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Examining the interaction between land use change, temperature extremes and land-atmosphere interactions

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Using the Weather and Research Forecasting Model, we examine the combined impact of land-atmosphere coupling and land use change (LUC) on simulated temperature extremes. The sensitivity of the impact of LUC on temperature extremes to the choice of planetary boundary layer (PBL) and cumulus parameterization schemes are also evaluated to examine whether the impact of LUC on temperature extremes is dependent on the atmospheric model physics and if this impact is modulated by changes in land-atmosphere coupling. A decomposition of the surface energy balance is used to examine the different responses to LUC. Results show a consistent weakening in the soil moisture-temperature coupling strength with LUC irrespective of the atmospheric model physics tested here. In contrast, temperature extremes show an asymmetric response to LUC dependent on the choice of PBL scheme, which is linked to differences in the parameterization of vertical transport. This influences convective precipitation, contributing a positive feedback on soil moisture and consequently on the partitioning of the surface turbulent fluxes. The results suggest that the impact of LUC on temperature extremes depends on the land-atmosphere coupling that in turn depends on the choice of PBL. Indeed, the sign of the change in temperature extremes due to LUC can be changed simply by altering the choice of PBL schemes examined here.