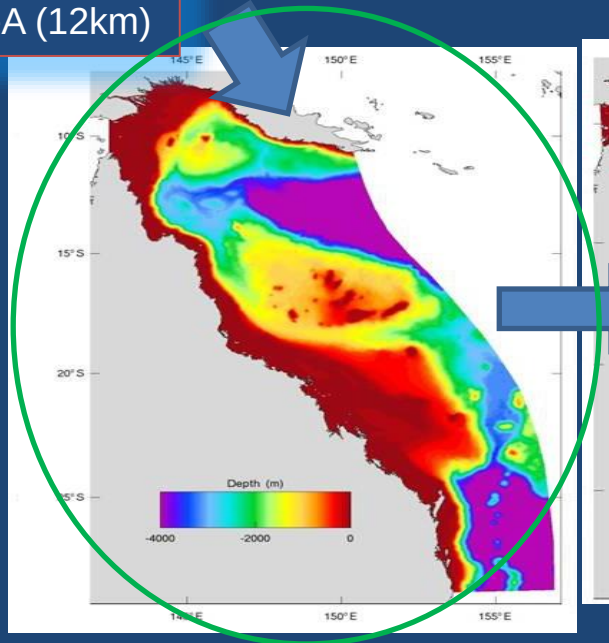
eReefs models:

Nested approach to traverse scales

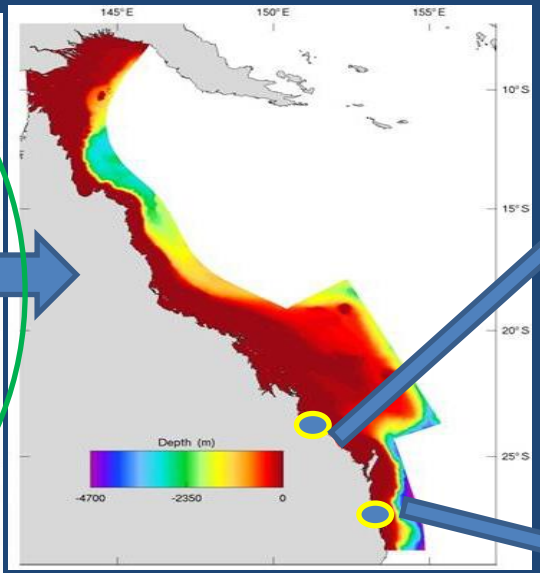
Herzfeld, CSIRO
COSS-TT meeting 2017, Cape Town

Global products:
- OFAM (10km)
- ACCESS-A (12km)

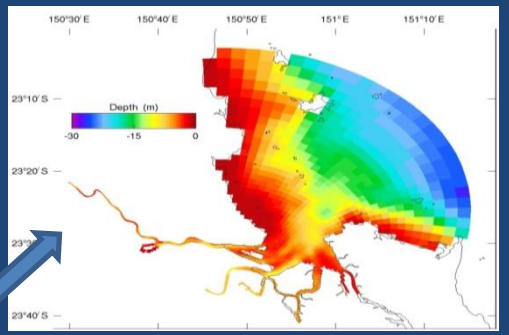
- **Downscaling to the reef/estuary scale is required (local models),**
- **Multiple nests are required to achieve boundary ratios ,**

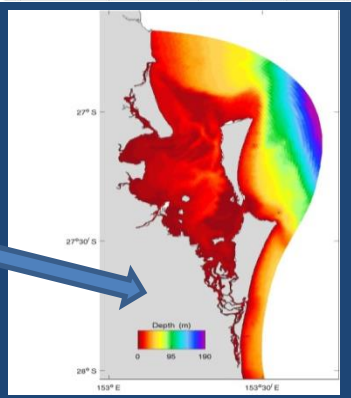


Bridging models (4km)



Hi-res regional (1km)





Local models

Separate but communicating…

- Model nesting is just one component of the approach – Also need:
  - Coastal datasets (which cannot be assimilated as such in larger-scale systems)
  - Coastal data assimilation
  - Coastal verification including verification of the larger-scale systems:
    - IV-TT talk (Greg or Fabrice)
- Downscaling approaches: reformulate the modelling-assimilation-forecasting problem at coastal scale from a large-scale solution
- Are initial/boundary conditions from large-scale systems adequate in coastal regions?
- Operational/service-based added value of a coastal system:
  - Run by a different team, better monitoring, specific practices
  - Serves as reference for larger scale systems.
  - Application-worthy estimated variables – e.g. surface currents.
    - CMCC decade projects (Ivan)

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Topic 3

Introduction of relevant projects within CoastPredict:

Project 9: "NAVIgating in the COASTal ocean" (NAVICOAST) (G. Mannarini)

Project 10: support for marine pollution hotspots' screening in coastal zones (G. Coppini)

Ivan Federico (CMCC, Italy), COSS-TT member 8' + 2'

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Topic 3

Large-scale model verification in the coastal seas

Fabrice Hernandez and Greg Smith, IV-TT co-chairs 8’ + 2’

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Topic 3: Seamless integration of coastal and larger-scale estimates

Discussion on strategic goals for the TT within this Topic, and on possible modes of TT support to Decade projects in CoastPredict and ForeSea

(Also take questions/comments on chat)

Chair: Pierre 15’

Topic 3: Areas where we (TT) should set strategic objectives

Seamless integration of coastal and larger-scale estimates (1/2)

- Advance and promote good COF practices within an integrated downscaling/modelling/observation framework, including:
  - Several examples of nesting/downscaling at COSS-TT general meetings – pending questions
  - Participation in ET-OOFS guide
- Actively participate in the assessment of global/basin-/regional-scale/coastal ocean forecasting systems in coastal regions, with our own quality criteria (with IV-TT) – (How?)
  - Consistency btw. Offshore and Coastal systems (4 points/questions in Greg's slide)
  - Evaluate set of endorsed metrics (…to be completed)
  - Establish common synthesis (…to be completed)
  - Dependency on/Need for measurement error estimates (verified!)…
- (Fabrice for IV-TT) Ready to work with volunteer coastal groups. Existing structure in EU. (Marcos) importance of regional services to promote (glo/reg/coast) model intercomparisons exercises (as proposed by Fabrice).
- (Marcos) Also important to share well-established operational model validation tools (usually with subregional capabilities) to assess added value of dynamical downscaling.

Topic 3: Areas where we (TT) should set strategic objectives

Seamless integration of coastal and larger-scale estimates (2/2)

- (Marcos) For multi-model comparisons at coastal scales, it is important to go further than the classic point-to-point statistic metrics. Inclusion of spatial validation methods to avoid double penalty (as Greg commented) is critical to compare different resolution models at coastal scales.
- (Alex) Assess the accuracy of coastal ocean models using multi-year in-situ data. Quality checking with long time series for long time scales.
- (Jeffrey) Building a software infrastructure for verification and validation is expensive and runs the risk of not being very versatile for new models/obs/regions. A common Validation/Assessment framework for both larger and coastal scales seems essential and fundamental. (Greg) This is an area for which the JWGFVR has been quite successful. But as metrics become more sophisticated the technical implementation can have a larger effect. Use of common tools can significantly improve efficiency.
- (Pierre) Assess the quality of surface current estimates in regional/coastal systems, and develop better approaches.
- Follow and monitor relevant Decade projects at TT meetings.

Topic 3 “live” discussion (15’)

- Add points here

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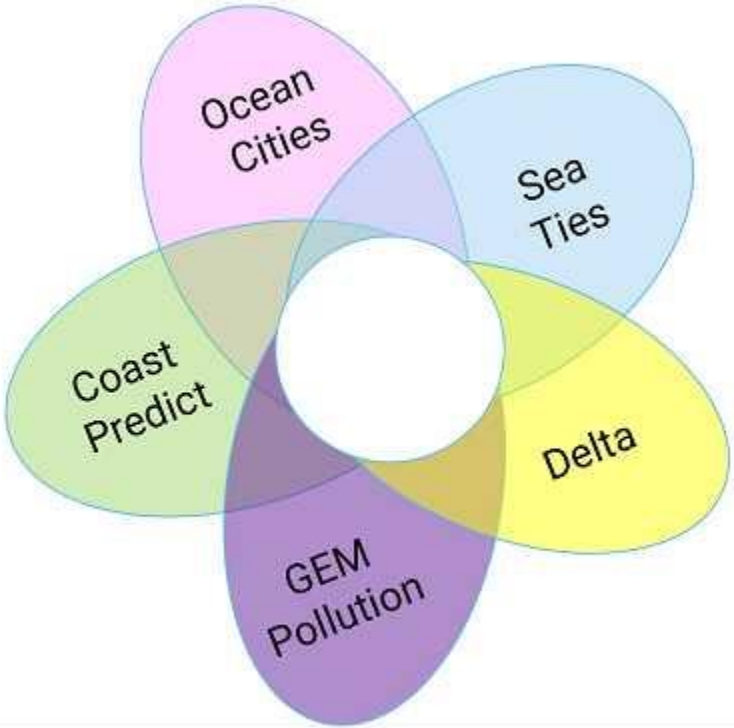
Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 4

Climate projections, coastal vulnerability and resilience

Chair: Villy 40’ incl. 15’ discussion

Topic 4: Introduction



CoastPredict Observing and Predicting the Global Coastal Ocean

OC-NET (**Ocean Cities**) Ocean Cities, an international network of cities in harmony with the marine environment

SEA'TIES Sharing solutions with coastal cities to tackle sea-level rise

Deltas associated with large rivers: Seeking solutions to the problem of sustainability

GEM Pollution Global Estuaries Monitoring Programme

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Topic 4: Introduction

PROVIDED BY: Chris **Davis**

UCAR

Topic 4: Introduction

Urban Oceanography toward improved impact forecasting

To Predict Better…

Submerged taxis in Hoboken during Hurricane Sandy

Taxis were moved to a "safer" part of town (from south to north)

Ponte et al. OceanObs19 coastal sea-level paper

- Useful for both Topics 1 and 4
- Recommendations for coastal sea-level observing and modeling systems:
  - Observational needs (mostly tide gauges/GNSS stations)
  - Modeling needs (mostly at climatic time scales, e.g. CMIP)
  - Developing future coastal sea-level services

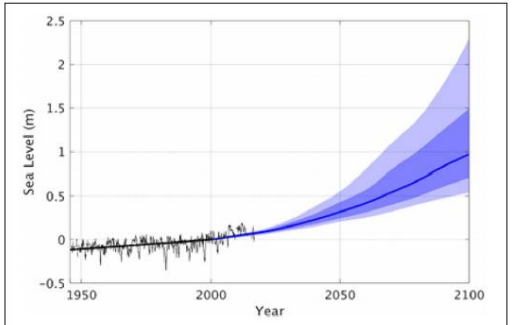

FIGURE 9 | Tide gauge observations (black lines) combined with sea level projections (blue) with RCP 8.5 scenarios at Kwajalein, Marshall Islands (Jackson and Jevrejeva, 2016). The thin black line is monthly tide gauge record, the thick black line is long-term linear trend; the thick blue line is sea level projection at 50% probability, and the dark and light blue shading areas represent 17–83 and 5–95% probabilities, respectively.

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Towards Comprehensive Observing and Modeling Systems for Monitoring and Predicting Regional to Coastal Sea Level

OPEN ACCESS

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Tide gauges combined with coastal sea-level projections
After Jackson and Jevrejeva (2016)

OceanPredict
Advancing the science of ocean prediction

Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 4

Introduction of relevant projects within CoastPredict:

Project 11: Reliable Climate Projections in the Global Coastal Ocean

Jason Holt (National Oceanography Center, UK), invited 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 4

Introduction of relevant projects within CoastPredict:

Project 12: Operational early-warning prediction system

Yannis Androulidakis (Univ. of Thessaloniki, Greece), invited 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 4: Climate projections, coastal vulnerability and resilience

Discussion on strategic goals for the TT within this Topic, and on possible modes of TT support to Decade projects in CoastPredict and ForeSea

(Also take questions/comments on chat)

Chair: Villy 15’

Topic 4: Areas where we (TT) should set strategic objectives

Climate projections, coastal vulnerability and resilience

- Improved, multidisciplinary and extended range predictive capabilities for the coastal zone (from events to climate) – test atmospheric forcing capabilities for coastal/shelf
- ICOFS: Integrated Coastal Ocean Forecast Systems for coastal hazards (environmental, ocean & human health, socioeconomic forecasts…) to address preparedness (risk scenarios…), resilience, sustainability
- (Jason) Coastal MIP? (along CMIP's lines) → (Marilaure) Ongoing efforts with ESM simulations, set up toolbox (to be completed from chat)
  - Set protocol, min set of experiments; to be further elaborated
  - Biogeochemistry & waves… 40 years very challenging… make priorities = on which basis?
- (Rafael) User-driven verification is an important metric (transverse) Plans for open data management and delivery (to users).
  - (Greg) Coastguards. S&R, emergency response. Need for uncertainty estimates (validated!). Build confidence in the systems. A good topic for the "global coastal ocean" concept.
- (Pierre) Coastal vulnerability, esp. in least advanced countries.
- (Rafael) Gap analysis based from feedback from user requirements. (transverse comment)
- Follow and monitor relevant Decade projects at TT meetings

Topic 4 “live” discussion (15’)

- Add points here

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

COSS-TT strategy meeting
Main theme: the COSS-TT in the UN Ocean Decade

DAY 3

9-11 June 2021, virtual (MS Teams)

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Topic 4

Introduction of relevant projects within CoastPredict:

Project 13: Coastal Urban Resilience in a Changing Climate

Alan Blumberg (Jupiter Inc, USA), invited 4’ + 1’

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

The “global coastal ocean” (The Sea, vol. 13)

Introduction of relevant projects within CoastPredict:

ROTATE – Redefining the concept of the global coastal ocean

JoAnne Hopkins (National Oceanography Center, UK), invited 7’ + 3’

Hopkins “live” discussion (3’)

- Add points here

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

Strategic goals and TT role

Chairs: Villy & Pierre

Revisiting TT Strategic Objectives for the Decade yrs

Envisaged process: (open for discussion)

1. **Your contribution needed at this meeting:**
   - Assess new environment of COSS-TT and CoastPredict: Decade, relevant programmes, projects, experts, GOOS, etc.
   - Review important topics for TT and areas where we should set strategic objectives
   - Prioritize and participate in this discussion
2. **OPST-4** later in June: OceanPredict-wide equivalent of 1., harmonize w/other TTs
3. **Later this year:**
   - Ensure representation of TT in decision-making circles in Decade programmes
   - Help make projects more concrete
   - Elaborate Strategy Note for TT, with priorities set
4. **At the next general COSS-TT meeting** (Montréal, April 2022)
   - Discuss/endorse
   - Adjust TT membership as needed

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

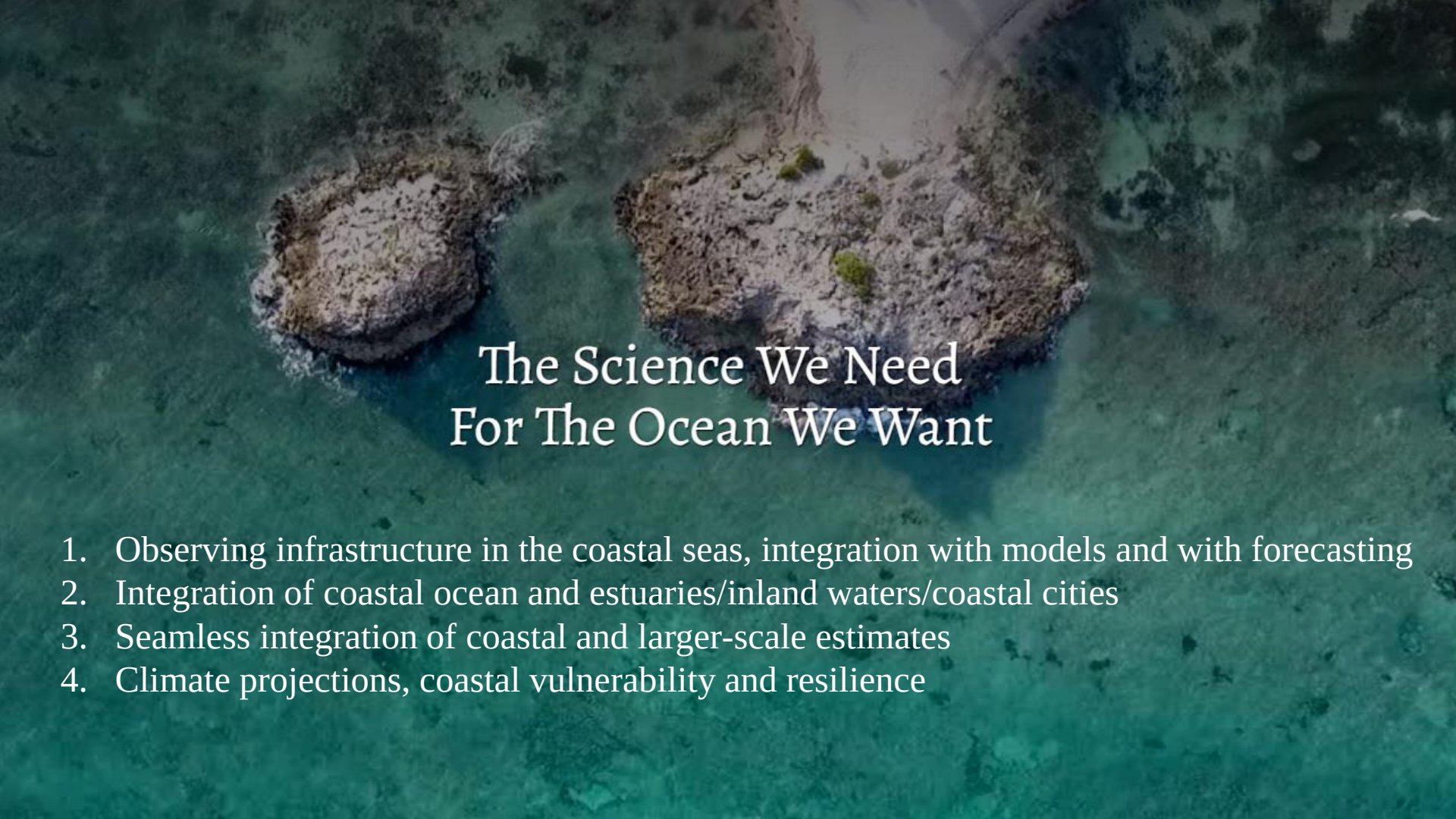
Strategic goals and TT role: the point of view of the co-chairs

Strategic goals

The Task Team's role within the OceanPredict-CoastPredict continuum

Villy & Pierre 25', followed by 45' discussion

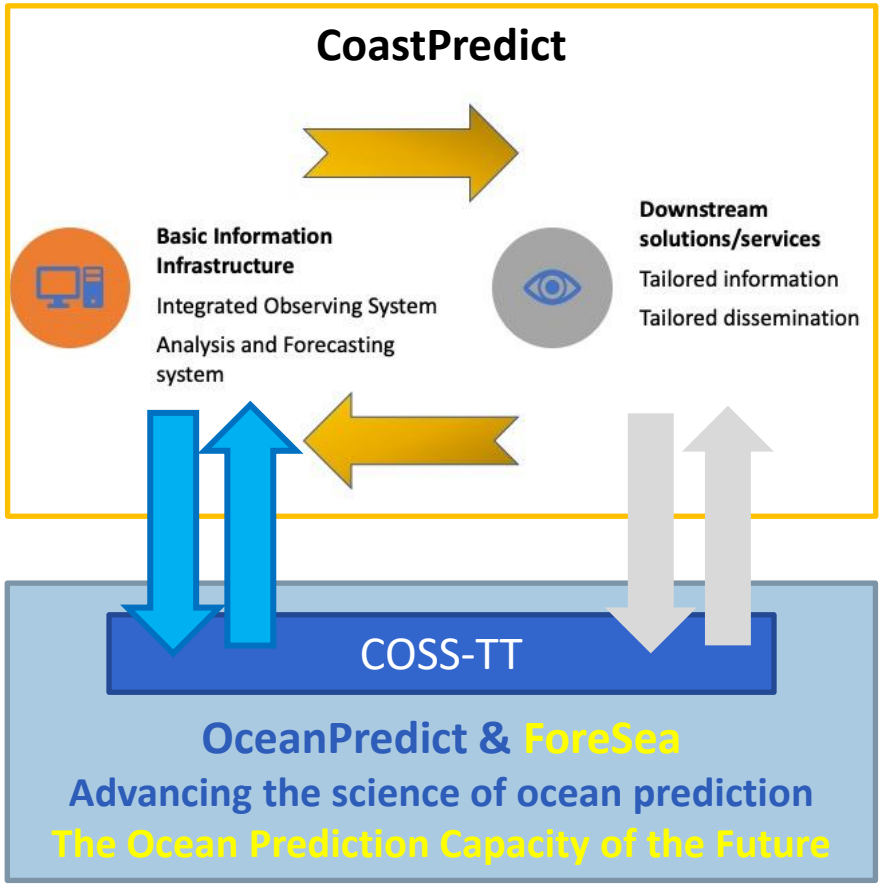
Current OceanPredict/COSS-TT Terms of Reference:
Foster international collaboration
to advance science and expertise
in support of regional/coastal ocean forecasting.



1. Observing infrastructure in the coastal seas, integration with models and with forecasting
2. Integration of coastal ocean and estuaries/inland waters/coastal cities
3. Seamless integration of coastal and larger-scale estimates
4. Climate projections, coastal vulnerability and resilience

COSS-TT and CoastPredict are parts of the same value chain

- The UN Decade is an opportunity to advance coastal ocean science and services.
- Need to anchor CoastPredict to COSS-TT coastal ocean modelling, observation and forecasting science and expertise…
- …and beyond the COSS-TT, to global ocean forecasting science, expertise and services (OceanPredict/ForeSea).
- Actively participate in the CP Steering Committee and WP.
- Representation of CP in OPST to be discussed at OPST-4.



The TT's role within the OP-CP continuum (to be discussed!)

CoastPredict can strengthen OceanPredict in the areas of:

- OP: Link with other world countries, in particular within UN capacity building/sustainability programs (in particular regarding the pursuit of UN Sustainable Development Goals)
- COSS: Scientific expertise in the Coastal Ocean (it is already present in the COSS-TT but can be complemented in some areas – **which ones? → identify gaps**)
- COSS: Farther reach via "global coastal ocean" concept and CO typology (JoAnne's talk)
- COSS: Coastal solutions and services provide are an opportunity to validate science options
- (Nadia) Fit-for-purpose information infrastructure, also in link w/ForeSea (make available large-scale flow fields)

OceanPredict can strengthen CoastPredict in the areas of:

- OP: Pool of working global/regional/coastal ocean forecasting systems for test cases
- OP: Systems-based "engineering" approach; real-time or scenario-mode operation
- OP: Advanced verification/validation approaches
- OP: Link with national ocean prediction services
- COSS: "Seamless" integration with large-scale prediction, nesting, downscaling
- COSS: Dedicated Task Team with (soon) 7 successful meetings and a rich community
- COSS: Promotion of synergistic model/data approaches in the coastal ocean

General contributions

- Promote good coastal ocean forecasting practices: participation in ET-OOFS guide; other?
- Follow and monitor relevant Decade projects at TT meetings
- …

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Topic 1: Areas where we (TT) should set strategic objectives

Observing infrastructure in the coastal seas, integration with models and with forecasting

- Advance and promote good COF practices within an integrated downscaling/modelling/observation framework, including:
  - Definition of suitable coastal *in situ* observing systems (OSE/OSSEs with OSEval-TT & SynObs?)
    - Combinations of coastal observations? Check in **some assimilating COSS-TT systems (voluntary)**. Several types.
  - Good practices for using future altimetry data in coastal regions (with SWOTST?)
    - Any experimental products that the COSS-TT could review?
    - OC
    - Currents
- Role of ML/DL & obviously DA approaches for sparsely observed coastal regions
- (Pierre, Mauro, Joanna) Need for obs error estimates (validated)
- Possible contributions to SynObs
  - Showcase coastal observational impact (could do in **some assimilating COSS-TT systems**)
  - Establish best practice coastal obs strategy (see above)
  - ? (check w/Yosuke)
- (Nadia) CP co-design w/GOOS – legacy at end of decade – new sensors -- standards (RT/QC esp. Gliders, get inspiration from ARGO) – COSS-TT can contribute systems w/ RT assimilation
  - (Chris) QC in RT for gliders in California
- (Joanna) Integration w/ land models, hydrology, wave models *(to be moved to another topics)*

Topic 2: Areas where we (TT) should set strategic objectives

Integration of coastal ocean and estuaries/inland waters/coastal cities (1/2)

- Integration of estuarine, coastal and open ocean observing and modelling systems
- Extend COFS to include estuaries/deltas as an integrated system (up to catchment area); intercomparison of coastal systems at different areas of river influence
- Advance the concept of "urban ocean" and methodologies to make COFS relevant for coastal cities
- (Paolo) (a) There are still pending challenges on our current turf; (b) Relaxation of some classic hypotheses for modelling (Bq, hydrostatic, …)
- (Ivan) 2-way nesting: need for design benchmark (at very high resolution: 1km → 100m)
- (Jason) Upscaling. Non-trad approaches: Machine Learning. Role of estuaries in Earth system.
- (Marcos) (a) Bathymetry morphohydrodynamics. (b) Atm forcing, digital terrain models (for surface wind?). (c) ML for improving the wind.
- (Emil) Bathymetric changes. Coherence btw. models and observations. 2-way interactions between open ocean, coastal ocean and estuaries.

Topic 2: Areas where we (TT) should set strategic objectives

Integration of coastal ocean and estuaries/inland waters/coastal cities (2/2)

- (Fraser) For Machine Learning and AI, these can be used to improve (not necessarily replace) prediction systems ocean models: ie identifying correcting model bias, model parameter estimation, model process estimation ....
- (Mike) Head of estuary fluxes are so important for driving hydro & BGC in estuaries. Hydrological catchment models that predict water quantity and quality can fill this role, but may require a different area of expertise.
- (Alex) Numerics (e.g. structured/unstructured-grid models) are key in estuaries and on the shelf
  - (Emil) Some themes are in common between topics, add cross-references
- (Jeffrey) Interaction w/Land Service modellers – requirements needed about frequencies of information (e.g. freshwater fluxes: instantaneous, daily averages, etc.)
  - (Alan) Especially for flood events, try to bring in some landside modellers?
- (Enda) Saline groundwater an issue

Topic 3: Areas where we (TT) should set strategic objectives

Seamless integration of coastal and larger-scale estimates (1/2)

- Advance and promote good COF practices within an integrated downscaling/modelling/observation framework, including:
  - Several examples of nesting/downscaling at COSS-TT general meetings – pending questions
- Actively participate in the assessment of global/basin-/regional-scale/coastal ocean forecasting systems in coastal regions, with our own quality criteria (with IV-TT) – (How?)
  - Consistency btw. Offshore and Coastal systems (4 points/questions in Greg's slide)
  - Evaluate set of endorsed metrics (…to be completed)
  - Establish common synthesis (…to be completed)
  - (Pierre) Dependency on/Need for measurement error estimates (verified!)
- (Fabrice for IV-TT) Ready to work with volunteer coastal groups. Existing structure in EU. (Marcos) importance of regional services to promote (glo/reg/coast) model intercomparisons exercises (as proposed by Fabrice).
- (Marcos) Also important to share well-established operational model validation tools (usually with subregional capabilities) to assess added value of dynamical downscaling.

Topic 3: Areas where we (TT) should set strategic objectives

Seamless integration of coastal and larger-scale estimates (2/2)

- (Marcos) For multi-model comparisons at coastal scales, it is important to go further than the classic point-to-point statistic metrics. Inclusion of spatial validation methods to avoid double penalty (as Greg commented) is critical to compare different resolution models at coastal scales.
- (Alex) Assess the accuracy of coastal ocean models using multi-year in-situ data. Quality checking with long time series for long time scales. Presentation of information from long-term in situ coastal data.
- (Jeffrey) Building a software infrastructure for verification and validation is expensive and runs the risk of not being very versatile for new models/obs/regions. A common Validation/Assessment framework for both larger and coastal scales seems essential and fundamental. (Greg) This is an area for which the JWGFVR has been quite successful. But as metrics become more sophisticated the technical implementation can have a larger effect. Use of common tools can significantly improve efficiency.
- (Pierre) Assess the quality of surface current estimates in regional/coastal systems, and develop better approaches.
- (Alex, Emil) Numerics (e.g. structured/unstructured-grid models) are key in estuaries and on the shelf
- (Youyu) Offer to build project to bring pieces together for topics 3&4. Project info through COSS-TT/COSS community email list.

Topic 4: Areas where we (TT) should set strategic objectives

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- (Pierre) Coastal vulnerability, esp. in least advanced countries.
- (Rafael) Gap analysis based from feedback from user requirements. (transverse comment)
- (Alan) A changing climate – climatic changes in the coastal ocean
- (Enda) *see chat* – saline intrusions are critical issues
- (Chris) Fisheries. Confused about time scales: variety of ts for forecasting.
- (Ivan) Vulnerability: advance on coastal relocatable models for emergency situations
- (Alan) "Why do we evolve our systems?"
- (Youtu) see chat

(Need for an additional technical/technological transverse topic?)

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Round table

- …

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Coastal Ocean and Shelf Seas Task Team (COSS-TT)

COSS-TT “business”

OPST-4 preparation questionnaire

Next steps with discussion

Chairs: Villy & Pierre 30’

Communication of TT outcomes

- **What are the products/knowledge/advances generated by the TT?** (data, reports, events, etc.? – please highlight)

- **How are these advances communicated to the science community, to operational systems, to the public …** (where feasible please provide examples)

- **What steps could be taken to increase the information and communication flow on TT and OP advances?**

TT community interactions

- **Please provide information about who uses TT output?**

- **What groups does the TT collaborate with?**

TT future plans in UN decade context

- **What gaps in knowledge/expertise need to be filled from your TT perspective?**
- **What do you see as challenges for the TT in the next 3-5 years?**
- **If available, what is the longer-term outlook in the TT field of expertise (next 10 years)?**
- **Where do you anticipate benefit in the Decade?**
- **How do you plan to engage with SynObs and/or CoastPredict?**

Revisiting TT Strategic Objectives for the Decade yrs

Envisaged process: (open for discussion)

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4. **At the next general COSS-TT meeting** (Montréal, April 2022)
   - Discuss/endorse
   - Adjust TT membership as needed

Next steps – continued

- "Strategy note 2021"
  - Co-chairs will circulate after summer
  - Inputs from all TT members (even not attending this meeting)
  - Opportunity to revise Task Team's ToRs and scientific objectives
- TT contribution to ET-OOFS guide
  - Urgency?
  - Downscaling section (N
  - Coastal Systems Information Table is 7 yrs old! Update will be requested by end of month.
- Topical Collection 3 in ODyn
- 7th COSS-TT meeting, week of 4-8 April 2022, Montréal
  - Hopefully, face-to-face
  - Review venue availabilities and support with local organizers following 2020 and 2021 unsuccessful attempts

Thanks to all
Stay safe!