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Circulation variability and temperature representativity on decadal to centennial timescales during the last interglacial - results from quasi-equilibrium simulations with the AOGCM ECHO-G

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For the Late Holocene large-scale climate has been estimated from local proxy data with statistical upscaling models that have been derived from the instrumental period. If one wants to estimate large-scale climate from Eemain proxy data, upscaling relationships derived from the instrumental period may not be realistic. As there are no direct meteorological observations for the Eemian, we chose model simulations as a surrogate for the real climate for analyzing large- to local-scale relationships. We investigated two equilibrium simulations with the AO-GCM ECHO-G, one for 125ka BP, which represent a period where deglaciation was complete and a stable climate was reached and one for 115ka BP, which represents the transition from a warm to a cold stage, and compared them with a simulation for preindustrial conditions with the same model.

In the Northern Hemisphere the Arctic Oscillation (AO) is the dominant circulation mode and is associated with strong teleconnections. The overall spatial structure of the simulated pressure anomaly and the AO-temperature signal on decadal timescales are very similar for the last interglacial (125kyr BP) and the pre-industrial period. However, in regions where the AO temperature signal is weak in the preindustrial simulation, for instance in Western Europe, the AO signal almost disappeared in the Eemian simulation. This suggests that during the Eemian the AO index explained less temperature variability in Western Europe than in the pre-industrial period. But the

Western European temperature could still have been strongly influenced by circulation anomalies that are different from the AO. In order to find the SLP anomaly that is linearly most closely linked to the European temperature, regression coefficients between western European temperature and the SLP over the North Atlantic/ European domain were calculated. The resulting SLP anomaly pattern is important if one wants to estimate circulation variability from local, temperature sensitive proxy data.

These changes in the link between atmospheric circulation and local temperatures could lead to changes in the spatial representativity of internally generated regional temperature variability. Different timescales and regions on the Northern Hemisphere are analyzed with one point regression and correlation maps for four simulation periods (125kyr BP, 115kyr BP, 115kyr BP later part of the simulation with extended snow cover and pre-industrial conditions). Regions with a continental climate (e.g. Eastern Europe) tend to have a stable representativity of a larger area, whereas regions with oceanic influence (e.g. Western Europe) are mostly associated with a stable representativity of a small area and with unstable teleconnections.