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Integration of BGC-Argo and the Mediterranean BGC forecast system: new developments of the oxygen data quality assessment and assimilation

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New insights on marine biogeochemical state and variability are yielded by recently available autonomous observation platforms such as the BGC-Argo floats. Additionally, the integration of BGC-Argo data and modelling systems can provide a further improvement on understanding marine biogeochemical dynamics. Indeed BGC-Argo variables can be profitably used for tuning and validation of biogeochemical models, and in data assimilation.

The Mediterranean Sea CMEMS marine forecasting system represents a convincing example of such integration: nitrate and chlorophyll BGC-Argo profiles are already assimilated providing corrections on nutrient and phytoplankton vertical dynamics, while float oxygen data are used for validation and will be integrated in the data assimilation scheme in 2022. Despite their value, BGC float oxygen measurements are prone to uncertainties such as those related to sensor drifts and their real time and operational use requires caution and specific quality control.

Since the quality control procedures on the real-time oxygen data are limited and automatic and considering that the presence of trend in the deep ocean can be considered a proxy for oxygen sensor drift, a novel operational quality assessment procedure of BGC-Argo oxygen data for model validation and assimilation is here proposed.

The QC procedure is based on (1) sensor drift computation with the RANSAC (RANdom SAmple Consensus) and Theil-Sen non parametric statistical estimators at two selected depths: 600 and 800m and (2) suspicious drift-oxygen-profiles correction.
Moreover, drift-corrected and uncorrected oxygen profiles are subjected to additional checks: (i) Comparison of surface value with oxygen at saturation (ii) Offset calculation between data and EMODnet2018_int climatological values at 550-650m (iii) Model-data misfit threshold.

The QC criteria have constrained more than one third of oxygen data to be corrected for a suspicious drift. In most cases, the removal of the drift acted as a relaxation factor towards the reference climatological fields.
To test the assimilation of quality-checked oxygen profiles into the CMEMS Mediterranean model system, a set of 2-year OGSTM-BFM-3DVarBio simulations have been implemented. Results show the feasibility of the oxygen data assimilation and the potential much higher impact of oxygen BGC-Argo data with respect to the chlorophyll and nitrate sensors given the evolution of the numbers

of BGC-Argo sensors in recent years.