

SynObs updates

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Synergistic Observing Network for Ocean Prediction



- Endorsed in June 2022 as an UN Ocean Decade project under the UN Decade Program ForeSea led by OceanPredict.
- Led by OceanPredict Observing System Evaluation Task Team
- Aim to identify optimum combination of in-situ and satellite data for ocean predictions in ocean observing network



2021 United Nations Decade
2030 of Ocean Science
for Sustainable Development

SynObs Contact

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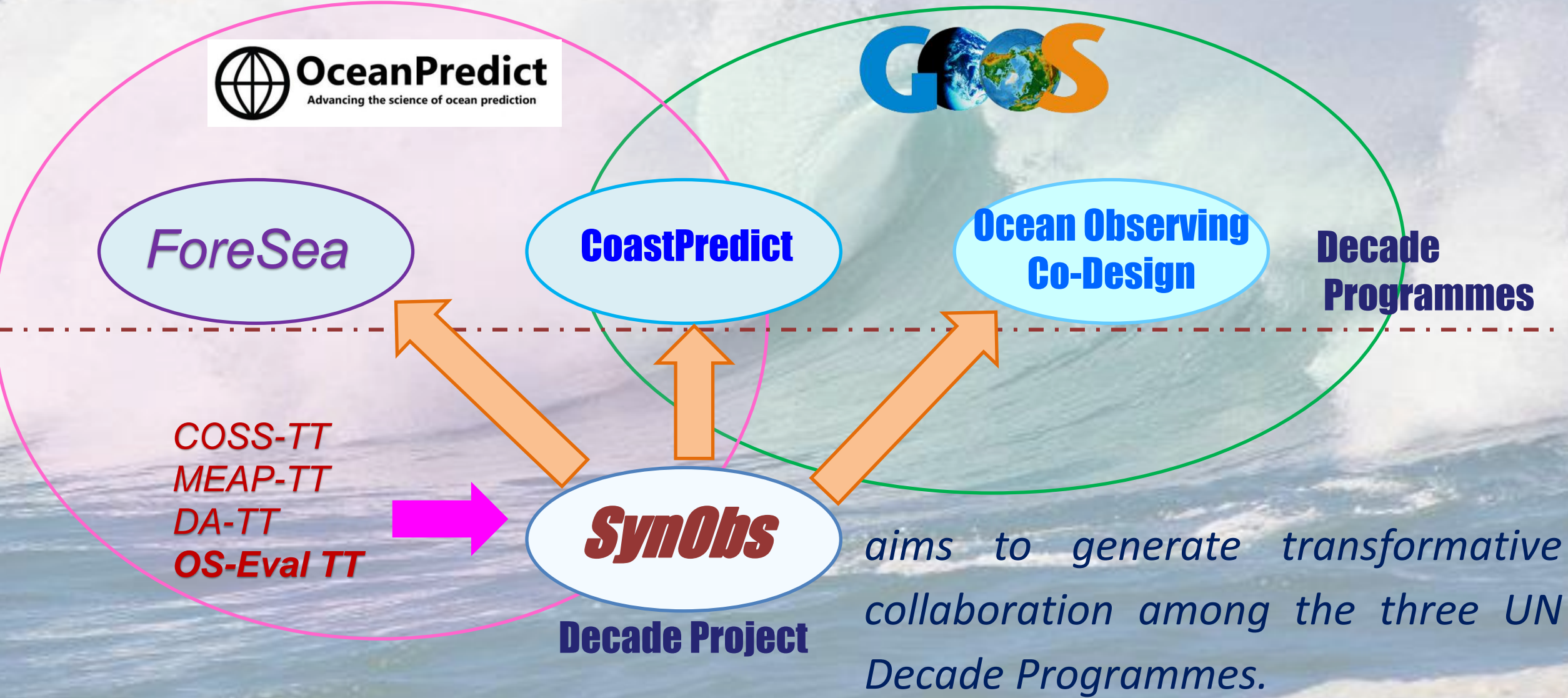
<https://oceanpredict.org/foresea/synobs/#section-overview>

Mailing List

SynObsML@googlegroups.com

Please mail to synobs@mri-jma.go.jp for joining

SynObs: A common comprehensive project



★ Web Meetings related to SynObs

SynObs Steering Team Meetings (Ideally every 3 month)

Members

- **Lidia Cucurull** (NOAA-QOSAP)
- **Fraser Davidson** (OPST)
- **Pierre De Mey** (COSS-TT)
- **Marjory Friedrichs** (MEAP-TT)
- **Yosuke Fujii** (Co-chairs, OS-Eval TT)
- **David Legler** (Ocean Observing Co-Design)
- **Andrew Moore** (DA-TT)
- **Peter Oke** (OS-Eval TT, CLIVAR/GSOP)
- **Elisabeth Remy** (Co-Chairs, OS-Eval TT)
- **Kirsten Wilmer-Becker** (OP Project Office)

SynObs web meeting (Basically every 2 month)

- All SynObs members, who are joining the SynObs mailing list, can participate in.
- Generally common to the OS-Eval web meeting.
- Currently being very active in order to determine the guideline of the SynObs flagship OSEs

★ SynObs Kickoff Workshop



- **15-18 Nov. in Tsukuba (Hybrid)**
- 146 Participants (Onsite: 38, Online: 108)
- 84 International participants (onsite 4, online 80)
- From USA, France, UK, Italy, Australia, Brazil, South Korea, Belgium, China, India, New Zealand, Ireland, Norway, Portugal, Saudi Arabia, South Africa, Spain, and Japan.
- 53 presentations (Invited: 6, Oral: 40, poster 7)



- **It was the good kickoff for SynObs.**
- Good opportunity to appeal the SynObs activity in Japan
- Good opportunity to communicate between ocean/coupled prediction and ocean observation communities.
- Discussed on the flagship OSE and other activities.
- **All (almost) presentations and the workshop summarizing report are available online:**
<https://oceanpredict.org/archived-events/synobs-kick-off-and-es-eval-cp-tt-workshop/#section-presentations>

★ SynObs Activities currently being planned

1. Collaboration for evaluation and design

- Collaboration on Multi-System OSE and OSSE (Flagship OSE/OSSE)
- Preparation of the Nature Runs ⇒ Use the GEOS/NASA high-resolution coupled simulation
- Make an environment to promote the collaboration

2. Supporting DA scheme development

- Summarize required development for extracting synergy from the targeted combinations
- Observational campaigns

3. Providing information from ocean prediction systems in real time

- Regular reporting on information of QC, innovations, increments, etc.
- Explore the methods to evaluate observing system status in real-time operation

4. OS-Eval showcase and reporting

- Collect OS-Eval examples and introduce them (Showcase)
- Generate a report on observation requirements and design

★ Flagship OSEs/OSSEs

- Ongoing discussion to agree on the precise design of the flagship OSE/OSSE and diagnostics
- 1 to 3-year OSEs covering the year 2020 and up to 2022
- 1-year OSSEs using GEOS/NASA high-resolution coupled-simulation as the Nature Run.
- 10-day ocean predictions from the beginning of every pentad.
- S2S OSE collaboration (20 years, ocean reanalysis and coupled prediction) is also considered as a side activity of SynObs.

For OSE and OSSE

1	CNTL	Ocean Model		SST	Argo 80%	Mooring	Other TS	Alt. (optional)
2	NoAlt	Ocean Model		SST	Argo 80%	Mooring	Other TS	
3	NoArgo	Ocean Model		SST		Mooring	Other TS	Alt. (optional)
4	NoMoor	Ocean Model		SST	Argo 80%		Other TS	Alt. (optional)
5	NoSST	Ocean Model			Argo 80%	Mooring	Other TS	Alt. (optional)
6	NoInsitu	Ocean Model		SST				Alt. (optional)
7	SSTonly	Ocean Model		SST				
8	Free	Ocean Model						
9	HalfArgo	Ocean Model		SST	Argo 40%	Mooring	Other TS	Alt. (optional)
10	Oper	Ocean Model	Oper. Setting	SST	Argo 100%	Mooring	Other TS	Nadir Altimeter

For only OSSE

10	FullAlti	Ocean Model		SST	Argo 80%	Mooring	Other TS	Alt. (optional)	SWOT
11	SWOT	Ocean Model		SST	Argo 80%	Mooring	Other TS		SWOT
12	OldTPOS	Ocean Model		SST	Argo 80%	Old TPOS	Other TS	Alt. (optional)	
13	NewTPOS	Ocean Model		SST	Argo 80%	New TPOS	Other TS	Alt. (optional)	

★ Output from the OSEs/OSSEs (Currently suggested)

Flagship OSE (10-20? system will join.)

◆ Reanalysis (~160GB for 1 year, 1 OSE, 1 center)

1. Daily high-resolution (1/10 deg) 2D fields for 14 variables (e.g., SST, SSH, TCHP etc.)
2. Pentad middle-resolution (1/4 deg) 3D fields for TSUV
3. Analysis values at the points and times of reference data

◆ Predictions (~80GB for 1 year, 1 OSE, 1 center)

1. High-resolution predicted 2D fields of 5th and 10th days for 14 variables.
2. Middle-resolution predicted 3D fields averaged over 6-10th days for TSUV
3. Predicted values at the points and times of reference data

S2S OSE (4+ system will join)

◆ Reanalysis (~250GB for 20 years, 1 OSE, 1 center)

1. Daily middle-resolution (1/4 deg) 2D fields for 14 variables
2. Pentad low-resolution (1 deg) 3D fields for TSUV
3. Analysis values at the points and times of reference data

◆ Predictions ?? (Including atmospheric output)

300TB will be required if we share all relevant data from a common storage (or web data space)!!

★ How to diagnose the results of the flagship OSE/OSSEs

◆ The ORA-IP strategy will be applied.

- SynObs is seeking several voluntary analysis groups which focus on specific regions or diagnostics.
- An analysis group requests data producing groups data they need for their analysis, and analyze the observation data impact by their own idea.

◆ We try to collaborate with observational and other groups for the analysis.

- Near surface temperature fields => ObsCoDe MHW Exemplar?
- TCHP => ObsCoDe Tropical Cyclone Exemplar?
- Agulhas Current regions(?) => ObsCode Western Boundary Current Exemplar?
- Tropical Pacific => TPOS group?
- Class 4 Metrics (VI-TT?)
- Regional groups?
- Argo Community
- Gliders
- Space Agency (Nadir and wide-swath altimetry, surface velocity, SST?)

◆ Planning optimal OSEs under collaboration with other groups (e.g., coastal OSEs) may be feasible.

★ Observing System Evaluation Showcase

- ◆ Collect OS-Eval examples performed by OceanPredict and other communities
- ◆ Subject of Evaluation: All ocean observation data including in-situ, satellite, open-ocean, coastal, physical, BGC ...
- ◆ to appeal our capacity to evaluate observing systems and to demonstrate importance of ocean observations.
- ◆ **Web Site:** It is possible to generate a site with 100GB web space but it is useful if we have 2TB. (FYI, 100GB is \$20/year and 2TB is \$100/year for google drive).
 - Human resource for creating the web sites is also required.
 - Collaboration with ForeSea or OP Office or Ocean Prediction DCC
- ◆ **Journal Special Issue**
 - In order to includes the achievements by the flagship OSEs the publication must be after the end 2024.
 - Setting 2 special issues? (one is published 2024 and the other, including flagship OSE results is published 2026)
 - Frontiers in Marine Sciences or other journals?
- ◆ **Special Session in Ocean Science Meeting or other big symposium?**

A large, powerful ocean wave is captured in mid-break, with a massive wall of white foam and spray rising from the crest. The water below is a deep, dark blue, contrasting sharply with the bright white foam. The sky is a clear, pale blue. The overall scene conveys a sense of immense natural power and energy.

Thank you

★ Expectations/Requests of OSE/OSSE to SynObs

◆ SynObs proposal defined 7 targeted combinations

- Sat Alti SKIM, and Argo ▪ Tropical buoy array, Argo, and Sat Alti
- Sat SSS and in-situ ▪ Sat SST-obs radiometers and near surface observations
- Sat ocean color and BGC Argos ▪ Sea ice concentration and thickness
- Coastal ocean and Open Ocean Observations

(But it is not feasible to conduct collaborative OSE for all targets.)

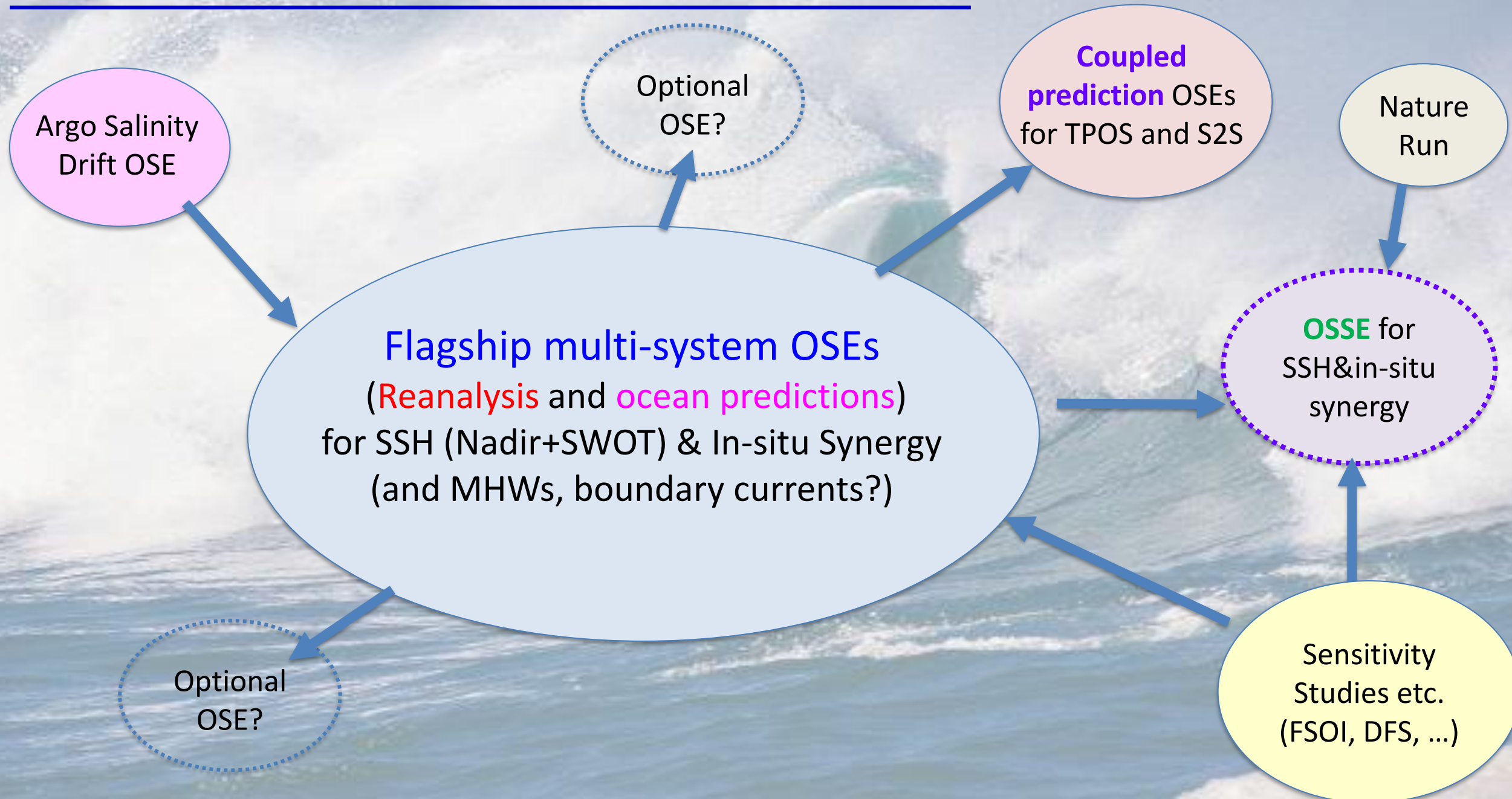
◆ Ocean Observing Co-Design expects SynObs to conduct OSE/OSSEs for some of their exemplars (Marine Heatwaves, Boundary Currents, Tropical Cyclones, Storm Surge, carbon Cycle, Biodiversity).

◆ TPOS-SAC requested OSE/OSSE for new TPOS, and ECMWF, NCEP, and JMA started to discuss on a collaborative OSE for S2S forecasts.

◆ Argo Science Team aims to enhance the communication with modeling communities.

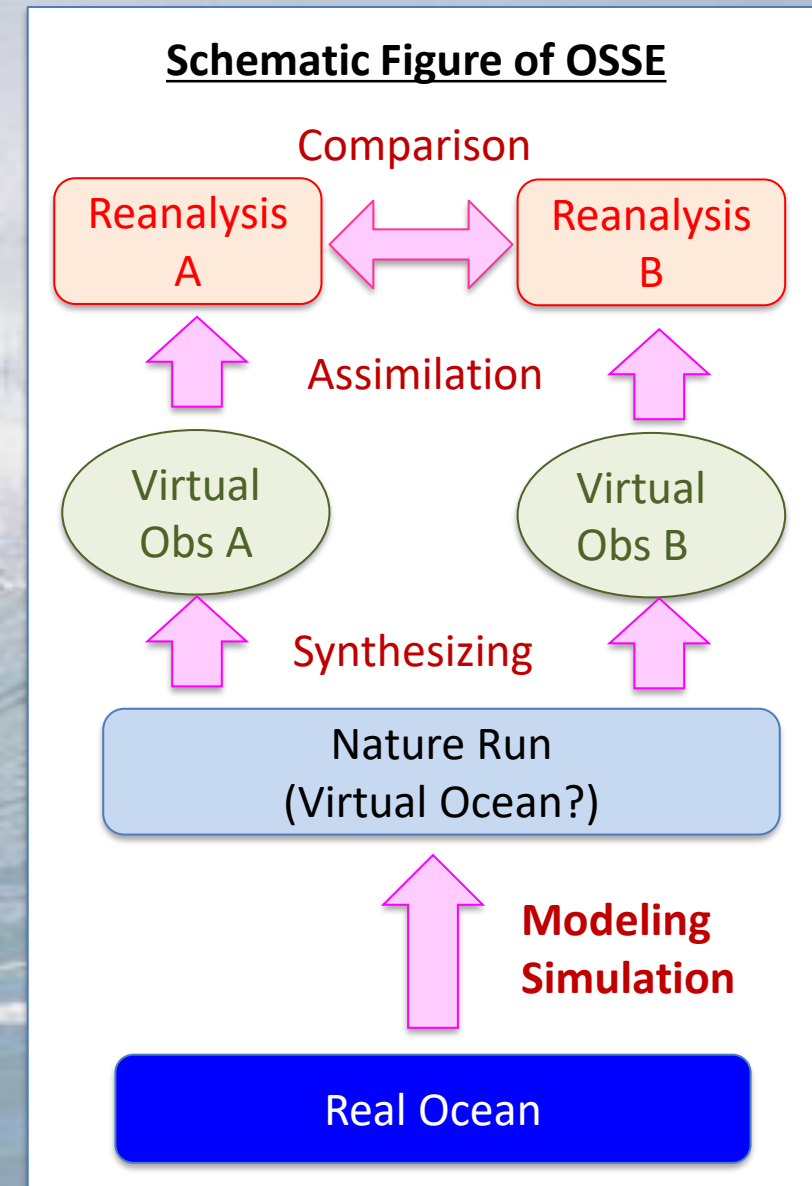
- The UN Decade forum was held in AST-23
- Multi-system OSE for salinity drifts are currently on-going

★ Rough Plan of Collaborative OSE in SynObs



★ Preparation of the Nature Runs (Collaboration with DITTO)

- ◆ A high-quality Nature Run is essential to make reliable evaluation through OSSE.
- ◆ But there are no sufficient resource and motivation to generate Nature Runs.
- ◆ For the time being, we develop a list of model simulation data which are available for a Nature Run.
- ◆ We also consider the possibility to collaborate with DITTO for preparing Nature Runs and conduct multi-system OSSEs.
- ◆ OSSE is actually the most familiar application of the concept of the digital twin ocean.
- ◆ The Japanese government relatively positive to contribute DITTO because it is one of the G7 project.
- ◆ Y. Fujii is currently communicating with the Japanese focal point to DITTO (JAMSTEC) to discuss on the possibility of providing Nature Runs and conducting multi-system OSSEs under the collaboration between DITTO and SynObs.





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Synergistic Observing Network for Ocean Prediction (SynObs)

UN Ocean Decade Project Under ForeSea
(Led by OceanPredict OS-Eval TT)



Officially Endorsed at June 8th

◆ Objective

SynObs will seek the way to extract maximum benefits from the combination among various observation platforms, typically between satellite and in situ observation data, in ocean/coastal predictions.

◆ Strategy

SynObs aims to identify the optimal combination of different ocean observation platforms through observing system design/evaluation, and to develop assimilation methods for maximum synergy among different observations.

◆ Scope

Targets of **SynObs** include open-ocean (global, tropical, mid-latitude, polar areas), coastal, and biogeochemical (BGC) observing systems

