

Synergistic Observing Network for Ocean Prediction (SynObs)

SynObs is endorsed as the UN decade project under ForeSea program, and collaborating with Observing System Co-design and CoastPredict.

Objective

Extract maximum benefits from the combination among various observation platforms, typically between satellite and in situ observation data, in ocean predictions.

Strategy

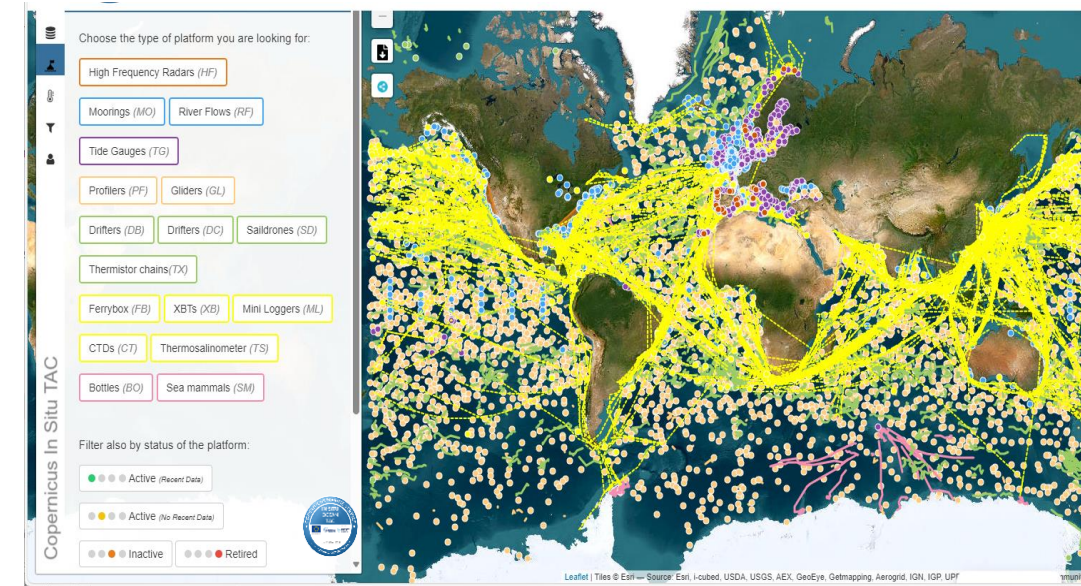
Design, produce and analyze observing system design/evaluation experiments to assess the complementarity of different ocean observation platforms to improve ocean analysis, short term ocean forecasts and coupled ocean-atmosphere subseasonal to seasonal (S2S) forecasts.

Planned multi system OSE experiments

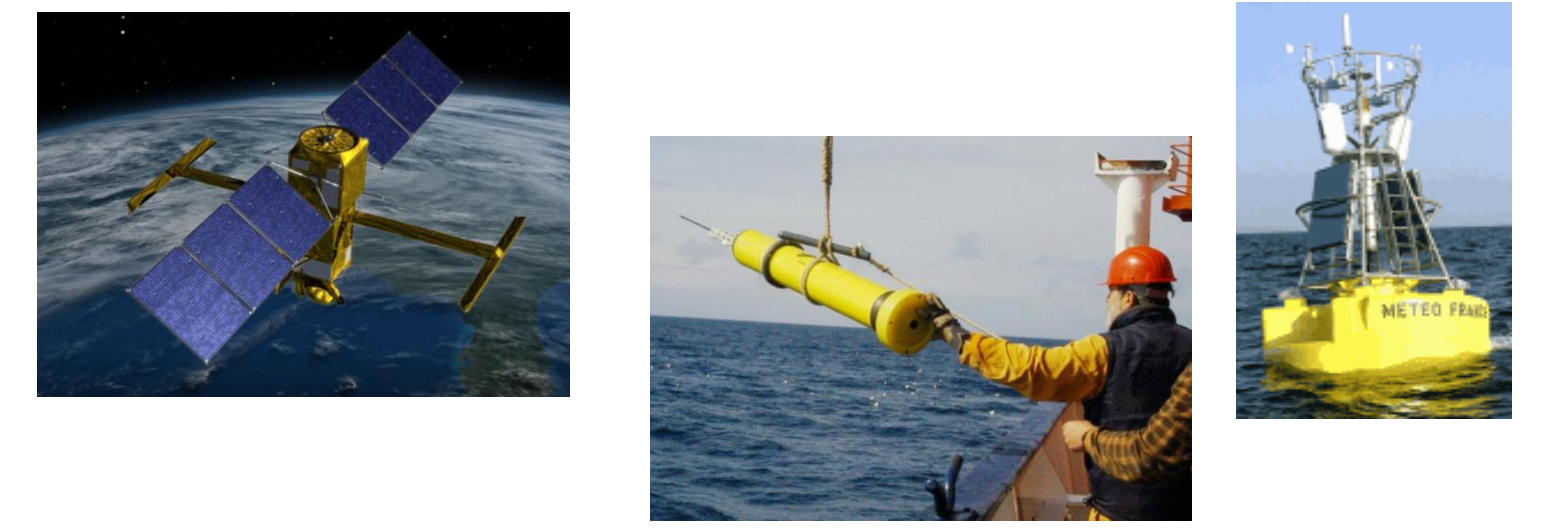
The role of the different observing network to constrain ocean analysis, forecasts and subseasonal to seasonal prediction is assessed by comparing two similar assimilation experiment where in one of them a given set of observation is withheld. Such experiments are called OSE for Observing System Evaluation and OSSE for Observing System Simulation Experiment when the observations are simulated. The later approach is used for future observations.

Operation	Ocean Model	Oper. Setting	SST	Argo	Moor	Other TS	Nadir Alti.
InsituAlti	Ocean Model		SST	Argo	Moor	Other TS	Nadir Alti.
NoArgo	Ocean Model		SST		Moor	Other TS	Nadir Alti.
NoMoor	Ocean Model		SST	Argo		Other TS	Nadir Alti.
Insitu	Ocean Model		SST	Argo	Moor	Other TS	
SatOnly	Ocean Model		SST				Nadir Alti.
SSTOnly	Ocean Model		SST				
Free	Ocean Model						
SWOT	Ocean Model		SST	Argo	Moor	Other TS	SWOT
FullAlti	Ocean Model		SST	Argo	Moor	Other TS	Nadir Alti. SWOT

Ocean predictions OSEs: 2020 up to 2022
10-day predictions
Sub.to Seasonal prediction OSEs: 2003-2022
Subseasonal (1-month) predictions
Seasonal (4-month) predictions



<https://marineinsitu.eu/dashboard/>



Center	System	Area	Res. (Deg.)
UK MetOffice	FOAM	Global	1/12
NOAA/NCEP/EMC	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
ECCC	GIOPS	Global	1/4
NOAA/NCEP/CPC	GLORe	Global	1
NOAA/QUOSAP	MOM6	Global	?
JAMSTEC-APL	JCOPE-FGO	Semi-glob.	1/10
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	Moana Forecast	S. Pac.	1/24

The design of the experiments is detailed here:
https://oceanpredict.org/docs/Documents/SynObs/SynObs_FlagshipOSE_Guideline_Ver1.pdf

Planned diagnostics:

- Impact of Argo on ocean Heat budget, marine heat waves and surface flux imbalances and on Sound Speed Profiles estimates
- Tropical Cyclone-related quantities of interest (0-50mT, Z20, Z26, TCHP, MLD) (done in collaboration with the TC ObsCoDe Exemplar)
- Representation of mesoscale Eddies in the Sea Surface Height
- Verification and intercomparison of near-surface ocean currents
- Lagrangian drift comparisons to drifters
- Innovation (observations – forecast) statistics for OP OSEs (in collaboration with the OceanPredict Intercomparison and Validation Team) and for S2S OSEs

Analysis per basin or regions will also be conducted, targeting more the representation of key regional features of interest.

The multi system approach is helping to reduce the results to the system dependency, helping to draw more robust conclusion on the impact of the different observing network.

Preliminary results from the multi-system OSEs

- No altimeter very similar to Free Run. Altimeter observations provide observed eddies.
- However, even without altimeter, NoAlt expt shows enhanced probability of detection over Free run for eddies less than 100km.
- SST observations can provide observed eddies less than 100km (seen in SSTonly run.)
- Adding profile observations may slightly degrade this by adding false alarms (not shown).
- See Smith and Fortin [2022] (<https://doi.org/10.1016/j.ocemod.2022.101982>)

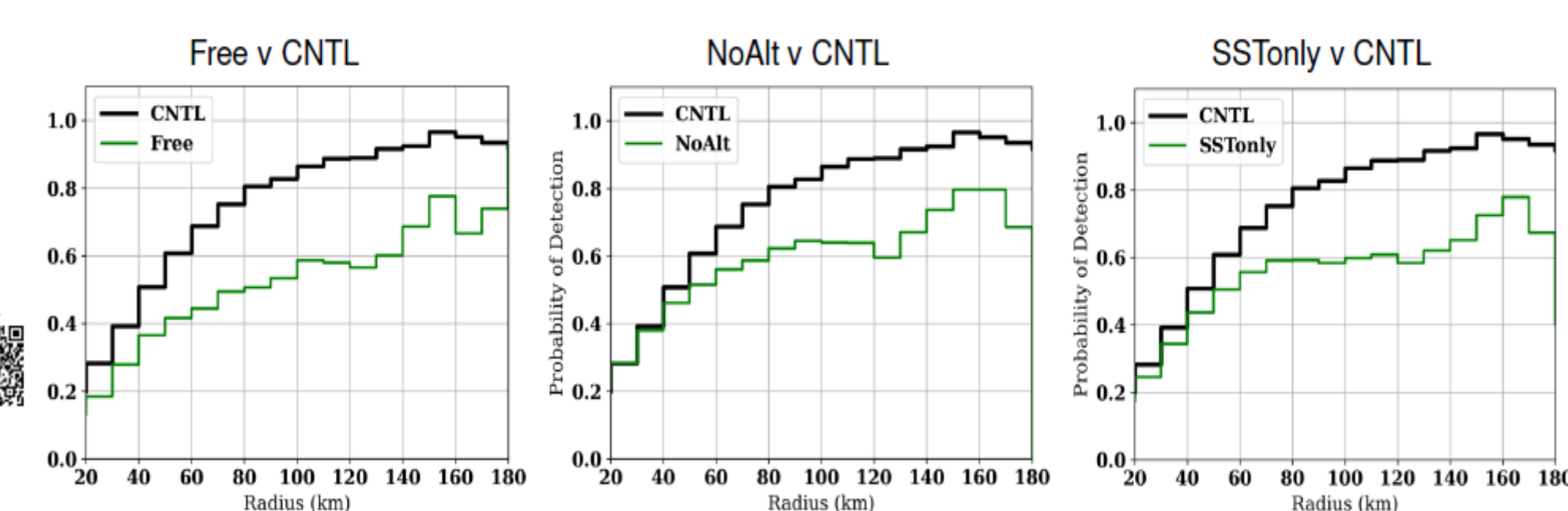
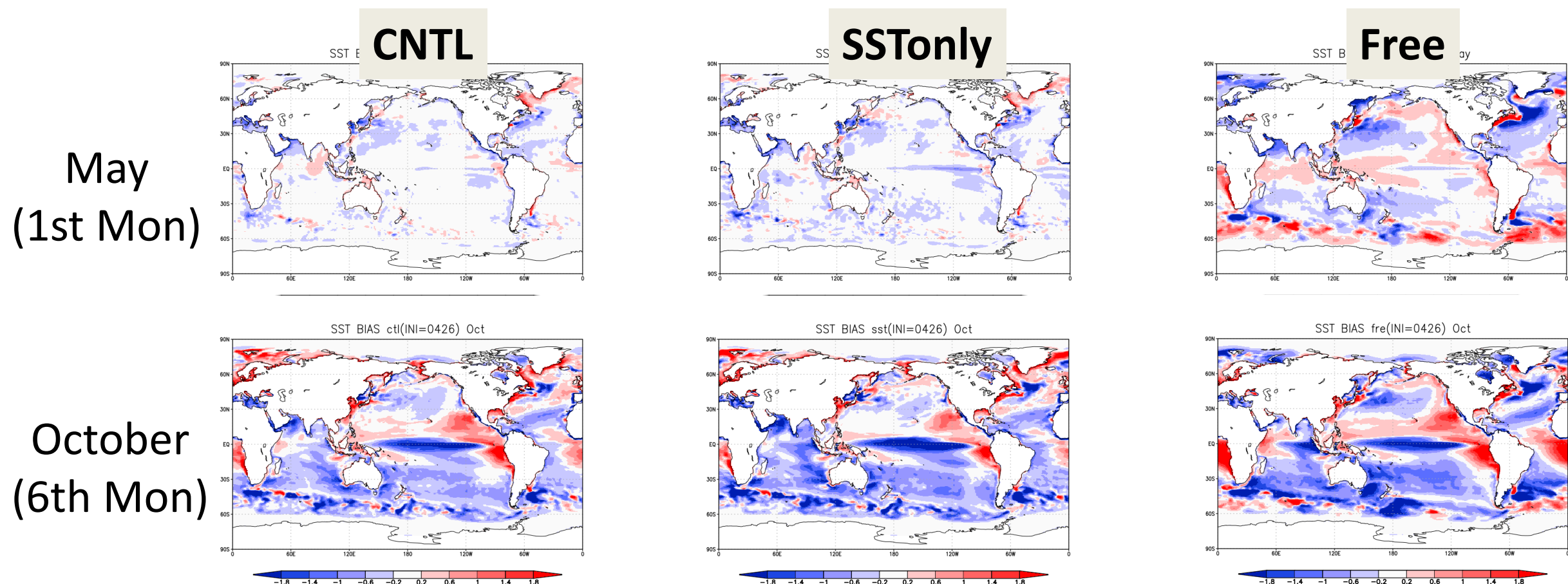


Figure 2: Probability of matching an observed eddy through cost function based on amplitude, radius and distance. Higher probability of detection implies increased skill.

Smith and Fortin (Oc. Mod. 2022) (! Not synobs?)

S2S prediction OSE in JMA/MRI



➤ The cold bias in the equatorial Pacific and the south hemisphere in SSTonly in the 1st month is reduced by assimilating in-situ and satellite altimetry data in CNTL. the SST bias is clearly reduced in the North Pacific in the range in SSTonly (6-month)

Expected outcomes

- 1. Providing information from ocean prediction systems on regular basis**
 - Monitoring the use of ocean observations in Ocean prediction and S2S systems
 - demonstrate the value of an observation network for operational analysis and forecasts,
 - help refining planned evolution of satellite and *in situ* observing networks from an integrated monitoring and forecast ocean and coupled system perspective.
- 2. Supporting DA scheme development**
 - Encourage discussions in DA-TT seminar series, OceanPredict Symposium in 2024, SynObs workshop in 2026.
 - Encourage developments of the methods for near-real-time observing system evaluation (e.g., DFS, FSOI, Array-mode, Multi-system ensemble, etc.)
- 3. Communication**
 - **Special issue on Frontiers in Marine Science Research “Demonstrating observation impacts for ocean and coupled prediction” planned for 2024 and at the end of the analysis of the flagship OSEs**
 - Dedicated talks / session at international conference (Science Session at the Ocean Science Meeting 2024, talks at to WMO observation impact workshop, ...)
 - Relay the ... of the experiment to the network (provider)

A public data archive center will be established in JAMSTEC to store the OSE data and make them accessible to participants. Volunteers to analyze the observation impacts from the OSE outputs are welcome to join the project.