Stable isotopes of oxygen to characterize a Metalimnetic Oxygen Minimum: insights from a 48 hours field campaign at Rappbode Reservoir, Germany

Marlene Dordoni1, Karsten Rinke1, Michael Seewald2, Jakob Schmidmeier2, and Johannes A.C. Barth1

1Department of Geography and Geosciences, GeoZentrum Nordbayern, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Schlossgarten 5, Erlangen, 91054, Germany (marlene.dordoni@fau.de)
2Helmholtz Zentrum für Umweltforschung (UFZ), Department Seenforschung, Brückstrasse 3a, D-39114 Magdeburg

The appearance of a Metalimnetic Oxygen Minimum (MOM) has been recorded in many natural lakes and reservoirs. However, its isotopic characterization with oxygen and carbon stable isotopes have not yet been fully constrained. The purpose of this work is to apply stable isotopes of carbon and oxygen to characterize photosynthetic and respiratory activities in the Rappbode Reservoir, Germany. Here we present the results of a 48 hours intensive sampling in July 2020. We provide preliminary data of dissolved oxygen (DO) concentration and saturation profiles, together with dissolved inorganic carbon (DIC). This includes data of oxygen (δ18O DO) and carbon (δ13C DIC) stable isotopes with particular focus on the metalimnion. Our profiles identified minor differences from day to day, such as an additional respiration-like peak above the MOM. Samples from within the MOM were characterized by the lowest oxygen content and saturation (7.05 mg L−1 and 75 %, respectively) and the highest δ18O DO (up to +30.1‰). These samples also showed the lowest δ13C DIC values (down to -12.8‰). Surface layers (between 0 and 9 meters) and the deepest water sample (65 meters) did not follow the expected depth profiles for δ18O DO and δ13C DIC. Surface layers were likely influenced by equilibration with the atmosphere that was enhanced by windy conditions. On the other hand, samples from 65 meters depth could have been perturbed by the presence of organic material from sediments. Moreover, oxygen and carbon stable isotopes patterns were able to show that the MOM can migrate within the water column up to 5 meters within 12 hours. These findings offer an interesting basis to establish mass balances of oxygen and carbon turnover in water bodies.