EGU2011 - 8934

The ice-core stable isotope records from small Arctic ice caps as proxis of climatic and evironmental changes

Rein Vaikmäe (1), Tõnu Martma (1), Elisabeth Isaksson (2), Dmitry Divine (2), Veijo Pohjola (3), Harro Meijer (4)

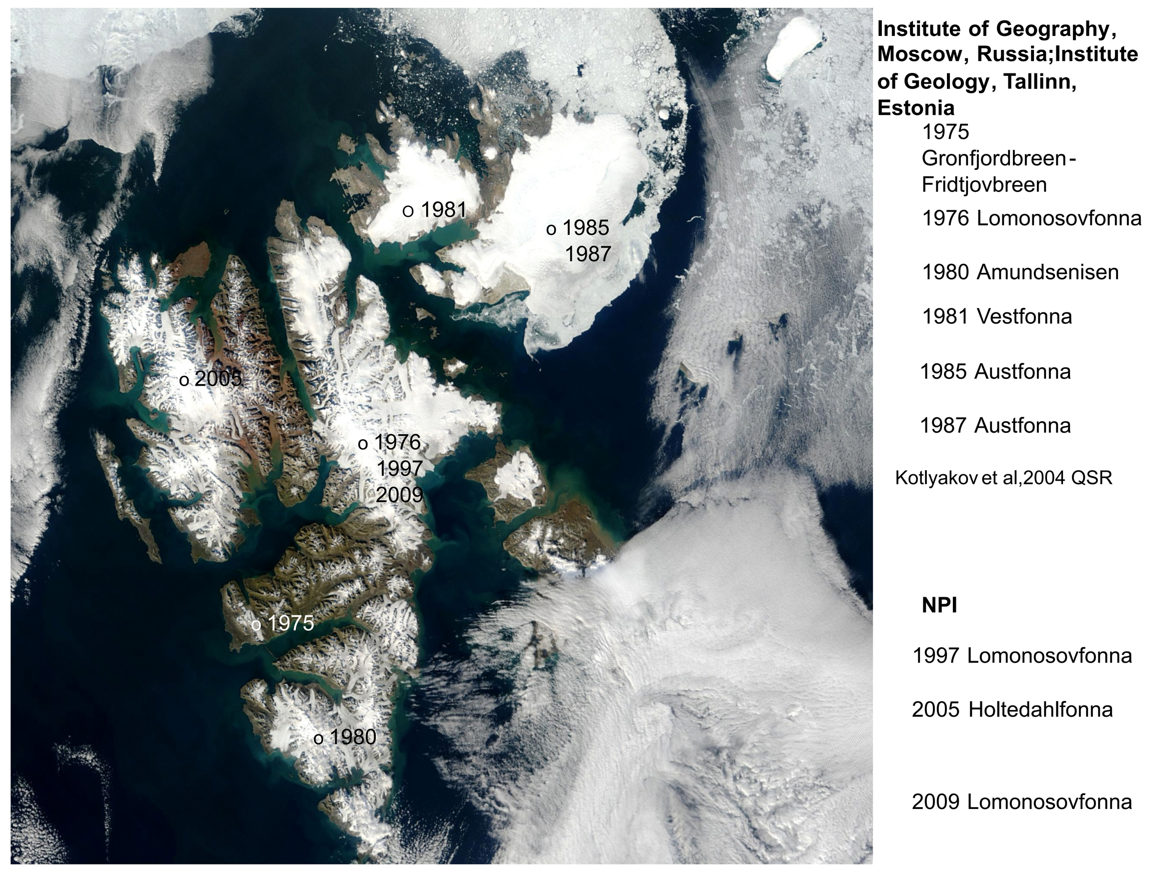
(1) Institute of Geology at Tallinn University of Technology, Tallinn, Estonia, (2) Norwegian Polar Institute, Tromso, Norway,
(3) Department of Earth Sciences, Uppsala University, Uppsala, Sweden,(4) Centre for Isotope Research, Groningen, The Netherlands

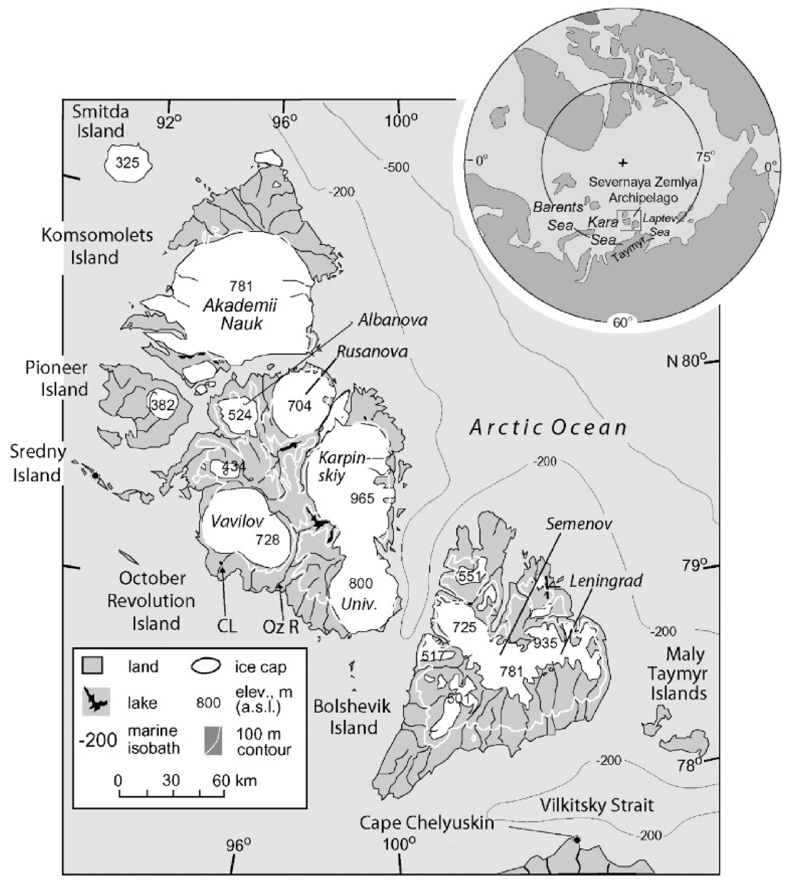
Introduction

Stable water isotopic composition ($\delta^{18}O$ and δD) of ice cores is commonly known as one of the most valuable paleo-climate proxies for temperature conditions of the precipitation formation in the past. The observed relationship between air temperature and isotopic content of the precipitation both geographical and temporal has been robustly confirmed experimentally and explained theoretically. Isotopic data extracted from deep ice cores from the polar ice sheets have contributed much information on climate variability both on inter-annual and ice ages time scales **1**, **2**. However, most of the available ice core records from the northern hemisphere are from the cold dry firn zone in interior Greenland.
Ice cores from the glaciers outside the main ice fields have not received much attention, partly because of surface melting during the summer season which could alter the original isotopic signal. In order to get a more comprehensive view of the climatic and environmental change on more global, or hemispherical scale the data from other locations outside large ice sheets are needed.

Drilling sites and discussion

In this paper the comparison of published stable isotope records from medium-deep ice cores drilled on glaciers of Eurasian Arctic (Svalbard and Severnaya Zemlya) from the middle of the 1970s to the end of 1990s **3, 4** will be discussed. The first set of records was obtained between 1975 and 1989 through drilling programmes of the Institute of Geography of the Russian Academy of Sciences (on Svalbard) and the Arctic and Antarctic Research Institute (on Severnaya Zemlya) with active participation of the Institute of Geology of the Estonian Academy of Sciences **5,6**. In those early projects the isotope-geochemical composition of the firn and ice were, as a rule investigated by discrete sampling (5-30 samples per 100m of a given core). $\delta^{18}O$ was measured in most cases and δD only on occasion **4**. More recent records from Svalbard, starting from 1997 were obtained in the framework of Norwegian Polar Institute-led collaborative international ice core projects **7**.
Since the middle of the 1970s the medium-deep core drilling of the Eurasian Arctic has entered a new phase. Repeated drilling of the most promising objects and complex research of ice core and hole on a new methodological basis started. The most informative parameters providing maximum precision and minuteness of paleogeographical reconstructions are the $\delta^{18}O$ and δD. The main reference points of time scales are the tracers of nuclear trials and volcanogenic horizons.



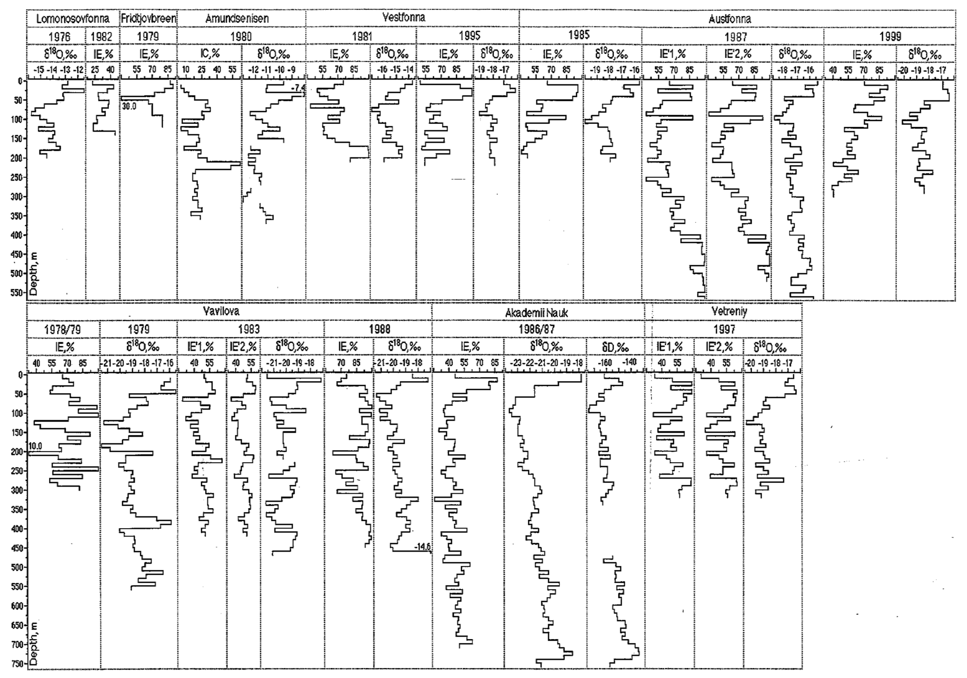


Severnaya Zemlya drill sites

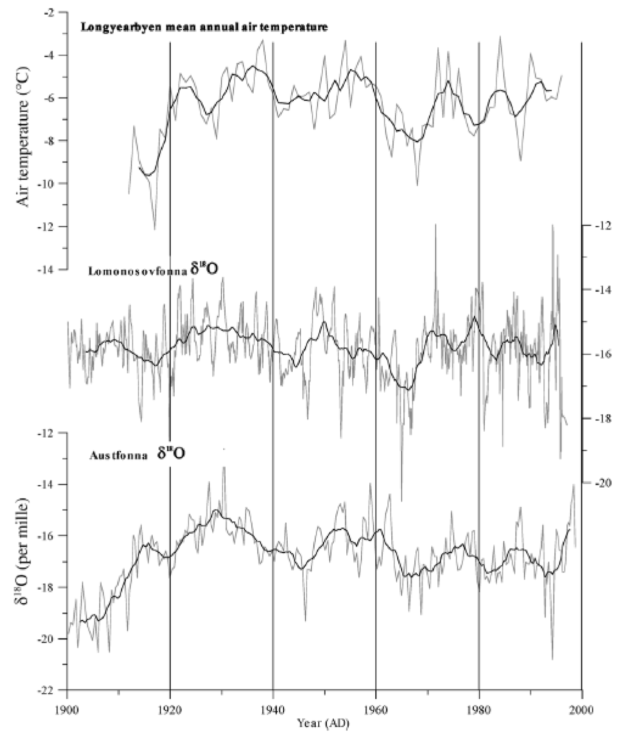
Lomonosovfonna fieldwork1997

Conclusions

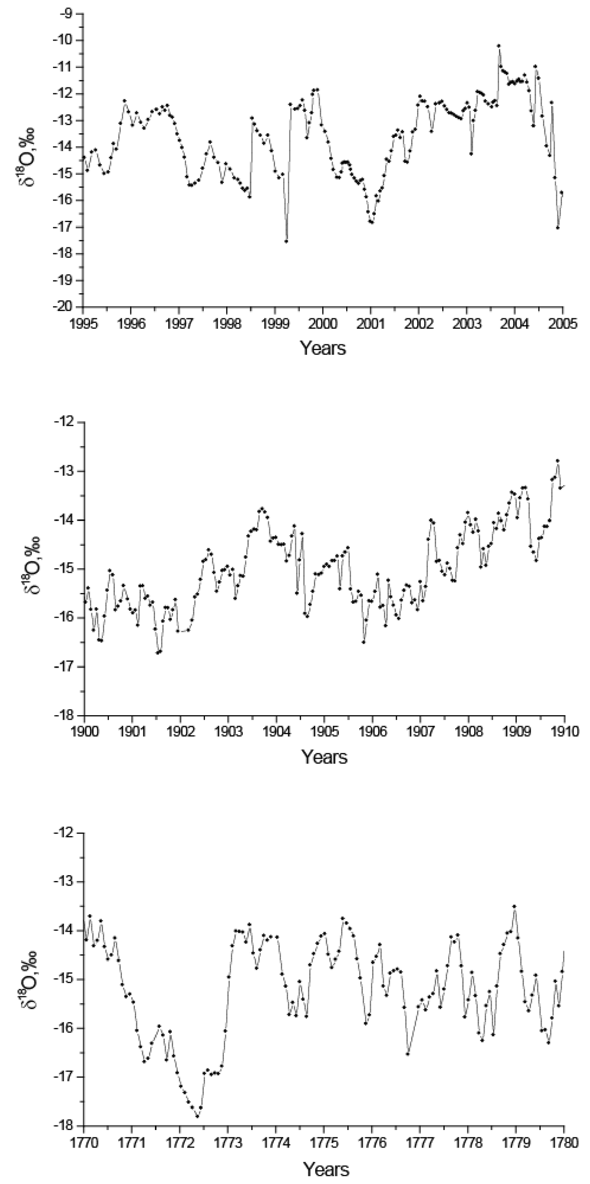
In Eurasian Arctic Svalbard is positioned in a climatically interesting area, since the climate over archipelago is very sensitive to changes in the North Atlantic Current, being situated at the turning point of the oceanic conveyor. In addition , the atmospheric circulation conditions also make Svalbard a suitable place for the study of anthropogenic influences from Europe **10, 11**. The location of the Severnaya Zemlya archipelago in the centre of Eurasian Arctic makes its ice cover a particularly interesting target area both its present conditions and its **history 8, 9.** Comparison of all the obtined data has shown that despite the fact that atmospheric records in these ice cores probably have been to some degree altered by melt, these records still provide information about major trends in atmospheric variability of both, climate parameters and pollution history **12, 13**. **Thus we belive that with careful site selection, high-resolution sampling and multiple isotopic and chemical analyses ice cores from small Arctic ice caps are extremely useful for a wide range of environmental studies.**



Drill cores from 1970s until 1990s (Kotlyakov et al, 20049)



The $\delta^{18}O$ records from Lomonosovfonna and Austfonna from the 20-th century (Isaksson et al, 2005)



Holtedahlfonna $\delta^{18}O$ in different time intervals

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