



# ***SynObs Web Meeting 6 (For Prediction Centers)***

## **Agenda**

1. Current Status of the flagship OSEs
2. How to sort Argo, Mooring, and other data
3. Calculation of output variables
4. Progress of OSE calculations

# ★ Confirmation of the current status of the flagship OSEs

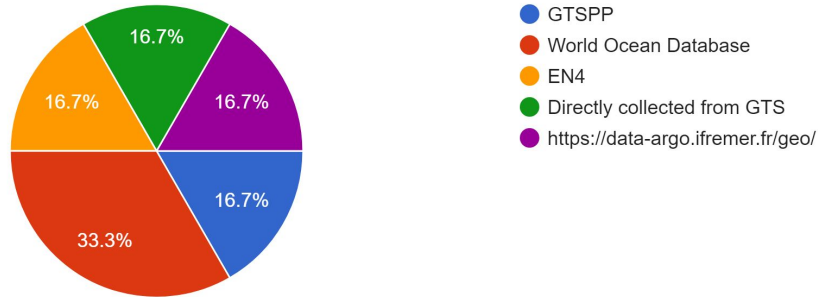
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1. Experiments are on-going in each operational center/research institute  
Tentative Deadline: Reanalysis Run: End of 2023 (likely to be extended)  
Prediction Run: End of April 2024
2. The flagship Guideline Ver. 1 is officially published from SynObs webpage as the reference document.  
[https://oceanpredict.org/docs/Documents/SynObs/SynObs\\_FlagshipOSE\\_Guideline\\_Ver1.pdf](https://oceanpredict.org/docs/Documents/SynObs/SynObs_FlagshipOSE_Guideline_Ver1.pdf)
3. The data will be distributed from JAMSTEC-APL server  
- Sample NetCDF file (in the expected format) are provided from  
<https://drive.google.com/file/d/1oeB-7irUW6Mn0Vc4KGsbMGKMR7Q4goXO/view?usp=sharing>  
(github for sample data creation) <https://github.com/shokido/SynOBS>
4. Results will be analyzed by several volunteer groups.
5. The activity and early results will be introduced in
  - Introduction paper for the Frontiers in Marine Science special collection (preface of the collection?)
  - Another introduction paper (on BAMS?, we will put more focus on this.)
  - WMO Observation impact workshop
  - OceanPredict Symposium 2024

# ★ Results of the survey about the observation data source

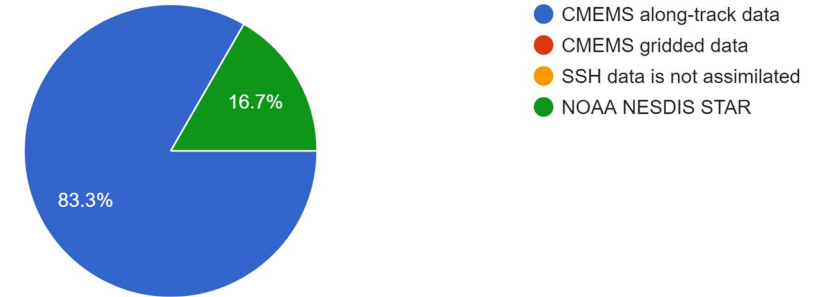
From which data source are the in situ TS observation data used in the OSEs collected? (e.g., GTSP, World Ocean Database, EN4, directly collected from GTS, etc.)

6 responses



From which data source are the satellite SSH observation data ? (e.g., CMEMS along-track data, CMEMS gridded data, etc.)

6 responses



## SST Data and Assimilation Method

- CMC SST (L4). Assimilated together with in situ and SLA
- JPSS METOP 3DVAR
- OSTIA, nudging, same as TS
- Same assimilation method as for in-situ T data
- OSTIA, the same assimilation method as for in situ TS data.
- MGDSSST (JMA's GHRSSST), 4DVAR with in-situ and satellite SSH data

# ★ How to sort the Argo, Mooring and other Data

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- It is difficult to sort data by type of observation in a completely identical method.
  - Some OSEs are already completed or on-going.
  - Need human resource to adjust the system to assimilate a new dataset
- However, it may be valuable to indicate a standard method. (Some centers may be confused by the difficulty of sorting data.)
- Possible Method
  - ◆ Create a standard list of Argo and Mooring data
    - Generate from Argo GDAC? (Caution: Some float data in GTSPPP do not exist in Argo GDAC)
    - Generate the list of Mooring from some dataset (GTSPPP?)
  - ◆ Suggest a standard method of identifying Argo and Mooring data for each database
    - WOD: Floats and Mooring data are originally separated.
    - GTSPPP (and GTS?): Use project and instrument codes?
    - EN4: ?
    - Other dataset?
- The method of sorting in each center should be clarified.
- We also need to note on the latency of each dataset
  - WOD has relatively long latency. Waiting 1 year is sufficient for the reanalysis runs?
  - How about EN4? How often EN4 is updated?



# ★ Calculation of output variables

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- ◆ **Linear Interpolation** in horizontal and vertical directions are recommended.
- ◆ Temperature and salinity should be interpolated at the target position before calculating the output variables.
- ◆ The survey result of density Equation: TEOS-10: 3 EOS-80: 2, Other 1
  - **Can we recommend TEOS-10?**
- ◆ We plan to **provide python codes** for calculating output variables (based on the well-used sea water library).
- ◆ Monthly 2D variables are newly added to S2S analysis output (for keep the guideline description brief). But they can be easily calculated from the daily means which are originally included.
- ◆ There is a strong suggestion to extend the analysis period to 2023 (because of on-going El Nino).
- ◆ Are there any other remaining concerns on the output variables?

# ★ Progress of OP-OSE Calculations

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ECCC: Completed: All Analysis runs (great!!!)

NOAA (RTOFS): Ongoing: CNTL(An)

Preparation: Other Analysis

NASA: Ongoing: CNTL (An+Fc)

Preparation: Free (An+Fc)

UKMO: On going: CNTL, NoAlt, NoArgo, Free, HalfArgo (An+Fc)

JMA (Global): Ongoing: CNTL(An)

Preparation: CNTL (Fc), Free, NoSST, NoInsitu (An)

(Other OSEs are not started)

JMA (regional): Not Started

- Possible Recommended Order: 1. CNTL, 2. Free, 3. NoArgo, 4. NoAlt, 5. HalfArgo
- Recommended to perform analysis runs first

# ★ Progress of S2S OSE Calculations

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NASA: Ongoing: CNTL (An+Fc)

Preparation: Free (An+Fc)

NOAA-NCEP: Ongoing: CNTL (An)

Preparation: NoIn situ, Free

JMA (Global): Ongoing: CNTL (An)

Preparation: CNTL (Fc), Free, NoIn situ, NoArgo (An+Fc)

(Other OSEs are not started)

ECCC: Not Available(?)

ECMWF: ?

□ Possible Recommended Order: 1. CNTL, 2. Free, 3. NoIn situ, 4. NoArgo, ...

□ Recommended to perform analysis runs first

Or possible to complete for the first several years?

A large, powerful ocean wave is shown crashing, with a massive wall of white foam and spray rising from the base. The water is a deep blue-green color, and the sky is a pale, hazy blue. The wave is the central focus of the image, with its crest curling over. The overall scene is dynamic and captures the raw power of the ocean.

Backup



# ★ SynObs flagship OSEs (OSE settings and the schedule)

## OSE Settings for OP and S2S OSEs

### ◆ Control Run (CNTL)

- Basically, regular observation data are assimilated
- 20% of Argo data are withheld and used as reference.
- Participants can choose whether or not to assimilate satellite altimetry data

### ◆ OSEs

- Data of a targeted observation type are excluded (e.g., NoArgo, NoMoor, NoSST etc.)

## OP OSSE setting will be discussed at SynObs web MT.

- SWOT, Satellite surface current obs, shallow sea profiles by gliders and other sources will be evaluated.

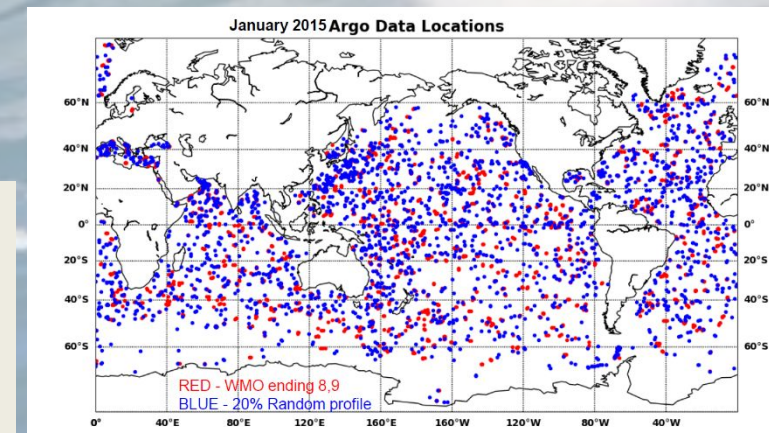
### ◆ Schedule

- Until the end of 2023: Assimilation (Reanalysis) Runs
- Until Apr 2024: Prediction Runs
- May 2024: WMO OIWS
- Nov 2024: OceanPredict Symposium

## Suggested OSE Settings

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

Distributions of Argo floats whose last digits of WMO number is 8 or 9 (red) and 20% random profiles (blue). Example for January 2015 (Thanks to Li Ren, NASA/GMAO.)



# ★ Database of the SynObs flagship OSE/OOSE output data

Table 1: Summary of the variables, resolution, frequency of output from each OSEs

	Daily	Pentad/Weekly	Monthly	Point Location
OP-OSE Analysis (OP-AN)	<b>OPA-D (OPA-DH)</b> Variables: OP-2 Resolution: 0.25°, 0.1° Frequency: Daily	<b>OPA-P</b> Variables: OP-1 Resolution: 0.25° Frequency: Pentad		<b>OPA-PL</b> • Argo (Daily) • Mooring (Hourly)
OP-OSE Forecast (OP-FC)	<b>OPF-D (OPF-DH)</b> Variables: OP-2 Resolution: 0.25°, 0.1° Lead Times: D1, D3, D7	<b>OPF-P</b> Variables: OP-1 Resolutions: 0.25° Lead Times: P1, P2		<b>OPF-PL</b> • Argo (Daily, D1-D10) • Mooring (Hourly, H1-H240)
S2S-OSE Analysis (S2S-AN)	<b>S2SA-D</b> Variables: S2S-2 Oc Resolution: 1° Frequency: Daily		<b>S2SA-M</b> Variables: S2S-1 Oc Resolution: 1° Frequency: Monthly	<b>S2SA-PL</b> • Argo (Daily) • Mooring (Daily)
S2S-OSE Forecast (S2S-FC)	<b>S2SF-D</b> Variables: S2S-3 Oc+Atm Resolution: 1° Lead Times: D1-D35	<b>S2SF-W</b> Variables: S2S-1 Oc+Atm Resolution: 1° Lead Times: W1-W18	<b>S2SF-M</b> Variables: S2S-1 Oc+Atm Res: 1° Lead Times: M1-M4	<b>S2SF-PL</b> • Argo (Daily, D1-D126) • Mooring (Daily, D1-D126)

- The SynObs flagship OSE/OSSE results are planned to be stored as netCDF files in the common database on a JAMSTEC-APL server and shared with the people who will collaborate for diagnosing the OSE/OSSE results, as well as prediction centers.
- The database will be constructed as a part of the digital twin ocean in JAMSTEC and contribute to the UN Decade Program DITTO.

Table 2: Variables in each variable group

Group	Included Variables
OP-1	3D-TSUV, SSH, SIC, SIT, SWHF, LWHF, LAHF, SNHF, NetHF, NetWF, Taux, Tauy Optional: TotalHF, TotalWF, Analysis Increment (3D-TSUV, SSH)
OP-2	SST, SSS, SSU, SSV, SSH, 0-50mT, Z20, Z26, TCHP, MLD005, 15mU, 15mV
S2S-1	<b>Ocean:</b> 3D-TSUV, SSH, 0-300mT, Z20, MLD001, 0-300mS, SIC, SIT, 0-50mT, Z17, Z26, Z28, TCHP,MLD005, ILD05, SWHF, NetHF <b>Atmosphere:</b> 3D-TZUVQ, T2m, U10m, V10m, Precip, LWHF, SWHF, LAHF, SNHF, Taux, Tauy, MSLP, Total Cloud Cover, OLR
S2S-2	<b>Ocean:</b> SST, SSS, SSU, SSV, SSH, 0-300mT, Z20, MLD001, 0-300mS, SIC, SIT, 0-50mT, Z17, Z26, Z28, TCHP, MLD005, ILD05, SWHF, NetHF <b>Atmosphere:</b> 3D-TZUVQ, T2m, U10m, V10m, Precip, LWHF, SWHF, LAHF, SNHF, Taux, Tauy, MSLP, Total Cloud Cover, OLR
S2S-3	<b>Ocean:</b> SST, SSH, SIC, MLD001, ILD05 <b>Atmosphere:</b> OLR, U200, U850
Point Location	<b>Argo:</b> TS <b>Mooring:</b> TSUV, SWHF, NetHF



# ★ Plan of SynObs Flagship OSEs/OSSEs

- SynObs plans to implement OSEs/OSSEs using various ocean prediction systems with a common setting.
- More than 10 systems will participate in the flagship OSE/OSSE project

## ◆ OP (Ocean Prediction) OSEs

- Use higher-resolution ocean DA and prediction systems.
- Assimilation run for 2020 (2020-2022 if possible)
- 10-day predictions: Started from every pentad

## ◆ S2S OSEs

- Use coupled prediction systems including lower-resolution ocean DA for initialization
- Reanalysis run for 2003-2022
- Subseasonal (1-month) predictions: Once a month
- Seasonal (4-month) predictions: from May and Nov.

## ◆ OP OSSEs

- Use GEOS/NASA coupled simulation as the Nature Run
- 1-year assimilation run and 10-day predictions from every pentad

Systems participating in the OP OSEs

Center	System	Area	Res. (Deg.)
UK MetOffice	FOAM	Global	1/12
NOAA/NCEP	RTOFS-DA	Global	0.08
ECMWF	ORAS5/6	Global	1/4
NASA/GMAO	GEO-S2S V3	Global	1/4
JMA/MRI	MOVE-G3F	Global	1/4
ECMWF	GIOPS	Global	1/4
NOAA/NCEP	GLORe	Global	1
NOAA/QUOSAP	MOM6	Global	?
JAMSTEC-APL	JCOPE-FGO	Semi-glob.	0.1
JMA/MRI	MOVE-NP	N Pac.	1/10x1/11
Pukyong Uni.	KOOS-OPEM	N. Pac	1/24
REMO-UFBA	HYCOM-RODAS	S. Atl.	1/12
MetService, NZ	MetService, NZ	S. Pac.	1/24

Name	Region	Res.	Ocean Prediction (OP) OSE										OP OSSE	S2S OSE
			CNTL	NoAlt	NoArgo	NoMoor	NoSST	NoInsitu	SSTonly	Free	HalfArgo	Oper		
FOAM	G	1/12	Yes	Yes	Yes	Pyes	Pyes	Pyes	Ifpos	Ifpos	Ifpos	Ifpos		
RTOFS-DA	G	0.08	Yes	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Ifpos	No		
ORAS5/6	G	1/4	Yes	Yes	Yes	Yes	Yes	Yes	Pyes	Yes	Pyes	Yes		Yes
GEO-S2S V3	G	1/4	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Ifpos	Ifpos	Pyes	Yes		Yes
MOVE-G3F	G	1/4	Yes	Pyes	Yes	Yes	Pyes	IfPos	Yes	Yes	Pyes	Ifpos	Yes	Yes
GIOPS	G	1/4	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Pyes	Yes	Yes
GLORe	G	1	Yes	No	ifpos	Ifpos	Ifpos	Yes	Ifpos	Yes	Pno	No		Yes
QUOSAP (MOM6)	G	?	Yes	Ifpos	Ifpos	Ifpos	Ifpos	Ifpos	Ifpos	No	No	Pyes	Yes	
JCOPE-FGO	Semi-G	0.1x0.1	Yes	Pyes	Pyes	Pyes	Pyes	Pyes	Ifpos	Ifpos	Ifpos	Ifpos	Yes	
MOVE-NP	NP	1/10x1/11	Yes	Pyes	Pyes	Ifpos	Ifpos	IfPos	Yes	Yes	Pyes	No	Yes	
KOOS-OPEM	WNP	1/24	Yes	Yes	Yes	Ifpos	Yes	IfPos	Yes	Yes	Pyes	Ifpos	Yes	
HYCOM-RODAS	SA	1/12	Yes	Yes	Yes	Pyes	Yes	No	Yes	Yes	Yes	No		
Moana Forecast	SP	1/24	Pno	Pno	Pno	No	Pno	Pno	Pno	Yes	No	Yes	Yes	
Yes + Pyes			12	10	10	8	9	7	7	9	7	5	7	5



# ★ How will we analyze OSE/OSSE results?

## □ Assign variables/diagnostics and regions to potential groups and request analysis.

### □ Analysis of variables or diagnostics for the global ocean

- ◆ Impact of Argo on heat budget and surface flux (ECCC)
- ◆ Diagnostics related to tropical cyclone (Ocean Observing CoDesign TC Exemplar Team)
- ◆ Comparison b/w forecasted value and Argo observation (OceanPredict IV-TT)
- ◆ Trajectory of Drifters (UKMO)
- ◆ Heat budgets and MHWs (ECMWF)
- ◆ Near-surface ocean current (ABoM)

## □ Regional Analysis

- ◆ MLD in tropics (Colorado Uni)
- ◆ Tropical waves - Peru coast (CEZA)
- ◆ WN Pacific (JMA/MRI)
- ◆ Brazilian Coast (UFBA-REMO)
- ◆ Agulhas Current (SAFWS)
- ◆ Arctic and Antarctic (NOAA NWS EMC)
- ◆ Indian Ocean (INCOIS)
- ◆ Western North Atlantic (S. Caroline Uni.)

