Abstract:

The peri-Atlantic Arctic, one of the most sensitive components of the Earth climate system, experienced pronounced climatic fluctuations during the Holocene. Several external forcings were considered responsible for these variations, including decline of insolation on the Northern Hemisphere, changes in distribution of land ice mass, explosive volcanism, or changes in atmospheric and oceanic circulation. In order to explore the driving mechanisms of the peri-Atlantic Arctic environmental variability, three sites located in different parts of the region were selected for palaeoenvironmental reconstructions with focus on extracting the climatic information. With this intention, sedimentary cores from i) Lake Garmaksla, Central Svalbard, ii) Jarfjorden, northeastern Norway, and iii) Kobbefjord area, southwestern Greenland, were retrieved and subjected to multi-proxy investigation. The absolute chronostratigraphic framework was established by comprehensive radiocarbon (^{14}C) and short-lived radioisotopes (^{210}Pb, ^{137}Cs) dating. Further analyses include measurements of magnetic susceptibility, grain size distribution, element composition by means of X-ray fluorescence (XRF), and elements bound to organic matter, i.e. organic carbon, nitrogen, sulphur and biogenic silica. The relationships between the acquired proxy data were investigated within individual sedimentary cores, between the cores from the same region, and finally, with other available reconstructions from the region of interest. Furthermore, stratigraphic sequences were correlated in order to improve precision of the age-depth models. Exploratory statistics and factor analysis were applied to extract relevant palaeoenvironmental information.

The presented palaeoreconstructions cover the Middle and Late Holocene in case of Garmaksla Lake and Jarfjorden records. These sequences were found to contain valuable information on the climatic development of the Neoglacial period. Garmaksla Lake sensitively reacted especially to variations in sea ice extent and continentality. In case of Jarfjorden lakes, the sedimentary records reveal episodes of increased erosion and reduction of vegetation cover, induced by either natural or anthropogenic influence, and evidence of pollution in the last 70 years. Infilled lakes from southwestern Greenland document the lake ontogeny and transition to peat bog that was nonetheless modulated by climate, especially shifts of the North Atlantic Oscillation in the past ~800 years. The synthesis of palaeoreconstructions from the entire peri-Atlantic Arctic pinpoints the importance of understanding the interconnected factors of climatic variability on the Holocene time scale, since it provides clues on the future climate development of the region.

Key words: palaeolimnology, Holocene, Arctic, proxy data, lake sediments