WP 7 workshop
Kokoushotelli Sofia, HELSINKI
January 22

Program

12:00-13:00 lunch

13:00-13:30 Heikki Seppä: WP 7 overview

13:30 -14:15 Atte Korhola: Temperature changes in the Arctic Atlantic region over the last 2000 years

14:15-14:45 Jon Egill Kristjansson: Tying it all together and interface with modeling

14:45-15.30 Elisabeth Isaksson (Meri Ruppel): Svalbard ice and snow as archives for climate and pollution

15:30-16:00 coffee break

16:00-17:00 Meri Ruppel: Unexpected increase in elemental carbon concentrations and deposition in a Svalbard ice core during the last 30 years

17:15-18:00 Ikumi Oyabu (Michael Boy): Chemical compositions of sulfate aerosols in Greenland NEEM ice core

18:00-19:00 Discussion on future plans and how to integrate the results into the Earth system modeling

19:00 dinner and end of meeting

List of participants

1. Jon Egill Kristjansson, University of Oslo
2. Michael Boy, University of Helsinki
3. Aki Virkkula, Finnish Meteorological Institute
4. Atte Korhola, University of Helsinki
5. Elham Baranizadeh, University of Eastern Finland
6. Heikki Seppä, University of Helsinki
7. Meri Ruppel, University of Helsinki

Notes

Heikki: In general, this work package can contribute to CRAICC deliverables and Earth System Modeling by providing information on how the atmospheric composition has changes during the last 10000 years and how this has affected temperature changes. One specific aim is to quantify past variations in short-lived climate forcers. This work has been partly done and is partly still ongoing. The major progress in WP 7 has been the simulation of Arctic tree-line dynamics during the Holocene by comparing fossil data to proxy-based vegetation reconstructions. The future challenge is to model the feedback of the treeline changes to climate change through albedo and carbon cycle modifications. In specific, not only the climate warming impact through decreased albedo will be considered but also the cooling effect of BVOC emissions from increased vegetation/forest coverage in the Arctic.

Atte: New statistical methods have been used to compile a more robust temperature reconstruction for the North-Atlantic region during the last 2000 years from proxy-data available in literature. The reconstruction indicates significant temperature variations in the region, and warmer time periods, such as the Roman Warm Period, having occurred during the last 2000 years than the present time. This work was not directly CRAICC related but it points out that the Arctic warming during the last 2000 years has been much less variable than in the North-Atlantic region. The Arctic warming indicates a clearer trend of decreasing temperatures during the last 2000 years, which has been interrupted by the anthropogenic warming. The historical proxy data as well as direct temperature measurements in the 20th century indicate that the Arctic warming in 1910-1940 has been much more

pronounced and faster than the warming after 1970. Processes behind this and the cooler period in 1940-1970 are still under investigation.

Jon Egill: The main message was that Earth SystemModels are probably best able to quantify the feedback loops intended to be investigated in CRAICC as they capture feedbacks and interactions between the different subsystems (biosphere, atmosphere, cryosphere and hydrosphere). At this point the models need the data, but the kind, that doesn't require any new parameterizations to be applied in the models.

Elisabeth: There is a lot of information on past pollutant variations available from Svalbard ice cores covering the last 1000 years. This includes sulphates, dust and black carbon. Sulphate records are ready whereas work on black carbon is still underway. The Svalbard ice core records also give valuable information on past Arctic Ocean sea ice cover changes. These changes have had significant impacts on past albedo variation and related feedback processes in the Arctic. The results indicate that the summer sea ice cover has started to decrease in an unforeseen way during the last ca. 100 years compared to the last 1450 years.

Meri: An ice core from Svalbard covering the last 300 years has been analyzed for elemental carbon (a proxy for black carbon). It indicates a concurrent peak in elemental carbon around 1910 as previously reported ice cores from Greenland. However, the elemental carbon values increase in the Svalbard record since 1970 towards the present which contradicts the Greenland ice core data and atmospheric measurements in the Arctic since 1989. The reasons for these discrepancies are probably changes in the scavenging efficiency of black carbon and flaring emissions from northern Russia affecting Svalbard but not reaching the high latitude Greenland coring sites. Regardless of the explanations for the observed trend it has significant implications for the radiative transfer and forcing at the site. The aim in further work is to model the past radiative forcing at the glacier site and more generally the impacts of flaring emissions in the Arctic.

Ikumi: A deep ice core from Greenland, NEEM, covering the last 130000 years has been and is analyzed for different constituent elements of nonvolatile particles, mainly sulphuric compounds. The aim is to clarify characteristics of chemical compositions of soluble aerosols deposited in polar environments. Sulphate

aerosols, particularly micrometre-sized particles of sulphate salt and sulphate-adhered dust, can act as cloud condensation nuclei, leading to increased solar scattering that cools Earth's climate. The results show that sulphuric compounds have increased drastically in the environment since the industrial era. Before the industrial revolution peaks in sulphate aerosol concentrations seemed to co-occur with cool temperature periods in the ice core record.