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Fixed Observatories and Long-time-Series of Dissolved Oxygen Measurements: Good Quality Data is a Challenge

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Long-term marine observation is primarily aimed at acquiring Essential Ocean Variables (EOVs), for the assessment of their multi-scale temporal variability (monthly to pluriannual). EOVs also provide a unique background to depict unusual events. Feeding from these unique high quality datasets, modelling can be achieved to produce numerical ocean circulation models and atmosphere-ocean models. One of the EOVs currently measured in this context is the Dissolved Oxygen (DO) content in seawater. Today, this parameter is commonly measured with a reference method, the Winkler Titration (1) based on discrete sampling whereas high frequency measurements are nowadays realised using autonomous DO sensors.
On a metrological point of view, the measurement of DO at the required accuracy, 1μmol.kg-1 (Gruber et al. 2010) (2) , is challenging. Because of the high presence of oxygen in air and consequent risk of contaminating the water samples, especially for low concentration conditions, no certified reference material exists for this parameter. Moreover, the quality of the reference measurement is strongly influenced by the sampling and analysing conditions.
In situ DO time series are historically based on discrete sampling requesting ship time and subsequent laboratory analysis. Over the last 10 years, the improvement of dedicated DO sensors allows the community to access to a higher sampling frequency to provide robust in situ time series. Nevertheless, the performances of the sensors are evolving with time, due to embedded sensor intrinsic limitation. For these reasons, calibrations are required to know the corrections/adjustment to apply to the measurements and ensure good quality datasets. These calibrations are achieved in controlled conditions with a calibration bench and comparison with Winkler titration. Pre and post deployment Winkler titration of in situ water samples also allows improving the dataset quality.
In this context and in the framework of the H2020 project EMSO-Link (3) , the EMSO-ERIC infrastructure consortium supports the collaborative construction of a DO sensor (whether stand alone or fitted on generic oceanographic instrumentation) calibration bench. This calibration platform aims to provide reliable metadata for the deployed sensors in order to reach and maintain high quality dataset for oceanography studies. The sustained use of these standard procedures will provide data coherence amongst the different observatories around Europe, and enable their use in extended spatial contexts.

(1) Winkler 1888, modified Carrit & Carpenter 1966
(2) Gruber, N. & Co-Authors (2010). "Adding Oxygen to Argo: Developing a Global In Situ Observatory for Ocean Deoxygenation and Biogeochemistry" in Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., D.E. Harrison & D. Stammer, Eds.
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