

# OceanGliders Data Assimilation Task Team

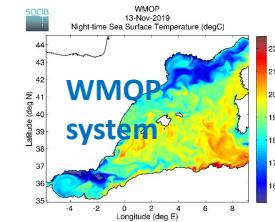
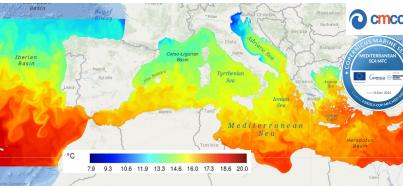
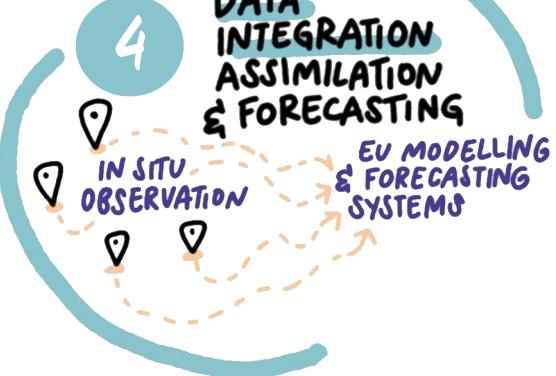
Ali Aydogdu, Elisabeth Remy, Ann Kristin Sperrevik, Victor Turpin



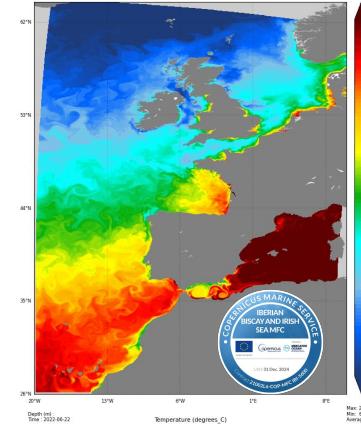
30 January 2024 - OceanGliders Steering Team Meeting



# EuroSea



Daily Global Physical Bulletin 1/12 - (B136QV5R1)  
Date: 2022-06-26 (4-day forecast)  
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**Task 4.1&4.2** Assimilation of gliders and floats in the Copernicus Marine systems: analysis/forecast quality assessment

30 January 2024 - OceanGliders Steering Team Meeting



- the best practices in use of glider and floats in-situ observations by operational forecasting systems
- On the accessibility to the glider / Argo floats observations in NRT and DT mode.
- On the quality control (QC) in the assimilation systems



Internal Milestone #28

Joint workshop between CMCC SOCIB Task 4.2, Task 4.3, Task 4.4 partners and WP3 on sharing best practices on how to use novel sensors (glider, floats) data for assimilation and validation in the CMEMS (global and MED) and SOCIB operational systems (physical and biogeochemical)

Date: 24 June 2021 10:00-12:00 CET

**Goal:** EuroSea Task 4.2 aims at evaluating the impact of the glider and BGC Argo observations on marine forecasting systems in the Mediterranean Sea. The question of where and how to access the data in both near-real-time (NRT) and delayed-time (DT) is critical for this task. Several issues have been identified concerning the glider data availability, especially for NRT systems. The objective of this workshop is to bring together European experts on glider data collection, processing and management with the data assimilation experts to open a discussion on this issues and propose solutions to use glider and float observations in operational forecasting systems in the best possible way.

#### AGENDA

10:00-10:15 Objectives and overview of the status (Ali Aydogdu)

10:15-10:25 Update on SOCIB experience (Jaime Hernandez)

10:25-10:35 NRT and delayed mode data exchange strategy and further opportunities (Victor Turpin / Daniel Hayes)

10:35-10:45 The status of glider observations in the CMEMS (Thierry Carval)

10:45-12:00 Discussion

#### *Best practices on how to use novel sensors (gliders and floats) for assimilation and validation*

##### A need...

- for more time to assimilate the high-quality glider and BGC-Argo observations in the NRT systems however, DM observations are already high-quality and synchronized to the required repositories.
- to come up with a universal solution. CMEMS (European) and SOCIB (Baleares) systems involved in EuroSea can be taken as a base to detect the need for improvements and propose solutions for every step of the data flow and usage.
- for communication between the communities, e.g., Argo vs. Glider communities to converge on coherent procedure and avoid inconsistencies, Argo + Glider vs. modelling + assimilation communities for the best practices on the use of observations in forecasting and reanalysis systems, e.g., on QC standards.

**Leveraging the multi-system glider data assimilation experiments within EuroSea to the international level**

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This poster aims at enhancing the cooperation between the ocean operational community and ocean observing community to:

- Advocate for sustainability of in-situ observations
- Show the role and potential of gliders data in improving the ocean estimates
- Identify future needs and opportunities from an operational perspective
- Identify best practices of the observation system, data assimilation, data management and quality control
- Disseminate results required during forums
- Strengthen the diversity of studies and the need for joint perspectives from each communities to leverage distributed efforts

**Assimilation of gliders in EuroSea**

Gliders are sampling routinely every region of the European Seas (SW, North Sea, Baltic, Arctic and Mediterranean Sea), supported by 12 European partners. Gliders are coordinated (cooperatively) and regularly (EuroGODIS).

Gliders contribute significantly to the number of vertical profiles in the ocean.

Gliders are used routinely along regular lines producing a long term time series of high resolution data available in real time.

It is crucial to understand how to benefit the best way from this sustained coordinated ocean observing by improving the quality of the data assimilated and the accuracy and consistency of the assimilated system.

A perspective from OceanPredict

Argo gliders and dedicated fleet of gliders are operated worldwide to monitor the boundary systems (California Boundary Glider Network, Mediterranean Ocean Observing System for Boundary Currents, and the North Atlantic Boundary Currents and Features of the Boundary Currents (NABC)) and observe the deep water convection in Labrador Sea.

Various types of these regional monitoring systems mostly assimilated in different operational hydrodynamic models.

- Glider assimilation can improve coupled hurricane forecast (Espin et al., 2017)
- High frequency variability (Data K. et al., 2018)
- Observe the effect of the assimilated gliders on the trajectory of boundary currents
- Glider vertical profiles need to be supported by surface drifters and other gliders to provide a better representation of the ocean (Keller et al., 2021)
- Develop glider fleet networking to facilitate the prediction (Aydogdu and Mourre, 2021), as well as adaptive learning strategy (Aydogdu and Mourre, 2012)
- Assimilate gliders in the ocean to predict the ocean circulation (Aydogdu and Mourre, 2018)

Dedicated efforts are needed to continue to improve the efficiency of glider assimilation, to increase the number of gliders in the ocean, to expand the glider networks when in operational mode, and to develop glider forecasting approaches.

Future works include:

- Coordinated glider dives targeting assimilation experiments
- Calibration of glider data to assimilate various procedures
- Investigating the assimilation of correlated observations in the water column

**Further studies on the glider assimilation**

Home Remedying  
Toward Better Hurricane Predictions of Atlantic Hurricane (Solin et al., 2015)

While Tropical Cyclone (TC) trajectory forecasts have improved consistently since 1970, short-term forecasts remain challenging. Hurricane intensity forecasts have been less successful. Hurricane intensity forecasts are critical for emergency preparedness and safety. It is important to improve hurricane intensity forecasts to reduce the impact of these events. This study focuses on the development of a new category of metrics, Assimilation of TC and TCs to reproduce ocean observations to improve TC intensity forecasting.

Glider forecast forecasting and analysis  
Why do we need glider assimilation in the Oregon-Washington Coastal Ocean-40B0 System With and Without Surface Observations, (Kurobe et al. 2021)

This study shows that it can be diagnostic to assimilate glider data in the coastal ocean. The high-resolution coastal model need to have assimilated glider data to improve the forecast. But these data are not supported by current observations.

The Oregon-Washington Coastal Ocean-40B0 System With and Without Surface Observations, (Kurobe et al. 2021)

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What's next?  
Advocate for OceanPredict representatives in the OceanPredict and OceanGlider representatives in the OceanGlider coordination bodies

International bodies like OceanPredict and OceanGlider should permanently include representatives of each communities in their coordination body to disseminate progresses and enhance scientific cooperation.

Sharing the best assimilation practices  
Ocean data assimilation practices is not very well known by the ocean observing community. This lack of shared knowledge between the two communities, is limiting scientific cooperation that is proposed in this poster. To overcome this situation, the OceanPredict community has recently open a dedicated repository for GitHub page: [https://github.com/OceanPredict/oceanpredict\\_assimilation\\_practices](https://github.com/OceanPredict/oceanpredict_assimilation_practices)

Engage in the RTCP Standard Operational Practices  
The RTCP Standard Operational Practices is a set of guidelines for the assimilation community. The standard operational practice for Real Time Quality Control is open to anyone interested in the best to suggest and improve RTCP for glider data. Data assimilators are amongst the number one user of the glider data real time, their feedback and comments is essential to build efficient RTCP.

**29 JUNE – 1 JULY 2022**  
**EuroSea/OceanPredict**  
Workshop on Ocean Prediction and Observing  
**EuroSea**  
Advancing the science of ocean prediction

**29 JUNE – 1 JULY 2022**  
**EuroSea/OceanPredict**  
Workshop on Ocean Prediction and Observing

**Assimilation of gliders in the Western Mediterranean**

Ali Aydogdu<sup>1</sup> on behalf of EuroSea WP4 Task 4.1 and 4.2  
Elizabeth Remy<sup>2</sup>, Baptiste Mourre<sup>3</sup>, Romain Escudier<sup>4</sup>, Jaime Hernandez-Lasheras<sup>5</sup>, Jenny Pistorio<sup>1</sup>, Alessandro Grandi<sup>1</sup>

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 962626.

Participation to EuroSea/OceanPredict workshop to present the collaboration between assimilation and observation communities.

Participation to OceanGliders BestPractices Workshops

[OceanGlidersCommunity / data\\_assimilation\\_practices](https://github.com/oceangliderscommunity/data_assimilation_practices)

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1 main · 1 branch · 0 tags Go to file · Add file · Code About

soerenthomenen Update README.md cfc4c47 · 8 minutes ago · 12 commits

DYNAT-O-09-00002-3.pdf early glider data assimilation experiment 1 hour ago

README.md Update README.md 8 minutes ago

key\_literature.md Update key\_literature.md 44 minutes ago

README.md

Data Assimilation Practices

In this repo we collect literature and approaches on glider data assimilation practices.

Read key literature here You have issues with glider data assimilation?

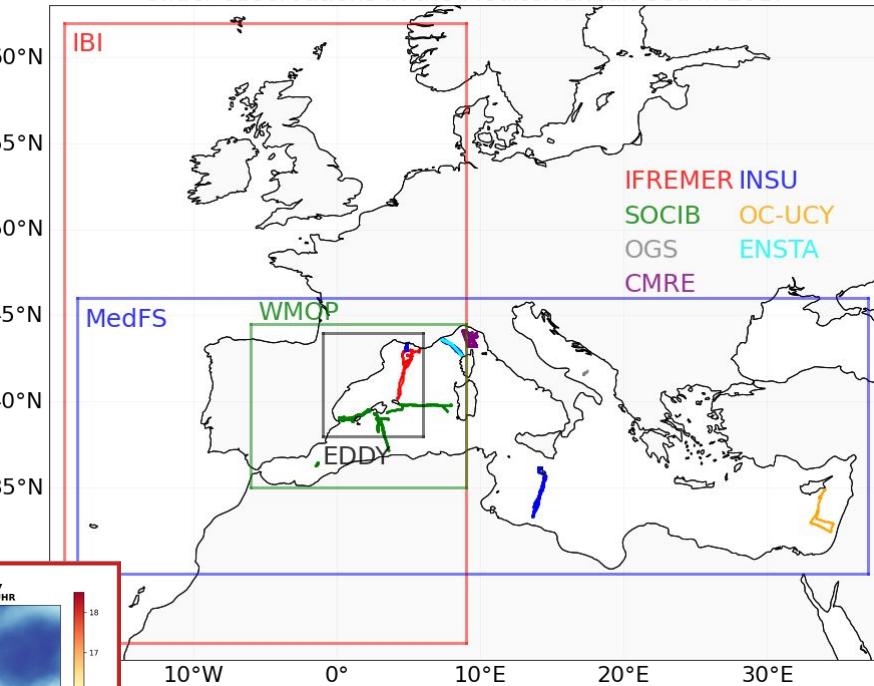
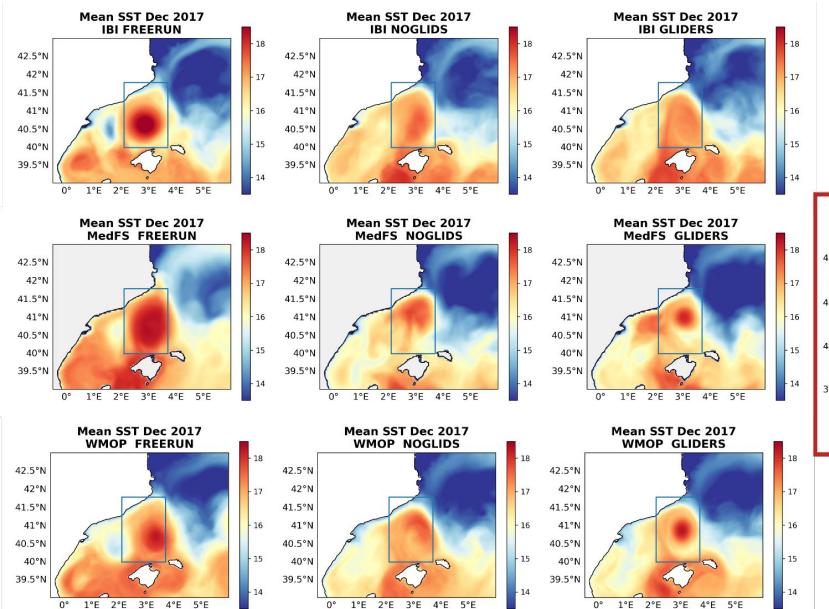
Short term goals

- collect glider data assimilation practices
- reports and papers
- share lessons learned

Mid- and longterm goals

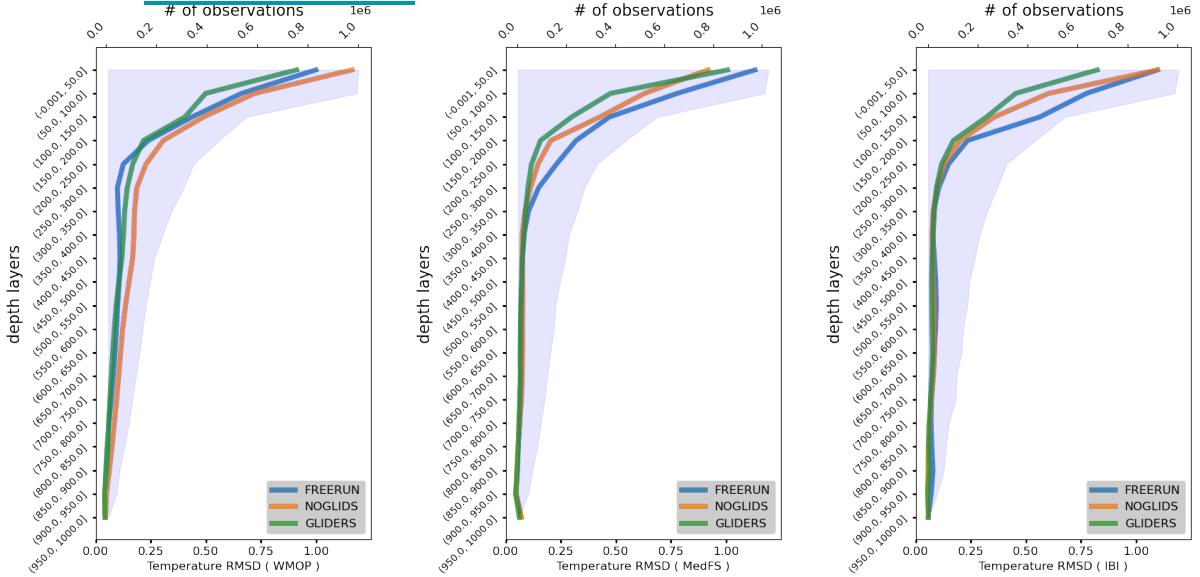
- develop best practices and Standard Operating Procedures (SOPs)
- harmonize approaches

→ Evaluation of the ability of glider DA to correct mesoscale structures (fronts, eddies) e.g., intense anticyclonic eddy in the Balearic Sea (Aguiar et al. 2019; OSR3, Aguiar et al. 2022, JGR-Oceans)



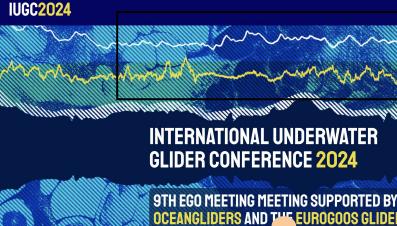
# Keep up to date bibliographic references

Report on the use (assimilation, validation, ...) of glider observations in OceanPredict systems:  
Observations table(s) (operational centre usage) - Ocean Predict



Center/ Institute	System Name	ABOUT				FOCUS				SCIENCE				UN DECADE				TEAMS				EVENTS				NEWS				DOCUMENTS							
		Drifter/ Temp.	Drifter/ Velocity	Drifter/ ocean waves	Drifter/ SLP	Ocean glider/ Temp.	Ocean glider/ Salinity	Animal/ bornet Temp.	Ice buoy/ drift	Ice tethered profiler/ Temp.	Ice buoy/ / Salinity	ALAMO	Tide Gage	Coastal Wave Recorders	Notes																						
BuB (CSIRO)	OceanMAPS	Level 1	Level 1			Level 3	Level 3	Level 3																													
CHM- REMO	RODAS								Level 1																												
EC3C	GIDPS (global 1/12)	Level 5	Level 1			Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5							
	RIDPS (Pac-Arctic-Natl 1/12°)	Level 5	Level 1			Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4							
ECMWF	OCEANS Global 1/4	Level 1	Level 1			Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5							
	ECWAM					Level 1																															
INCOIS	RAIN (1/12 degree)																																				
	INCOIS-GODAS (1/2X1/4 global)																																				
	HYCOM (1/12 degree)																																				
	SWAN																																				
	WAVEWATCH III (1 degree)																																				
JMA	MOVE (Global)	Level 5							Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5					
	MOVE (Regional)	Level 5	Level 1						Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4	Level 4				
	Wave DA Systems								Level 4	Level 4																											
Mercator Ocean	RT Global 1/12°	Level 1	Level 1																																		
	Reanalysis 1/12°								Level 1																												
	Regional 1/36°																																				
MET Norway	TOPA24 (Pan Arctic)	Level 1	Level 1																																		
	WAM3km								Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5	Level 5			
Met Office	FOAM global and regional (1/4 and 1/12 degree)	Level 5	Level 1																																		
	FOAM shelf (1.5 km)	Level 5	Level 1																																		
	Coupled DA (1/4 degree)	Level 5	Level 1																																		
	WaveWatchII																																				
NASA GEOS	S2Sv2 global 1/2																																				
	S2Sv3 MERRA2 Ocean 1/4																																				
NOAA	RTGFS-DA	Level 5	Level 1																																		
CMCC	GOFS16 (global 1/16°)		Level 1																																		
	MEDFS																																				

Intercomparison to evaluate the ability of glider DA to improve error statistics.



## OGDA TT core scientific objectives

Cooperation with OGDM TT  
Best Practices TT

Cooperation with: Event base TT  
BOON TT

### OceanGlider Data Assimilation Task Team

R

**Improve observation error covariances**

H

*Develop/improve observation operators*

QC

*Better online quality control*

Process

*Identify processes / improve representation*

Subsampling/Superobing  
Correlations

Mapping the modelled observation

Blacklisting  
Timeliness for the NRT systems

transports  
eddies

Links OceanGliders to OceanPredict

Involves early career researchers putting hands on glider assimilation

Search for funding for better use of glider observations

Possible coordinated experiments using analysis/forecasting systems

deep water formation  
biogeochemistry