Geophysical Research Abstracts
Vol. 16, EGU2014-5538, 2014
EGU General Assembly 2014

The puzzle of oceanic oxygen utilization

Wolfgang Koeve and Paul Kähler

GEOMAR, Helmholtz Zentrum für Ozeanforschung, Biogeochemical Modelling, Kiel, Germany (wkoeve@geomar.de, +49 1212-5 1061 8829)

The biological carbon pump is an important component of the oceanic carbon cycle and expected to respond to the anthropogenic perturbation of climate and ocean chemistry. Yet, large uncertainties exist in the quantification of the strength of the biological carbon pump of today's ocean. The export of organic matter from the ocean's euphotic zone is a critical benchmark number of this strength. Local measurements of the export flux are highly uncertain, due f.e. to severe methodological issues and undersampling of the ocean. Uncertainties in the contribution of dissolved organic matter to export further add when it comes to a global assessment. The vertical integral of oxygen utilization in the interior of the ocean is considered an independent and save estimate of export production, which accounts for particles as well as dissolved export pathways. For that purpose regional oxygen utilization rates (OUR) have been computed from apparent oxygen utilization (AOU) and an estimate of the time elapsed since the last contact with the atmosphere. Surprisingly the assumptions underlying this concept have not been tested rigorously. Using global ocean biogeochemical models we compare OUR computed from AOU and an ideal age tracer with an independent and perfect estimate of ocean respiration available in the model. Consistently in three different global models, we find that OUR underestimates true respiration by a factor of about three. Most of the differences between respiration and OUR are observed in the upper 1000m of the ocean. In addition to this underestimate in bulk global numbers, we find also important qualitative differences between the two independent approaches. For example, the contribution of dissolved organic matter driving oxygen utilization is largely underestimated when based on bulk tracer concentrations (AOU, DOC), which is the usual approach applied to observations. Also, diagnosing the global importance of denitrification relative to oxic metabolism is found to be uncertain by a factor of three when based on analysis of bulk tracers.