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# Orbitally forced changes of large- to regional scale relationships of atmospheric climate variability based on ECHO-G climate simulations

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To infer large-scale atmospheric circulation variability from only few regional climate information often the statistical relationship between the large- and regional scale is used. For the late Holocene it is assumed that these relationships are stable. To apply the statistical relationship in periods with substantially different climate conditions to the fitting period this assumption may be problematic. Here the sensitivity of the large-to regional-scale relationship for the boreal winter season on annual timescales is tested. Quasi equilibrium simulations with the AOGCM ECHO-G for periods of the last interglacial (125ka BP) and the last glacial inception (115ka BP) are analyzed and compared with a simulation for the preindustrial period.

In all simulations the mean climate response to insolation changes is as expected. Differences of the sea level pressure (SLP) at positive and negative phases of Northern Annular Mode (NAM) reduced or increase the relationship between the NAM and regional temperature. The NAM-temperature signal is weaker over Europe and stronger over Siberia at 125ka BP than in the other periods. The differences of the NAM-temperature signal strongly effect the relationship between temperatures variability in different regions, so called temperature teleconnections. For regions where the NAM-temperature signal is moderate to strong the temperature teleconnections are dominated by the NAM and where the NAM-temperature signal is weak the temperature teleconnections are influenced by different mechanisms to the NAM.

These results are not only important for the period of the last interglacial but also for

periods with similar orbitally-induced insolation changes such as the mid-Holocene. Further these results should be taken into account when the large-scale climate is inferred from regional climate information (e.g., proxy data) and when highly temporally resolved temperature estimates from proxy data from different regions are compared.