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A 1,500 year ice core record of Akademii Nauk ice cap (Severnaya Zemlya) – Long term changes of climate, environment and aerosols in the Central Russian Arctic

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Ice cores provide a lot of climate and environmental information. A new 724 m deep ice core was drilled on Akademii Nauk ice cap (Severnaya Zemlya) between 1999 and 2001 to gain high resolution proxy data from the Central Russian Arctic. The Akademii Nauk ice core contains significant proxy data for the reconstruction of climate and environmental changes, although the ice cap is affected by summerly melting and infiltration processes, resulting in alteration of the original isotopic and chemical signals.

Here we present overview data (mean values over 0.3-1.0 m) of stable water isotopes (δ^{18}O, deuterium excess) and major ions of the uppermost 530 m as well as high resolution data for some special sections. Dating of this ice core is based on reference layers (nuclear weapon tests, volcanoes) and on counting of annual cycles of stable isotopes and electrical conductivity. The age model yielded an age of about 1,500 years for the core section viewed here.

δ^{18}O data reflect Eurasian Arctic surface air temperature (SAT) changes and show a generally decreasing trend, culminating in the absolute SAT minimum around 1800.

Thereafter the values increased strongly to the absolute maximum around 1930. Whereas this SAT pattern can be interpreted as the termination of the Little Ice Age, no pronounced onset of this cool period or a distinct long-lasting warmer period like the Medieval Warm Period are detectable.

The decreasing SAT trend is at least partly caused by the growth of Akademii Nauk ice cap. This is also reflected in the annual layer thickness data and a decreasing overall trend of sea salt ions, which reached their lowest values also around 1800. In contrast, there is no clear trend in ammonium and nitrate observable.

After 1800 almost all ions show increasing concentrations until the mid-20^{th} century, followed by a repeated decline in the last decades. The 20^{th} century record is superimposed by the anthropogenic pollution of the Arctic, mainly visible in strong increasing levels of sulphate and nitrate after World War II with highest concentration from the 1960ies to the 1980ies and again decreasing values thereafter.

Some of the sharp sulphate peaks could be attributed to certain volcanic eruptions, e.g. Laki/Iceland (1783) and Bezymianny/Kamchatka (1956).