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The CMEMS-Med-MFC-Biogeochemistry operational system: implementation of NRT and Multi-Year validation tools

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The Mediterranean Monitoring and Forecasting Centre (Med-MFC) is one of the regional production centres of the EU Copernicus Marine Environment Monitoring Service (CMEMS). Med-MFC manages a suite of numerical model systems for the operational delivery of the CMEMS products, providing continuous monitoring and forecasting of the Mediterranean marine environment. The CMEMS products of fundamental biogeochemical variables (chlorophyll, nitrate, phosphate, oxygen, phytoplankton biomass, primary productivity, pH, pCO_2) are organised as gridded datasets and are available at the marine.copernicus.eu web portal.
Quantitative estimates of CMEMS products accuracy are prerequisites to release reliable information to intermediate users, end users and to other downstream services. In particular, validation activities aim to deliver accuracy information of the model products and to serve as a long term monitoring of the performance of the modelling systems.
The quality assessment of model output is implemented using a multiple-stages approach, basically inspired to the classic "GODAE 4 Classes" metrics and criteria (consistency, quality, performance and benefit). Firstly, pre-operational runs qualify the operational model system against historical data, also providing a verification of the improvements of the new model system release with respect to the previous version. Then, the near real time (NRT) validation aims at delivering a sustained on-line skill assessment of the model analysis and forecast, relying on the NRT available relevant observations (e.g. in situ, Bio Argo and satellite observations). NRT validation results are operated on weekly basis and published on the MEDEAF web portal (www.medeaf.inogs.it). On a quarterly basis, the integration of the NRT validation activities delivers a comprehensive view of the accuracy of model forecast through the official CMEMS validation webpage. Multi-Year production (e.g. reanalysis runs) follows a similar procedure, and the validation is achieved using the same metrics on available historical observations (e.g. the World Ocean Atlas 2013 dataset).
Results of the validation activities show that the comparison of the different variables of the CMEMS products with experimental data is feasible at different levels (i.e. either as skill assessment of the short-term forecast and as model consistency through different system versions) and at different spatial and temporal scales. In particular, the accuracy of some variables (chlorophyll, nitrate, oxygen) can be provided at weekly scale and sub-mesoscale, others (carbonate system, phosphate) at quarterly/annual and sub-basin scale, and others (phytoplankton biomass, primary production) only at the level of consistency of model functioning (e.g. literature- or climatology-based).
In spite of a wide literature on model validation has been produced so far, maintaining a validation framework in the biogeochemical operational contest that fulfils GODAE criteria is still a challenge. Recent results of the validation activities and new potential validation framework at the Med-MFC will be presented in our contribution.