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Local and non-local climatic impacts of land use across scales

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It has been widely recognized that land use/land cover changes have great potential to influence climate at different scales. However, their local and non-local impacts have not been well understood. First, previous studies are limited by the assumption that the local impacts of land use do not modify the atmospheric background states. Second, land-use impacts may vary if simulations are conducted at a different spatial scale. In this study, we investigate the local and non-local impacts of historical land use using the Community Earth System Model version 2, and explore the possible influence of model resolutions on the local and non-local impacts. The local and non-local impacts of land use are separated using atmospheric nudging, in which the horizontal winds in the upper atmosphere are forced to follow the ERA-Interim reanalysis, whereas the nudging strength is zero at the surface. The multi-resolution experiments suggest that the local impacts of land use are consistent at different spatial scales, but the non-local impacts are influenced by the model resolution. We will also discuss the local and non-local impacts of land use on climate extremes across scales. This study presents a new way to distinguish the local and non-local impacts and highlights the uncertainty in simulated land-use impact in climate studies.