Geophysical Research Abstracts,
Vol. 11, EGU2009-9422, 2009
EGU General Assembly 2009

Testing the integrity of stable isotope records of two Spitsbergen ice cores by using high-resolution tritium data.

L.G. van der Wel (1), H.A.J. Meijer (1), E. Isaksson (2), M.M. Helsen (3), R.S.W. van de Wal (3), T. Martma (4), V.A. Pohjola (5), and J.C. Moore (6)

(1) University of Groningen, Center for Isotope Research, Groningen, Netherlands (L.G.van.der.Wel@rug.nl), (2) Norwegian Polar Institute, Tromsø, Norway , (3) Institute for Marine and Atmospheric Research Utrecht, Utrecht University, The Netherlands , (4) Institute of Geology, Tallinn University of Technology, Tallinn, Estonia , (5) Department of Earth Sciences, Uppsala University, Uppsala, Sweden , (6) Arctic Centre, University of Lapland, Rovaniemi, Finland

The ratios of $^{1}H^{16}O^{2}H$ and $^{1}H^{18}O^{1}H$ in precipitation water vary with temperature and can therefore be used as a proxy for past climate. Ever since the 1960-s, retrieving these isotope signals has been the main motivation for the drilling of deep ice cores. Most of the ice core records originate from selected sites in Greenland and Antarctica. Other Arctic locations are much less used. However, since the late 1990-s ice cores have been drilled on the Lomonosovfonna and Holtedahlfonna ice caps in Spitsbergen. The advantages of drilling at these sites lies in the high accumulation rate present in Spitsbergen, as well as the very location of the Spitsbergen archipelago. However, due to relatively high temperatures in this region, the isotope record is affected by melt and subsequent percolation, thereby potentially losing its value for climatic studies.

In an attempt to test the integrity of the Spitsbergen cores, we measured the concentration of the radioactive isotope of hydrogen (tritium) at high spatial (and thus temporal) resolution. Due to above-ground nuclear bomb tests in the 1950-s and 1960-s, the tritium signal in the atmosphere has been highly variable in that period, with distinct peaks. Moreover, due to the high load of tritium in the stratosphere at that time, spring and early summer mixing between stratosphere and troposphere induced a clear seasonal pattern in precipitation records for two decades.

The tritium concentration in precipitation has been measured (monthly average) since the 1950-s. After precipitation the tritium record is altered due to decay, diffusion and melt. Incorporating information of these three processes into a numerical model, we produce a quantitative estimate how much the isotope record is influenced by melt and percolation. This gives us a tool to determine whether the stable isotope record is a valid proxy for past temperatures.