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# Biogeochemical controls on the Black Sea oxygen dynamics : relevant diagnostics, key processes and adequacy of the monitoring infrastructure.

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An important deoxygenation trend has been described in the Black Sea over the five past decades from in-situ observations [1]. While the implications for basin-scale biogeochemistry and possible future trends of this dynamics are unclear, it is important to consolidate our means to resolve the dynamics of the Black Sea oxygen content in order to assess the likelihood of future evolution scenario, and the possible morphology of low-oxygen events.

Also, it is known that current global models simulate only about half the observed oceanic O2 loss and fail in reproducing its vertical distribution[2]. In parts, unexplained O2 losses could be attributed to illy parameterized biogeochemical processes within 3D models used to integrate those multi-elemental dynamics.

Biogeochemical processes involved in O2 dynamics are structured vertically and well separated in the stratified Black Sea. O2 sources proceed from air-sea fluxes and photosynthesis in the photic zone. Organic matter (OM) is respired over a depth determined by its composition and sinking, via succeeding redox reactions. Those intricate dynamics leave unknowns as regards the biogeochemical impacts of future deoxygenation on associated cycles, for instance on the oceanic carbon pump. Here we use the Black Sea scene to derive model-observation strategies to best address the global deoxygenation concern.

First, we decipher components of the O2 dynamics in the open basin, and discuss the way in which O2-based indicators informs on the relative importance of processes involved. Using 1D biogeochemical model set-up, we then conduct a sensitivity analysis to pin-point model parameters, ie. biogeochemical processes, that bears the largest part in the uncertainty of simulated results for those diagnostics. Finally, we identify among the most impacting parameters the ones that can most efficiently be constrained on the basis of modern observational infrastructure, and Bio-Argo in particular.

The whole procedure aims at orienting the development of observations networks and data assimilation approaches in order to consolidate our means to anticipate the marine deoxygenation challenge.

[1] Capet A et al., 2016, Biogeoscience, 13:1287-1297

[2] Oschlies A et al., 2018, Nature Geosci, 11(7):467–473

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