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Attributing the biophysical impacts of Land-use Induced land-Cover Changes (LULCC) to various sources. Results from the first LUCID set of simulations.

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The biogeophysical impacts of human-induced Land Cover Change (LCC) are studied from the multi-model and multi-member (ensemble) set of simulations of the LUCID intercomparison project (Pitman et al. 2009, GRL).
The inclusion of crops and managed grasslands in the temperate regions of North-America and Eurasia characterizes the LULCC since the pre-industrial times, resulting in significant changes of surface physical properties in these regions. Apart from the robust signals of LULCC shown by the model-mean anomalies, as the year-long cooling led by the increase in surface albedo, the individual responses show an important dispersion between them. This pattern is particularly strong in the non-radiative anomalies, especially for latent heat flux.
The results presented here are used to assess the role of a number of drivers in the different responses to LCC and to quantify the relative contribution of the two main sources of the observed model dispersion: the biogeography forcing strength and the land-surface parameterizations. Differences in the deforestation rates come from the specificity of the natural vegetation maps and methods that describe the sub-grid plant heterogeneity of land-surface models (LSMs). On the other hand, the resulting LULCC-induced anomalies on such variables as evapotranspiration will strongly depend on the character of the different vegetation types (e.g., stomatal resistance, leaf area index, surface roughness).
Results from a multi-variable regression analysis show that the wintertime albedo responses to LULCC are led by the strength of the snow-masking effect of the forest and therefore by the deforestation rate. In this case, the observed model spreading in the albedo responses is explained in the same order by both the different surface forcings (deforestation) and the different snow-masking sensibilities of each LSM. The model spreading in summer albedo responses are also explained (in the same order) by differences in deforestation and in the LSM's snow-free albedo drivers (e.g., leaf albedo and LAI). Meanwhile, the non-radiative impacts of LULCC play a major role in summer by perturbations in surface heat fluxes. Unevenly between models, latent heat flux (LE) anomalies respond principally to changes in LAI, in the water availability (soil moisture), in available energy and in the plant-type-related evapotranspiration efficiencies (e.g., stomatal resistance). The uneven role of these LE drivers will finally explain the spreading between the LSMs responses.