Climate of the Past
An Interactive Open Access Journal of the European Geosciences Union

Clim. Past, 1, 1-7, 2005
www.clim-past.net/1/1/2005/

Quantifying the effect of vegetation dynamics on the climate of the Last Glacial Maximum

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Abstract. The importance of the biogeophysical atmosphere-vegetation feedback in comparison with the radiative effect of lower atmospheric CO_2 concentrations and the presence of ice sheets at the last glacial maximum (LGM) is investigated with the climate system model CLIMBER-2. Equilibrium experiments reveal that most of the global cooling at the LGM (-5.1°C) relative to (natural) present-day conditions is caused by the introduction of ice sheets into the model (-3.0°C), followed by the effect of lower atmospheric CO_2 levels at the LGM (-1.5°C), while a synergy between these two factors appears to be very small on global average. The biogeophysical effects of changes in vegetation cover are found to cool the global LGM climate by 0.6°C. The latter are most pronounced in the northern high latitudes, where the taiga-tundra feedback causes annually averaged temperature changes of up to -2.0°C, while the radiative effect of lower atmospheric CO_2 in this region only produces a cooling of 1.5°C. Hence, in this region, the temperature changes caused by vegetation dynamics at the LGM exceed the cooling due to lower atmospheric CO_2 concentrations.

Final Revised Paper (PDF, 977 KB) Discussion Paper (CPD)

Citation: Jahn, A., Claussen, M., Ganopolski, A., and Brovkin, V.: Quantifying the effect of vegetation dynamics on the climate of the Last Glacial Maximum, Clim. Past, 1, 1-7, 2005. Bibtex EndNote Reference Manager