Geophysical Research Abstracts
Vol. 15, EGU2013-8444, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Stability of the relationship between Greenland accumulation and atmospheric circulation

Niklaus Merz (1,2), Christoph C. Raible (1,2), Hubertus Fischer (1,2), Thomas F. Stocker (1,2)

(1) University of Bern, Physics Institute, University of Bern, Switzerland , (2) Oeschger Centre for Climate Change, University of Bern, Switzerland

Accumulation records from ice cores drilled in the Greenland ice sheet have been linked with various atmospheric variability features, e.g., blocking frequencies and large-scale atmospheric circulation patterns. The use of such proxies offers the potential to reconstruct variability in Northern Hemisphere (NH) circulation patterns over the last millennia. However, an important prerequisite for this reconstruction is the stable relationship between local accumulation at the ice core site with the respective circulation pattern.

We address this stability issue for the Holocene and the last glacial maximum (LGM), making use of a comprehensive climate model. We have performed a set of high-resolution time-slice simulations for the present, the pre-industrial, the early-Holocene and the LGM period. We analyze accumulation in different regions of Greenland in a pseudo-proxy approach.

A previous study showed that within ERA40 reanalysis data in three of these regions the annual mean accumulation is significantly correlated with distinct atmospheric circulation patterns. However, except for the Greenland south-east region, the model does not show the same circulation patterns not even for the simulation of the present climate. Moreover, the patterns within the paleo simulations are not stable either. The reason for these differences can be attributed to a strong seasonal cycle within the relationship of local accumulation and atmospheric circulation patterns which is found consistently in ERA40 and the model. On the seasonal time-scale, the circulations patterns which relate to local accumulation compare very well between the model simulations and ERA40. For both, the summer and winter season, accumulation in all three region is related to very similar patterns in all Holocene simulations and to some lesser degree also for the LGM. However, since the seasonal signals add-up differently to the annual signal in ERA40 and the various simulations, we do not find a stable relationship between annual accumulation and annual circulation patterns. This seasonality issue should be taken into account when linking Greenland accumulation records with atmospheric circulation variability.