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Impacts of global re-/afforestation and deforestation on large scale atmospheric circulation

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Land cover and land management (LCLM) changes have a high potential to influence the biogeophysical and biogeochemical earth system processes. The interaction of soil and vegetation with the atmosphere alternates the water, energy and momentum balance, in turn affecting the climate locally, as well as the climate of distant regions through teleconnection pathways. This, among others, might benefit or oppose risks to local and global breadbasket regions, impacting the crop yields.

In this study, we conduct model experiments to assess the local and remote impact of LCLM changes, in particular global re-/afforestation and deforestation, with a focus on the large-scale boreal summer atmospheric circulation. We hypothesize that due to the dominant role of land-atmosphere feedbacks in this season, robust dynamical transformations take place due to the LCLM changes. The idealized model experiments consist of three fully coupled Earth System Models (EC-EARTH, MPI-ESM and CESM) that run under constant 2015 greenhouse forcing for 150 years. Globally the LCLM changes go through a sequence of unchanged grid boxes in a checkerboard approach as recent studies have done, in order to accurately separate the local from the non-local effects.