Geophysical Research Abstracts
Vol. 17, EGU2015-3360, 2015
EGU General Assembly 2015

Linking diatom deposition in a deep lake with the spring temperature gradient (Tiefer See, NE Germany)

Ulrike Kienel (1,2), Georgiy Kirillin (3), Brian Brademann (2), Birgit Plessen (2), and Achim Brauer (2)

(1) University Greifswald Institute for Geography and Geology, Friedrich-Ludwig-Jahn-Str. 16, 17487 Greifswald, Germany (ulrike.kienel@gfz-potsdam.de), (2) Section 5.2 Climate and Landscape Evolution, Deutsches GeoForschungsZentrum, GFZ, Telegrafenberg, 14473 Potsdam, Germany (brau@gfz-potsdam.de), (3) Leibniz-Insitute of Freshwater Ecology and Inland Fisheries, Müggelseedamm 310, 12587 Berlin, Germany kirillin@igb-berlin.de

Monitoring of deep Lake Tiefer See showed a much larger deposition of diatoms following ice out and a rapid spring stratification in mid April 2013 compared to that following the gradual warming and stratification in mid April 2012. The manifold of diatom individuals in 2013 compared to 2012 amounted to calculated 2.0 compared to 0.15 g silica per square meter and day. The striking difference was the two orders of magnitude larger number of Stephanodiscus sp. in 2013, which were only a minor component in 2012.
The monitored weather and lake conditions suggest the 2013-spring bloom was boosted by a quick succession of ice breakup, spring turnover, and stratification leading to nutrient recycling and rapidly improved light conditions. The comparatively longer mixing in spring 2012, calculated using the lake-temperature model FLake, caused population losses that impeded bloom development.
To verify the exemplified inverse relation of diatom deposition and mixing duration in spring we use the subannually laminated, recent sediment record of Lake Tiefer See (AD 1924 – 2008), the instrumental series from the meteorological station in Schwerin, and model simulations of the spring mixing. The mixing duration was calculated as the period between water temperatures of 4°C and a mixing depth of 6 m were reached for the period 1951 – 2008. To cover the full sediment record a simple estimate of the mixing period was calculated from mean temperatures, i.e. the temperature duration from the first 5°C-day to the first of $\geq$5°C days.
The annual diatom deposition was calculated as the annual average μXRF-counts of Si in the sediment record (AD 1924-2008), based on negligible amounts of detrital Si, low deposition of inorganic matter during winter, and a striking balance of IM deposition and Si deposition calculated from the diatom frustules deposited.
We find support for the linear and inverse relation of diatom silica deposition with the duration of spring mixing using the modeled mixing duration with 25% explained variability and with 20% using the temperature relation, respectively. The explanation increases to 49%, respectively 53% when the period after AD1980 is removed from the data set. The lack of diatom response during this period is supposed to relate to the primary influence of nutrients from intensive manuring and drainage in the catchment on the algal development at that time.