

Global oxygen changes and oxygen variability in the eastern Pacific off Peru

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Numerical model runs predict decreasing ocean oxygen with increasing CO₂ emission scenarios. Oxygen measurements are generally sparse in the ocean, nonetheless at some key locations longer-term oxygen time series exist and trends for the global ocean can be estimated. In many regions especially the tropical oceans oxygen has decreased during the last 50 years, however especially in the subtropical ocean regions with increasing oxygen values exist. Typical oxygen trends range from -0.5 to +0.4 $\mu\text{mol kg}^{-1} \text{yr}^{-1}$ in the upper ocean for the last few decades, with a global mean oxygen trend of -0.066 $\mu\text{mol kg}^{-1}\text{yr}^{-1}$ between 50°S and 50°N at 300 dbar for the period 1960 to 2010 [Stramma et al., 2012]. In a measurement to model comparison for the last 50 years the model reproduce the overall sign and to some extent magnitude of observed ocean deoxygenation, though with a mismatch in regional pattern. Further analysis of the processes that can explain the discrepancies between observed and modeled oxygen trends is required to better understand the climate sensitivity of oceanic oxygen fields and predict potential oxygen changes in the future. Further expansion of low oxygen regions in conjunction with overfishing may threaten the sustainability of pelagic fisheries and accelerate shifts in animal distributions and changes in ecosystem structure.

In the eastern Pacific Ocean multidecadal variability (Pacific Decadal Oscillation) and also El Nino phases have a strong influence on long-term oxygen trends [e.g. Czeschel et al., 2012]. Historical data combined with new hydrographic measurements from two ship expeditions in the eastern tropical Pacific in 2009 and 2012 as well as oxygen sensor data from floats allow an enhanced view at the circulation, oxygen variability and trends in the oxygen minimum zone off Peru. Oxygen differences derived by comparison of ship sections show large variability in some locations. This local variability from eddies, seasonal and longer-term variability obscure trends in oceanic dissolved oxygen. Caution in interpretation of the data is necessary.

REFERENCES

- Czeschel, R., Stramma, L., and Johnson, GC., 2012. Oxygen decreases and variability in the eastern equatorial Pacific. *J. Geophys. Res.*, 117, doi:10.1029/2012JC008043.
- Stramma, L., Oschlies, A., and Schmidtko, S., 2012. Mismatch between observed and modeled trends in dissolved upper-ocean oxygen over the last 50 yr. *Biogeosciences*, 9, 4045-4057, doi:10.5194/bg-9-4045-2012.
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