Isotopic investigations of contemporary carbonate sedimentation in lakes from N Poland

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The study area of NE Poland is a region of most pronounced seasonal climatic contrasts and best preserved varved sediments in lakes. Within the project "Climate of northern Poland during the last 1000 years: Constraining the future with the past (CLIMPOL)" the isotopic investigations have been performed aiming at the creation of transfer functions for the reconstruction of temperature in the past.

The presented study will be focused on the results of isotopic measurements (δ2H, δ13C and δ18O) for samples of water and contemporary carbonates collected from the lakes along the West-East transect in northern Poland, which have been chosen to form the CLIMPOL training set for calibration space-for-time. The measurements have been performed with use of continuous-flow IRMS Isoprime coupled with automated carbonate/water preparation device Multiflow.

The measurements of δ18O for lake water (47 samples) demonstrate variability of values from -7.7 to -1.9‰ (VSMOW) and show a general W to E gradient. The δ2H measurements have been performed so far for 22 samples and the results vary from -71 to -19‰ (VSMOW). The plot of δ2H versus δ18O reveals linear correlation with the equation: δ2H = 7.9δ18O – 4.6 (R^2 = 0.80), which slope is identical to GMWL, while intercept is ca. 15‰ lower.

The δ18O and δ13C of carbonates from sediment traps have been determined for 35 samples, and the results range from -13.1 to -6.1‰ (δ18O, VPDB) and from -10.6 to +0.15‰ (δ13C, VPDB).

The obtained results have been used to calculate temperatures from δ18O according to so-called "temperature equation" (Kim and O'Neil, 1997), which produced exotic results of 35°C on the average. These results demonstrate that during the $CaCO_3$ precipitation the isotopic equilibrium is not present. On the other hand, the correlation between δ18O in water and δ18O in carbonates (R^2 = 0.76) suggests that carbonates record the isotope composition of water in which they are formed.

It seems that temperature signal can be recovered from the isotope dataset, as the values of δ18O in sediment trap carbonate and summer temperature (June, July, August) are correlated (R^2 = 0.38). This simple linear equation was tested as a transfer function to reconstruct the temperature for CLIMPOL master site record from Lake Zabinskie. The comparison of calculated temperatures and instrumental record for the last 120 years shows that generally the average temperature can be reconstructed, but the inter-annual variability is poorly reflected in the reconstructions.