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Improved understanding of Diatom stratigraphy in a varved sediment through lake monitoring and sediment trap data

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Biological remains in lake sediments reflect past conditions in the lake itself and within its catchment. However, it is difficult to disentangle to which extent the environmental drivers are natural (e.g. population dynamics, climate) or human-induced (e.g. agriculture, forestry). Therefore, comprehensive lake monitoring is crucial to understand taphonomy and sediment formation, and enhances the value of the paleolimnological archive.
In this study, we analyze survey data of a varved lake in northern Sweden (Nylandssjön, Nordingrå) with special focus on the diatom record. Different monitoring components are combined, i.e. (1) bi-weekly data of chemical parameters (chlorophyll a, nutrients) covering the period from 2012 to 2015, (2) physical parameters (temperature, oxygen, ice-cover) covering the period from 2000-2015, (3) high-resolution data from a sequential sediment trap covering the period from 2000-2015 and (4) annually resolved diatom data from the sediment varves.
Early and intense spring mixing in 2012 translates into a short but vertically pervasive chlorophyll a band which is simultaneously recorded in the sequential trap with a high diatom peak (500 000 valves cm2 d-1). The years 2013 and 2014 show higher chlorophyll a concentrations in the water column, but diatoms do not form a peak flux (>100 000 diatoms cm2 d-1) at any time in the sediment trap, probably due to stratification patterns. The trap record from 2012 indicates a spring bloom dominating the sediment signal, but this is not repeated in 2013 and 2014.
Future analyses will be directed towards linking the monitored in-lake processes to annually or even seasonally resolved environmental characteristics. The multiplicity of potential ecological and environmental drivers led us to reverse our analytical view by starting with the diatom stratigraphy in the varved sediment, continuing through the data from sediment trap and water column into the lake catchment to identify deviations (timing, sediment flux, diatom assemblage composition) among seasons and years and their causes. Linking the survey data with the corresponding sediment stratigraphical features will allow us to distinguish which information and events can or cannot be inferred from the sediment.
Obtained monitoring results covering recent years will improve the interpretation of long-term data of the past century in Nylandssjön.