

The quality of the ocean analysis and forecasts highly rely on the observations and their accuracy used to constrain the ocean circulation. They are also crucial for their evaluation.

-> need of strengthen the link between the ocean observing community and the monitoring and forecasting centers to improve the integrated model products and advocate for the observation network sustainability.

A close collaboration between the ocean monitoring and forecasting centers (MFC) with the data providers is crucial:

- **To define suitable observation products** for operational oceanography
- **To ensure the best use of the observations** assimilated routinely **in model analysis**
- **To help designing the evolution of the observing systems** to improve ocean analysis and forecasts.

MFCs from CMEMS and Ocean Predict are already involved with the observing community/agencies and begin to be recognized as part of the full value chain from the observations to users.

- **Requirement documents on observing system evolution and data provision (level, QC, error estimate, timeliness, tracability,...)** are produced: CMEMS requirements for the evolution of the Copernicus Satellite and in situ observations, SSS requirements from GOV
- **Observation impact assessment of present and future observing system in ocean analysis and forecasts.**

MFCs need to be involved in evaluation of the present network and design of future / evolution of the GOOS component and products to be assimilated. Multi system experiments allow more robust conclusions.

This begins to be recognized as a best practice, especially within the satellite community.

Mercator Ocean was involved in different Observing System evaluation projects: the SMOS Nino 2015 project (ESA funded), Future large swath altimetry and SWOT (ESA, CNES and NASA project), Evolution of the In situ Atlantic networks (AtlantOS and EuroSea H2020 projects), Sentinel's impact (CMEMS).

Impact assessment of the present observing networks in ocean analysis and forecasts

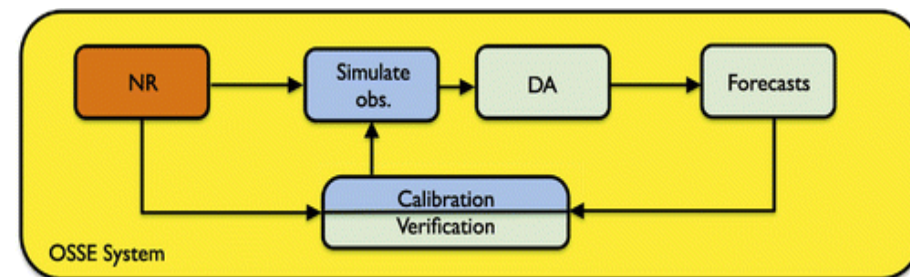
- Dedicated simulation with operational systems (OSE - semi-operational), Observation sensitivity diagnostics (R and D)
 - To **monitor the role of each component of the GOOS** in constraining ocean analysis and forecasts.
 - To **provide feedback to observation community on the use and impact of observations**

Impact assessment of the future observing networks in ocean analysis and forecasts

- Dedicated simulation with improved version of operational systems (OSSE – near operational); Design optimization (R and D)
 - To **develop/test the capacity** of monitoring and forecasting systems **to benefit from future/improved observations**.
 - To **provide guidance on observing system evolutions and future ones** for ocean monitoring and forecasting.

Best practices inherited from the atmospheric community.

- Review of Observing System Evaluation studies in Ocean Predict centers by Y. Fujii et al., 2019: <https://doi.org/10.3389/fmars.2019.00417>
- G. Halliwell et al., 2014: Rigorous Evaluation of a Fraternal Twin Ocean OSSE System for the Open Gulf of Mexico: <https://doi.org/10.1175/JTECH-D-13-00011.1>



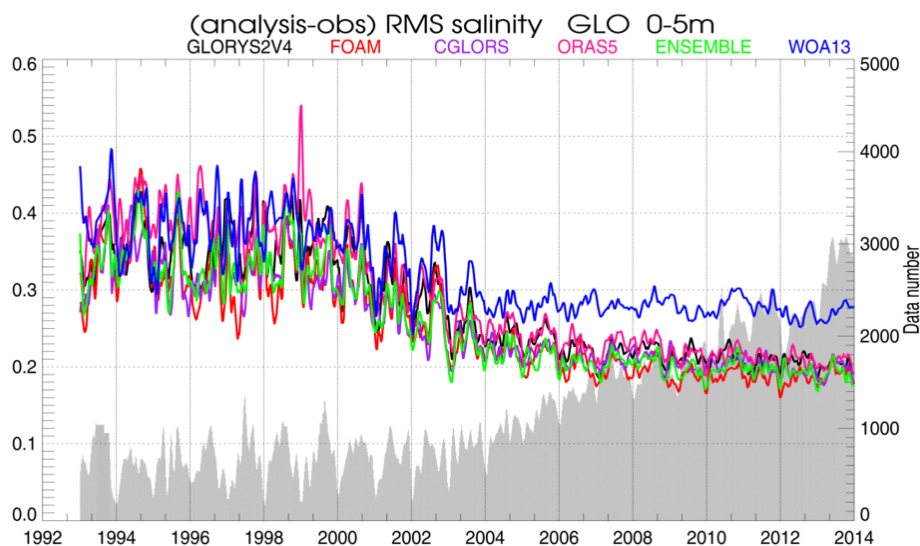
www.aoml.noaa.gov/qosap/osse-checklist/

Observations are also important for:

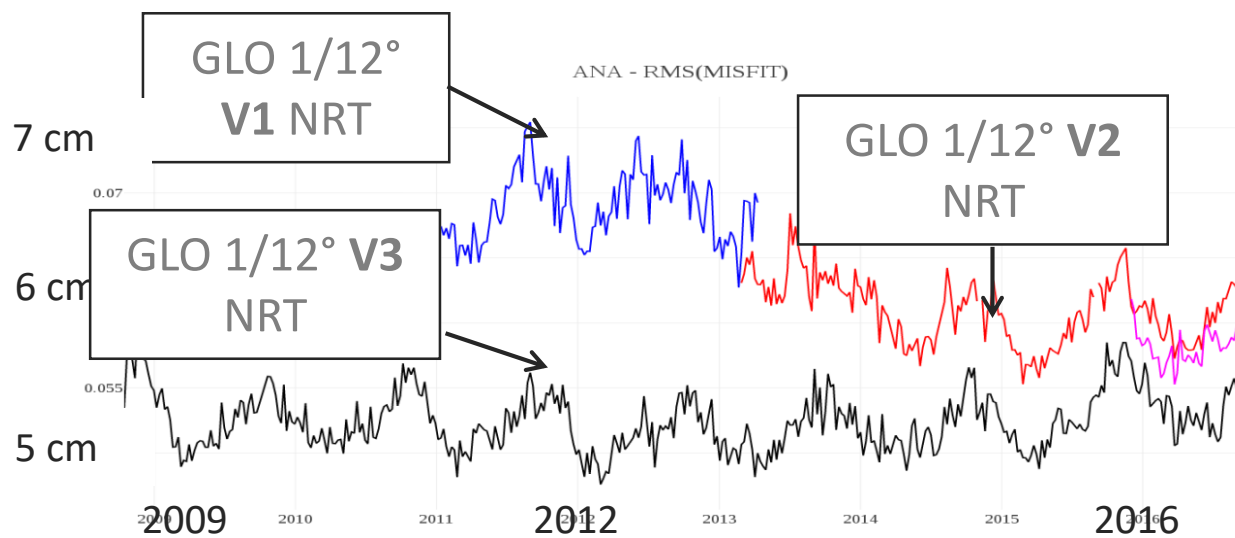
- **Evaluating** monitoring and forecasting **system evolutions** (model, DA),
- **Providing accuracy estimation** for the analysis and forecasts.

Common evaluation metrics agreed within GODAE/Ocean Predict and CMEMS ocean monitoring centers:

- Hernandez, F., et al., 2018: Measuring performances, skill and accuracy in operational oceanography: New challenges and approaches. In "*New Frontiers in Operational Oceanography*", E. Chassignet, A. Pascual, J. Tintoré, and J. Verron, Eds., GODAE OceanView, 759-796, doi:10.17125/gov2018.ch29.



RMS differences between the analysed and observed in situ salinity in different CMEMS reanalysis



Time evolution of RMS of SLA misfits for the Mercator Ocean global systems