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# Simulating the Climate of the last Glacial

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The last glacial maximum (LGM) offers an ideal testbed for the validation of climate models, as this period combines a climate signal that has similar magnitude as the expected climate changes within the next centuries with the availability of a large amount of well-dated paleo proxy data.

The coarse resolution version of the MPI model used for the IPCC simulations has been applied to the last glacial maximum. The model consists of the AGCM ECHAM5 (T31, 19 levels) and the OGCM MPIOM (40 levels). To account for land surface feedbacks, the dynamical vegetation model LPJ was interactively coupled to the model. For the LGM simulations the PMIP boundary conditions were used. For the baseline simulations (preindustrial CTRL and LGM) the model was spun up using a periodically-synchronous coupling technique until - after several thousand integration years - the model drift was neglegible. The entire model runs without flux correction.

The simulated global mean cooling of the near-surface air temperature is 5K. The strongest cooling is simulated over the North American and European ice sheets. The cooling in the tropics is somewhat smaller, but increases with height. In accordance with observations the tropical SST cools by 3K, the cooling over land is somewhat stronger. The simulated temperature response is largely consistent with reconstructions. The model results will be compared to proxy reconstructions of the last glacial climate and vegetation.

A factor analysis with a set of additional near-equilibrium model experiments reveals that the atmospheric composition is by far the most important factor for the colder glacial climate. The effect of insolation at the LGM is comparably small. Interac-

tive vegetation leads to a substantial cooling on the northern hemisphere land masses, where the boreal forest retreats southward. Changes in topography also have a strong impact. Over the ice sheets a strong cooling is simulated due to the changes in height and albedo. Whereas the temperatures over the Arctic decrease, North Atlantic SST becomes substantially warmer due to enhanced overturning.

Experiments with meltwater perturbations indicate both a less stable Atlantic meridional overturning circulation as well as s stronger response in surface temperature and sea ice.