Geophysical Research Abstracts
Vol. 15, EGU2013-12660, 2013
EGU General Assembly 2013

Holocene and Late Glacial varved sediments from Czechowskie Lake (Poland)

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Annual laminated (varved) sediment records are essential for detailed paleoclimate and environmental reconstructions as they function as a natural memory beyond instrumental datasets. In order to determine Holocene inter-annual and decadal-scale variability we investigated varved Lake Czechowskie (53°52' N/ 18°14' E, 108 m asl.), northern Poland. During two coring campaigns in 2009 and 2012 we recovered several long and short cores with the longest core reaching 14.5 m. Based on correlation with a biostratigraphically and tephrochronologically dated neighboring paleolake sediment record (Trzechowskie mire) the record extends back in to the Late Glacial.
Lake Czechowskie is well suited for climate reconstruction as varves are almost entirely well (88 %) or poorly (5%) preserved. Only 7 % of the sediment profile are non-varved. Detailed investigations have been carried out for the last 2000 years of the sediment profile applying micro-facies analyses combined with X-ray fluorescence element scanning (μ-XRF) at 200 μm resolution and carbon and nitrogen analyses (TOC, TC, TN) at five-varveresolution.
The chronology has been established by a multiple dating approach with 137Cs (for the last ca. 50 years), AMS 14C on plant macro remains (back to 2800 cal BP) and varve counting. Varve formation and preservation ceases at the beginning of the 20th century whereas the younger sediments are again faintly varved. Micro-facies analyses reveal that the sediment consists of biogenic calcite varves with intercalated diatom rich layers. Three distinct 100 to 200 years long periods of up to threefold thicker varves (approx. 1.4 to 5.0 mm/year) are predominantly caused by an increase in the diatom sub-layers and indicate distinct short-term climatic and environmental fluctuations. Possible reasons for these changes that occurred abruptly with only few years are either changes in lake water circulation or in nutrient supply to the lake.
This study is a contribution to the Virtual Institute ICLEA (Integrated Climate and Landscape Evolution Analysis) funded by the Helmholtz Association.