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Assessing the inter-model spreading in biophysical impacts of land cover change: Results from LUCID intercomparison project

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Biophysical impacts of land cover change (LCC) from seven global models are presented as results of LUCID project (Pitman et al. 2009). Preindustrial to present-day induced anomalies are obtained from a set of snapshot simulations that represent the vegetation of 1870 and 1992.
The results described here are focused on two temperate regions (in North America and Eurasia), that show strong anthropization of lands in the studied period. Inclusion of crops and managed grasslands in these regions has principally been made in detriment of forests, resulting on significative changes of physical properties such as surface albedo, surface roughness and leaf density.
Results from LUCID experiences show that land-use forcings are dominated by increases in surface albedo, resulting on a yearlong cooling as a model-mean response to LCC. However, individual model results are highly uneven between them. The dispersion observed of near-surface temperature anomalies is coherent with the high model-spreading observed in net shortwave radiation anomalies and in the responses of the other surface energy budget components, in particular turbulent fluxes.
We identified two sources of dispersion in the responses to land-cover changes that are inherent to the representation of vegetation in land surface models (LSMs): differences in the final biogeography anomalies and differences on the specific plant parameterizations. Since every LSMs has specific potential (natural) vegetation and has specific method to describe sub-grid plant heterogeneity, there is no common vegetation change even if each modeling group achieve to introduce the same crop and pasture fractions. In the other hand, the resulting anomalies in some surface properties such as evaporation efficiency will depend on plant type's parameter settings. These two aspects explain the main fraction of inter-model dispersion on variables that directly depend on surface parametrization (e.g., albedo and leaf area index). This vegetation forcing will partially lead the responses of turbulent fluxes, that will also depend on land-atmosphere coupling character.