

## Preface

# “Holocene climate variability over Scandinavia – A special issue originating from a workshop organized by the Bert Bolin Centre for Climate Research”

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Scandinavia has a long tradition of Late Quaternary research – it was in this part of the world that much of the foundations for our current understanding of the post-glacial climate evolution was laid, not the least through analyses of fossil plant evidence in peat bogs (e.g. Andersson, 1902, 1909; Seppä et al., 2010):

*“... in the whole of Scandinavia, from the most northerly to the most southerly parts, there are found, on land and in the sea, traces of a warmer period in post-glacial time during which the time of vegetation was considerably longer than now, and with about 2.5 °C. mean temperature higher; while the winters were presumably about the same as now or inconsiderably warmer.”* (Andersson, 1909, p. 65).

Since the earliest investigations more than a century ago, other climate archives with sometimes high temporal resolution, e.g. lake sediments, speleothems and tree-rings, have been explored by the use of various types of proxies, such as the variations of stable oxygen isotope ratios (Lauritzen and Lundberg, 1999) and the sedimentary accumulation rates of organic and minerogenic matter (Ojala and Alenius, 2005). Moreover, the undertaking of numerical simulations with advanced climate models now makes it possible to test hypotheses for patterns of, and processes behind, climate changes inferred from proxy data at different time scales (e.g. Renssen et al., 2009) – something that was hardly even thinkable a century ago.

The recently founded Bert Bolin Centre for Climate Research at Stockholm University launched in 2007, as one of its first activities, a project called “Stable oxygen isotope variations and tree-ring records in Scandinavia and their relations to atmospheric circulation patterns during the Holocene”. The overall project aim was to increase the understanding of climate variability during the Holocene through integrating proxy data analysis and global climate modelling. To gain knowledge from a wider scientific community with an interest in Holocene climate variability over Scandinavia, the Bolin Centre project group invited 28 scientists and arranged a workshop which was held on 1–2 April 2008 at Säby Säteri, Ingarö, near Stockholm.

The aim with the workshop was to bring together scientists working with stable oxygen isotope archives, dendroclimatology and atmospheric or ocean modelling relevant for Scandinavia, and thereby fertilize cross-disciplinary discussions among proxy data experts and climate modellers, and to learn from each others disciplines. Five key-note talks were presented; two of them reviewed the state-of-the-art concerning data availability and interpretation of  $\delta^{18}\text{O}$  records from lake sediments and tree-ring records and three others reviewed knowledge from climate modelling studies. The key-note talks served to stimulate subsequent group discussions.

Despite substantial progress in knowledge gained throughout the century of proxy-based research in this region, the discussions held at the workshop revealed that there are still several uncertainties regarding the interpretation of various proxy-data types. From a modelling point of view, these uncertainties together with the rather sparse availability of



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proxy records in many regions – not the least in many areas outside Scandinavia – led to conclusions that there is not yet sufficient information to firmly validate the simulations. Therefore, the workshop participants agreed that there is still a strong need for improved understanding of the proxy records, reduced uncertainties and increased spatial density of proxy data. The participants further advocated the development of synthetic pseudo-proxy records, in particular methods for forward modelling of synthetic  $\delta^{18}\text{O}$  records, in order to use those records for methodological development of data assimilation techniques. Such methods were considered useful to investigate the possibilities to reconstruct circulation patterns, trajectories and flow regimes.

One particular and concrete outcome of the workshop, was the recognition of the usefulness of a special issue that provides an overview of the current state-of-the art of the Holocene climate variability over Scandinavia – focusing on both proxy-data and modelling issues. Seven workshop participants and two further colleagues volunteered to act as lead authors, whereafter the local organizers contacted the editorial board of *Climate of the Past* which agreed to set up a special issue on the topic in question. The nine papers that now constitute this special issue are:

1. Last nine-thousand years of temperature variability in Northern Europe (Seppä et al., 2009).
2. Stable isotope records for the last 10 000 years from Okshola cave (Fauske, northern Norway) and regional comparisons (Linge et al., 2009).
3. Reconstructing past atmospheric circulation changes using oxygen isotopes in lake sediments from Sweden (Jonsson et al., 2010).
4. Dendroclimatology in Fennoscandia – from past accomplishments to future potential (Linderholm et al., 2010).
5. An introduction to stable water isotopes in climate models: benefits of forward proxy modelling for paleoclimatology (Sturm et al., 2010).
6. Holocene trends in the foraminifer record from the Norwegian Sea and the North Atlantic Ocean (Andersson et al., 2010).
7. Climate change between the mid and late Holocene in northern high latitudes – Part 1: Survey of temperature and precipitation proxy data (Sundqvist et al., 2010).
8. Climate change between the mid and late Holocene in northern high latitudes – Part 2: Model-data comparisons (Zhang et al., 2010).
9. Using data assimilation to study extratropical Northern Hemisphere climate over the last millennium (Widmann et al., 2010).



**Fig. 1.** Workshop participants. Photo: Anders Moberg.

The guest editors wish to express their thanks to all contributing authors, and also hope that readers will find this special issue to be useful and a source of inspiration for further research.

## Appendix A

### Workshop participants (with key-note speakers typed in **italic>**)

- Carin Andersson Dahl, Bjerknes Centre for Climate Research, Bergen University
- Deliang Chen, Department of Earth Sciences, University of Gothenburg
- Ralf Döscher, Swedish Institute for Meteorology and Hydrology, Norrköping
- Kristofer Döös, Department of Meteorology, Stockholm University
- Tore Furevik, Bjerknes Centre for Climate Research, Bergen University
- Håkan Grudd, Department of Physical Geography and Quaternary Geology, Stockholm University
- Björn Gunnarson, Department of Physical Geography and Quaternary Geology, Stockholm University
- Karin Holmgren, Department of Physical Geography and Quaternary Geology, Stockholm University
- Steffen Holzkämper, Department of Physical Geography and Quaternary Geology, Stockholm University
- Jee-Hoon Jeong, Department of Earth Sciences, University of Gothenburg

- Christina Jonsson, Department of Physical Geography and Quaternary Geology, Stockholm University
- Erland Källén, Department of Meteorology, Stockholm University
- Heiner Körnich, Department of Meteorology, Stockholm University
- Peter Langen, Niels Bohr Institute, University of Copenhagen
- Stein-Erik Lauritzen, Department of Earth Science, Bergen University
- *Melanie Leng*, NERC Isotope Geosciences Laboratory, British Geological Survey, Nottingham
- *Hans Linderholm*, Department of Earth Sciences, University of Gothenburg
- Anders Moberg, Department of Physical Geography and Quaternary Geology, Stockholm University
- Johan Nilsson, Department of Meteorology, Stockholm University
- *Hans Renssen*, Faculty of Earth and Life Sciences, Vrije Universiteit, Amsterdam
- Allan Rodhe, Department of Earth Sciences, Uppsala University
- Gunhild Rosqvist, Department of Physical Geography and Quaternary Geology, Stockholm University
- *Christophe Sturm*, Department of Geology and Geochemistry, Stockholm University
- Hanna Sundqvist, Department of Physical Geography and Quaternary Geology, Stockholm University
- Kerstin Treydte, Swiss Federal Research Institute WSL, Birmensdorf
- Stefan Wastegård, Department of Physical Geography and Quaternary Geology, Stockholm University
- *Martin Widmann*, School of Geography, Earth and Environmental Sciences, University of Birmingham
- Qiong Zhang, Department of Meteorology, Stockholm University

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