Time-lagged Ensemble Model Verification for Short-term Prediction of Drifter Trajectories

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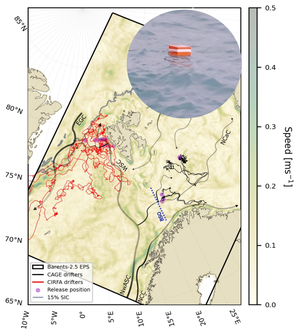
Why should we care?

Different stakeholders make use of operational surface ocean currents products, including emergency response centres.

Goal: evaluate the performance of an ensemble prediction system.

What did we do?



Scan me!

Two drifter data sets

CAGE *– Barents Sea, Aug. 2022.*

CIRFA *– Fram Strait, Apr. 2022.*

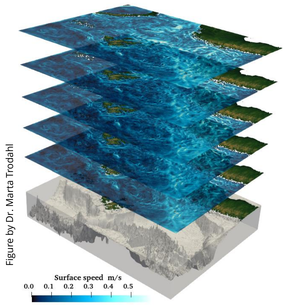
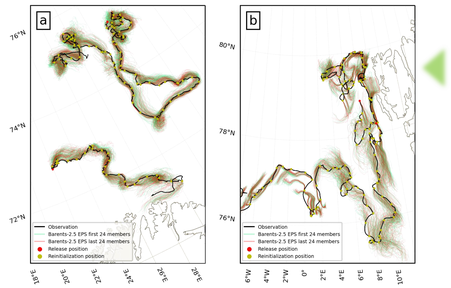


Figure by Dr. Marta Trodahl

Ensemble Prediction System

Ocean and atmospheric ***ensemble fields*** *from Barents-2.5 EPS [1].*

(48 time-lagged members)



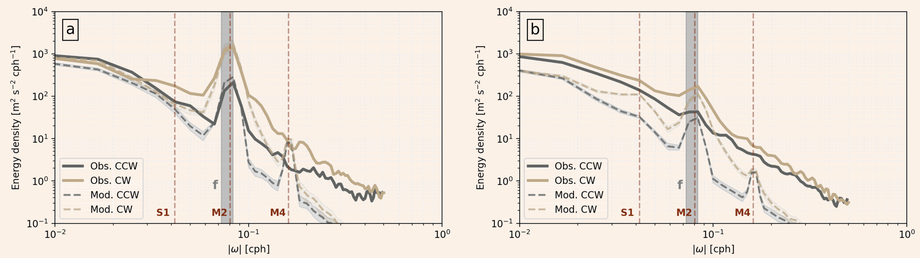
Trajectory Prediction

EPS fields used as forcing and simulations were ran for 5 days.

Evaluation

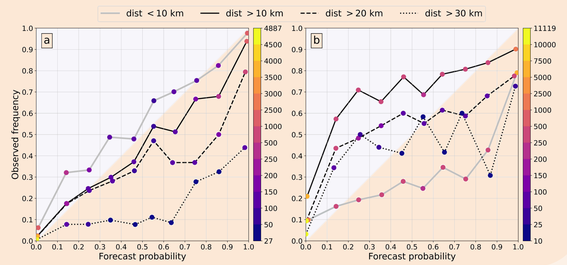
Rotary spectra, rank histogram, reliability diagram and error/spread.

What did we find?



- The EPS captures sub- to inertial motions well in the Barents Sea (a), but it lacks energy in the Fram Strait (b).
- Steeper modeled energy decay at superinertial frequencies.

Reliability holds **up to 20 km (~12 hours)** in the Barents Sea!



Data set	First 24 members Error, Spread [km] (mean, st. dev.)	Last 24 members Error, Spread [km] (mean, st. dev.)
CAGE	(6, 1.2), (2.6, 0.3)	(6, 1.2), (2.4, 0.4)
CIRFA	(10.9, 1.3), (2.3, 0.5)	(10.8, 1.3), (2.2, 0.5)

Virtually **no difference** between first (30 - 48 hours lagged) and last (analysis - 24 hours lagged) 24 ensemble members. Similar **spread**, higher **error** for CIRFA.

What are the take home messages?

Ensemble modeling should also become a **standard method** for **ocean currents prediction**.

The EPS performance is different between the two regions:

- **Surface observations are needed** in highly dynamic areas (e.g. Fram Strait) **to constrain the model's initialization and improve its reliability**.
- **Increasing** the **model's horizontal resolution** might **improve** the **energy density estimation**, but **not necessarily its predictive skill**.

What can we expect of SWOT?

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References

1. Röhrs, J. et al. - *Barents-2.5km v2.0: An operational data-assimilative coupled ocean and sea ice ensemble prediction model for the Barents Sea and Svalbard*. (2023). Doi: 10.5194/gmd-16-5401-2023.

Acknowledgements

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