

Spatiotemporal distribution of temperature and hydroclimate proxy data in the Arctic

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The Arctic2k working group met for an open meeting during the European Geosciences Union (EGU) General Assembly 2015 to discuss the current state of the group and future activities. Twenty-five participants attended the meeting.

Johannes Werner reported on the status of the database and the plans for creating regional temperature reconstructions. As the Arctic2k region already had a well-developed database for the first phase of the temperature reconstructions (see PAGES2k Consortium 2013; McKay and Kaufman 2014), only a few new temperature records have become available since then. The largest “gap” identified in the current temperature database is a number of tree ring records, mainly from Scandinavia and Russia, that have not yet been included. Hans Linderholm is currently quality checking and formatting these records.

One problem identified in recent temperature field reconstruction attempts is the poor skill over Greenland (e.g. Anchukaitis and McKay 2014), which is surprising given the relatively good coverage of ice core records. Thus, to find the source of the problem, Valerie Masson-Delmotte has volunteered to coordinate an activity to check the quality and climatic interpretation of the ice core data, and their correlation with the regional meteorological records.

Another project proposed by Jostein Bakke aims to prepare a funding application for additional ²¹⁰Pb and ¹⁴C dating of existing sedimentary climate records. This would serve two purposes: data that could, up until now, not be included in the 2k database could then pass the dating selection criteria, and data already included would be improved.

Hydroclimate

A breakout discussion, lead by Anne Hormes, focused on the hydroclimate and the type of proxy records available. As a first step, the group decided to work on a paper reviewing the available records in the Arctic and discussing which hydroclimate parameters could be reconstructed. The linked proxy record database will be completed by the second half of 2015, to allow enough time to create a hydroclimate reconstruction for the 2k Network synthesis in 2016. Please contact Hans Linderholm or Anne Hormes if you want to contribute to the collection and quality control of the proxy records, or to contribute to the review article.

Reconstruction methods

A second group, lead by Johannes Werner, discussed the spatial temperature and precipitation reconstructions themselves. Although the spatial density of data in the Arctic is low, the group will attempt a circumpolar spatial temperature reconstruction. However, it was noted that great

care must be taken in communicating the reconstruction quality and uncertainties that would change through time and space. A promising method for doing this was recently showcased by the NOAA 20th Century Reanalysis Project, and consists of clouding out areas that do not fulfil the criteria for trustworthy reconstructions. Johannes Werner and Nathan Steiger offered to lead the reconstruction effort, using Data Assimilation and Bayesian hierarchical models. Contributions from other reconstruction groups are encouraged.

Climatically coherent regions that are well covered in terms of proxy data will also be identified. Generating regionally averaged reconstructions over these regions will provide a valuable second set of reconstructions that can be compared with the spatial reconstructions.

The group agreed that a reconstruction should be more than an updated version of already available spatio-temporal climate reconstructions. One novel aspect could be improving the communication and visualization of the spatio-temporal uncertainties of the reconstruction. Additionally, a fortuitous fact is that the landmasses surrounding the North Atlantic basin are relatively well covered in terms of proxy records, and preliminary results show that good reconstruction skill over this region is possible. A North Atlantic reconstruction should enable the comparison of atmospheric circulation changes that can then be linked to high-resolution marine archives. Several decadal resolution sediment archives are available, and new sclerochronological records will hopefully become available in time for the final comparison.

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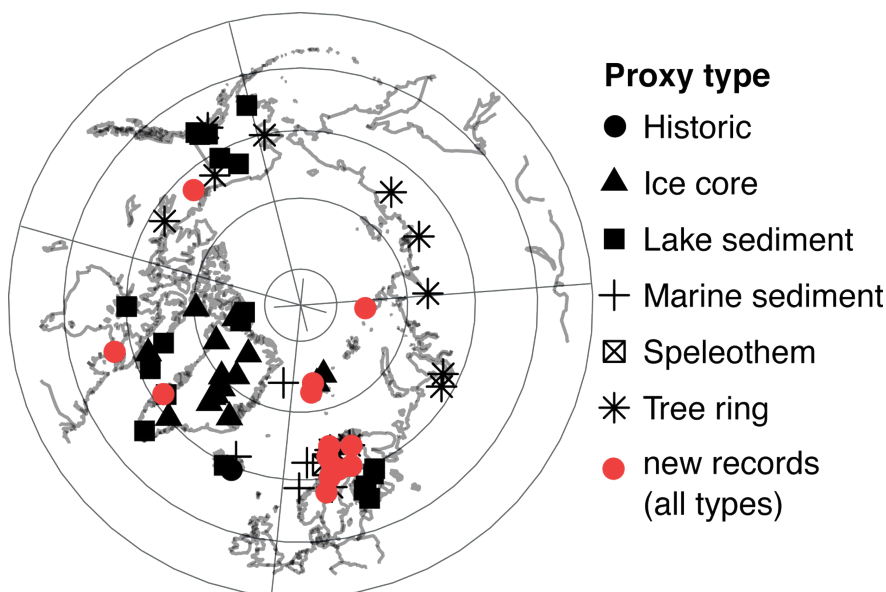


Figure 1: Overview of temperature proxy archives in the Arctic2k database, new records are highlighted in red.