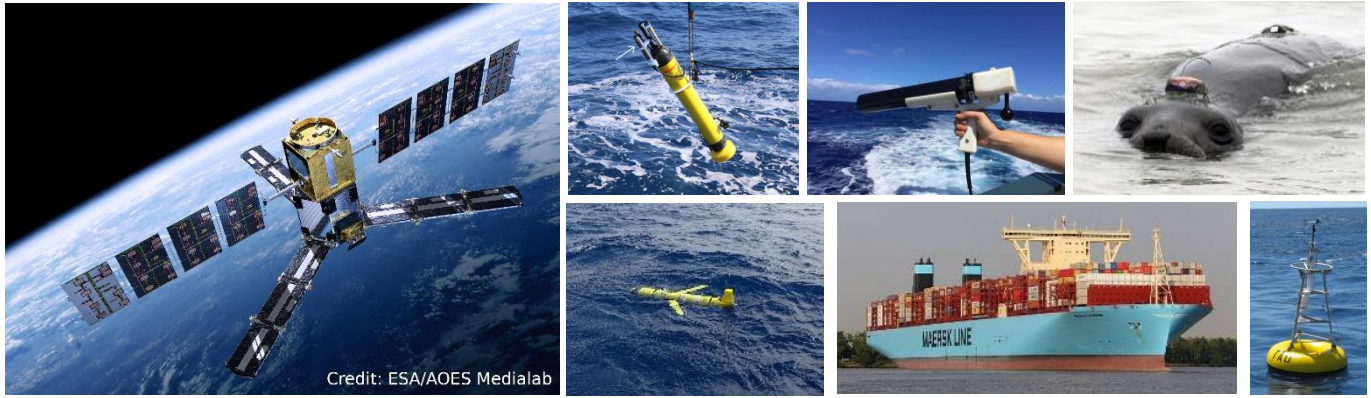
Zentrum für
Geoinformationswesen
der Bundeswehr

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Ocean Data Assimilation in the Earth System Model of the DWD

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Outline

- The ESM-W project at DWD
- The data assimilation system
- Ocean observations
- Verification results of experiment

Earth System Modelling at the Weather scale (ESM-W)

- DWD operationally runs a global and regional weather DA cycle and forecasting model (up to 10 days)
- Extend this to a coupled system atmosphere-land-ocean-sea ice
- 4+4 year project; started 2 years ago
- 8 project employees + support from permanent staff

Main goals of ESM-W

(1) Global coupled ocean-atmosphere forecasting system

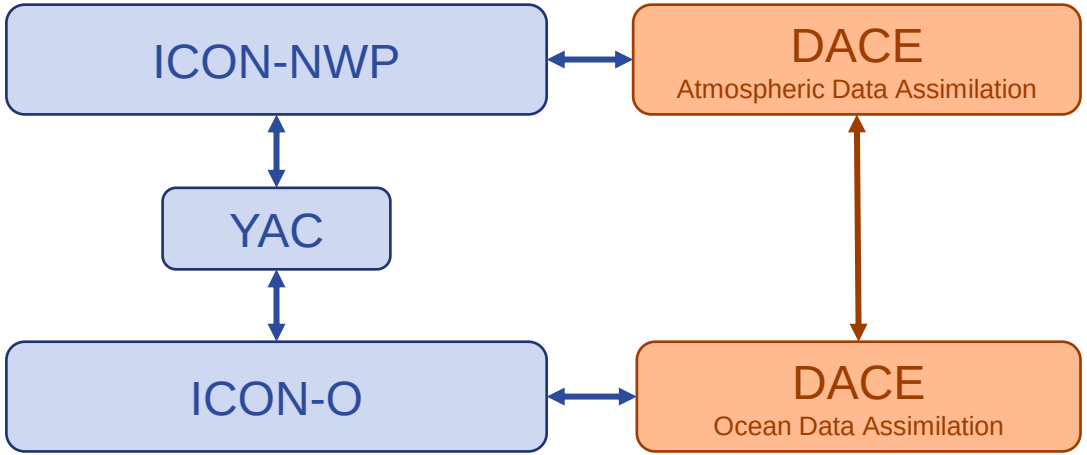
- with focus on forecasting horizons between 0-10 days

(2) Coupled data assimilation system

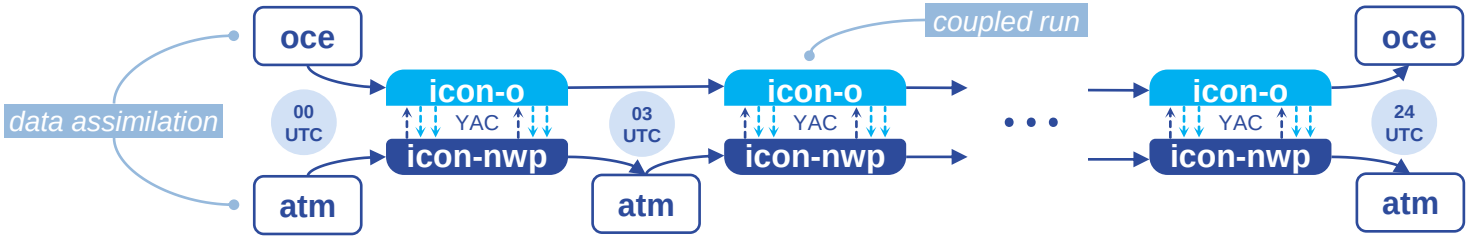
- based on the available atmospheric DA method (EnVAR + LETKF) and on a new ocean DA system (first 3DVAR, then EnVAR + LETKF)

(3) Regionalization of ICON-O

- ICON-O-LAM & ICON-O-ZOOM



Current experimental setup



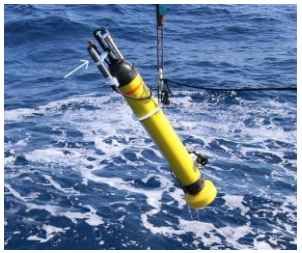
atmosphere

- 3DVAR 3 hourly
- conventional and satellite data
- No IAU
- 80km (R02B05) + 90 levels
- start: operational DWD coarsened

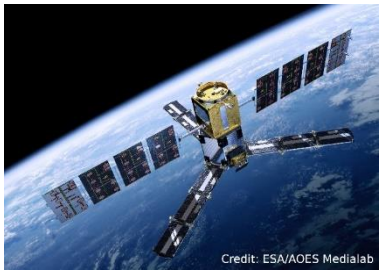
ocean

- 3DVAR daily (00 UTC)
- ARGO CTD, SMOS SSS, FGAT OSTIA SST
- No IAU
- 40km (R02B06) + 72 levels
- Start: climate + pre-industrial/historical

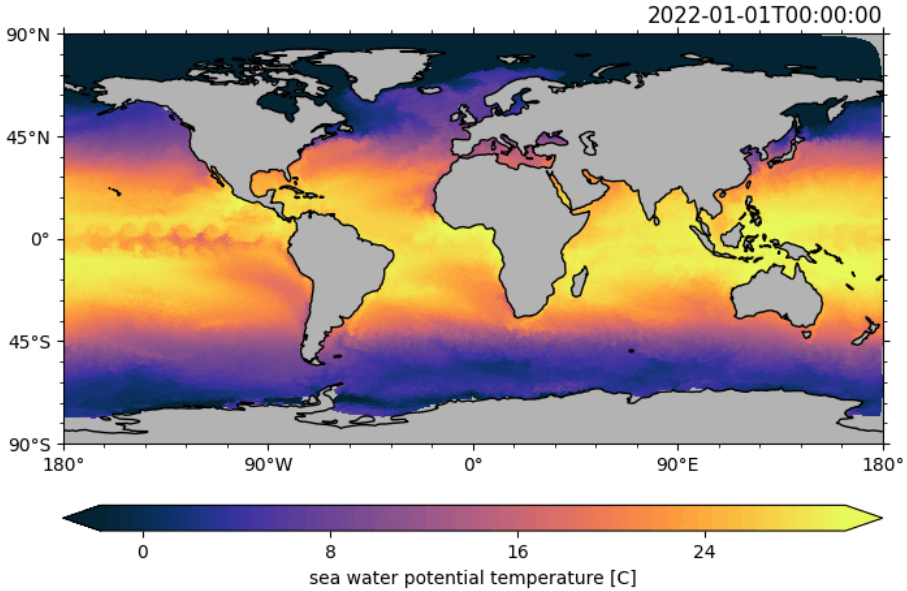
Ocean observation

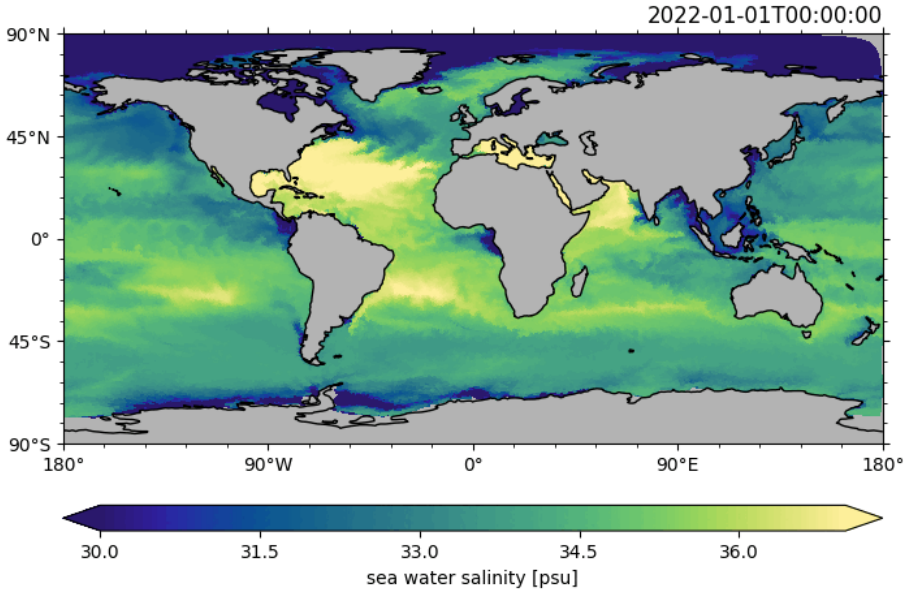


- In situ
  - ARGO profiles
  - DRIBU; not assimilated, used for independent verification
- Satellite ocean products
  - OSTIA SST
  - SMOS SSS
- Satellite ice products
  - OSTIA sea ice fraction (SSMIS)
  - OSISAF sea ice fraction (AMSR2); not assimilated, used for independent verification

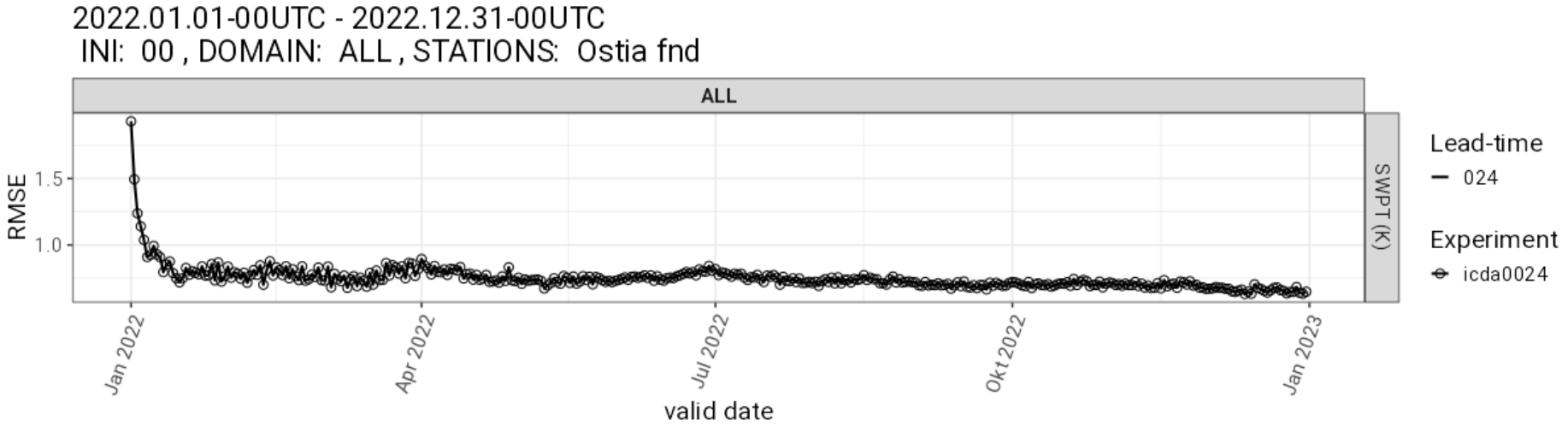


Experiment results

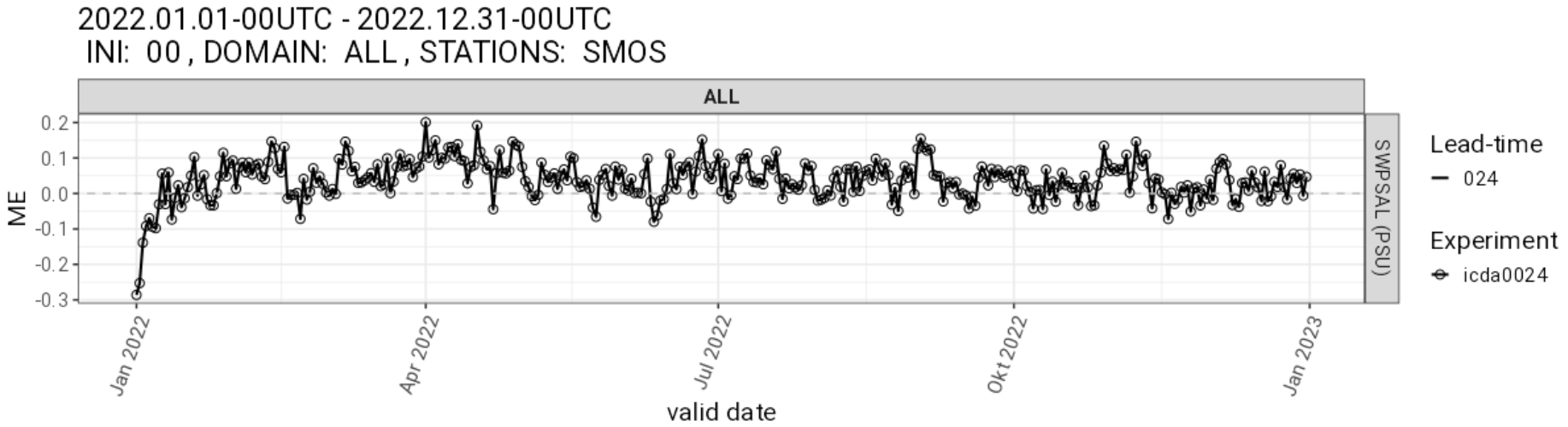




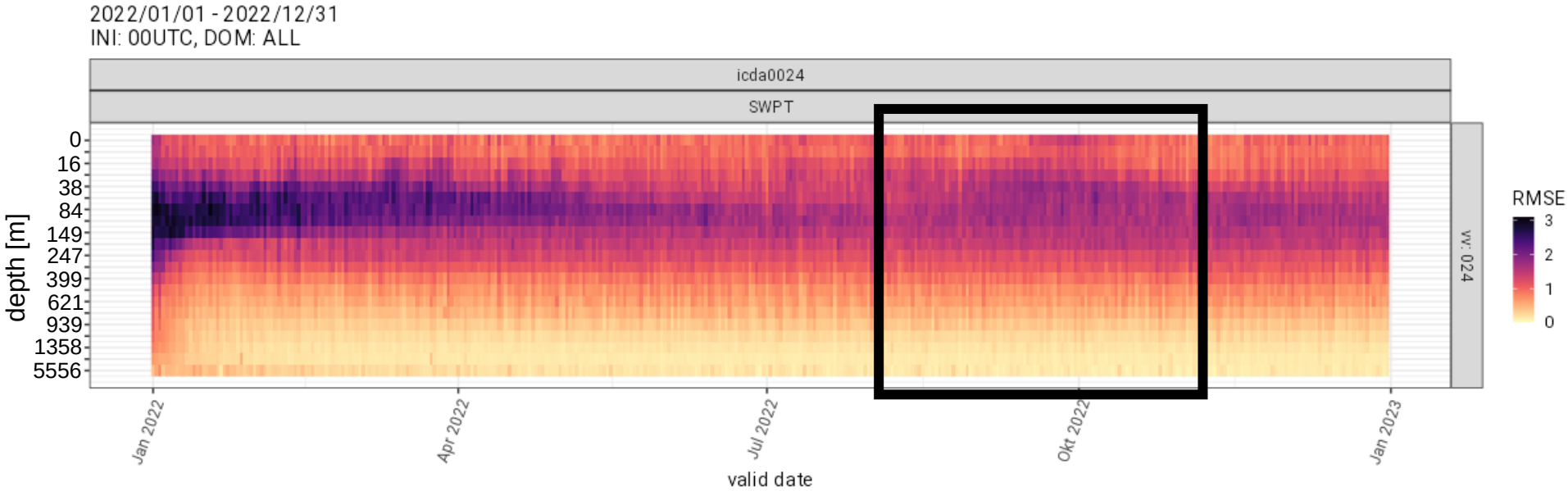
Verification: RMSE against OSTIA SST



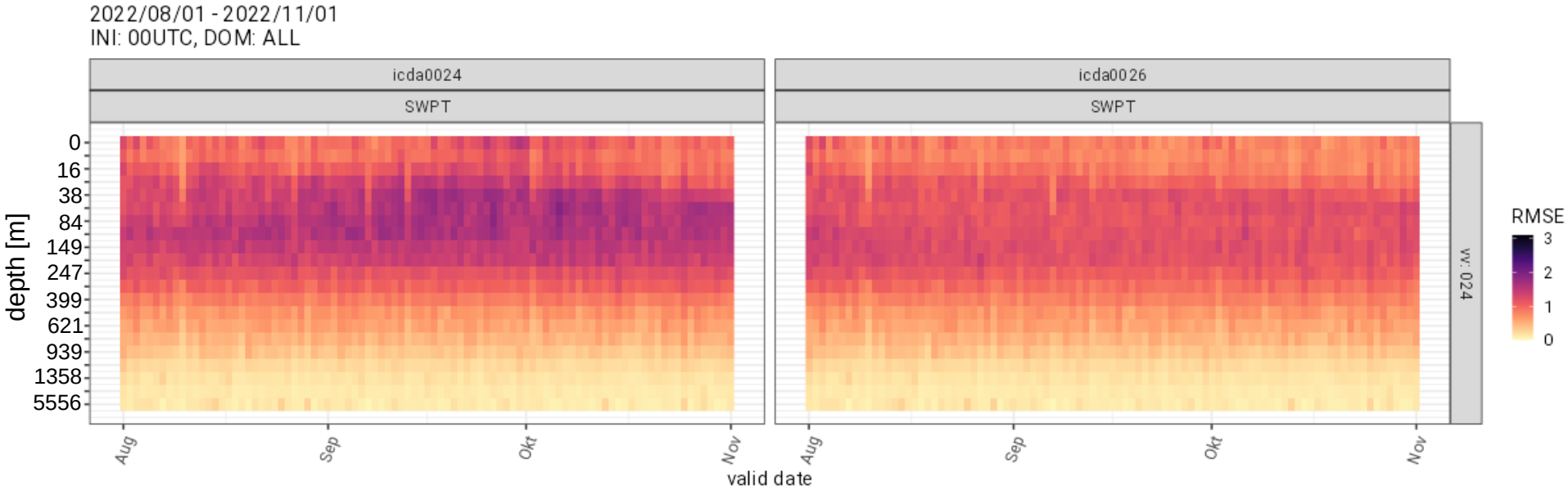
Verification: Bias against SMOS SSS



Verification: RMSE against ARGO T



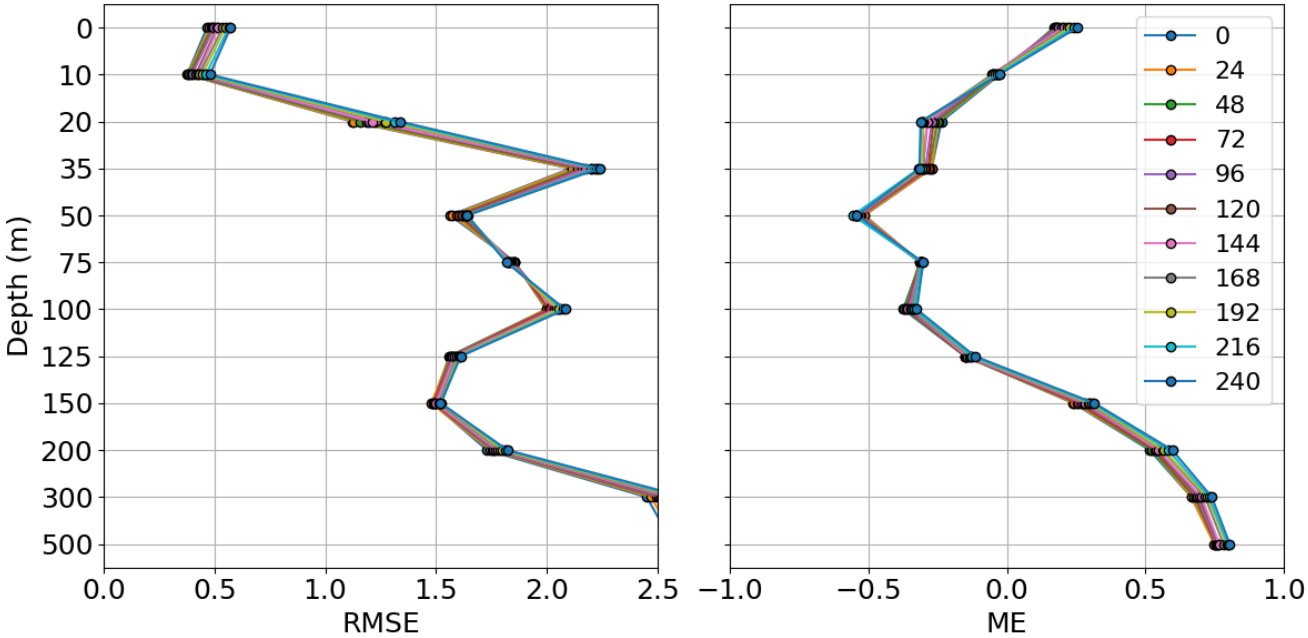
Verification: RMSE against ARGO T



icda0026 uses model MLD for vertical combination of ARGO / satellite data

Verification: fixed/drifting buoys

- Aug-Oct 2022
- (sub) tropics
- Temperature [K]
- Not assimilated



Conclusion

- ESM-W project aims at developing atm-oce coupled forecasting system for weather scale
- A first weakly coupled DA cycle implemented
- Assimilation of ARGO, SMOS, OSTIA (SST + sea ice concentration)
- DA experiment run for one year
- Ongoing work on improving the system