



## **The impacts of land use and land cover change on tropospheric temperatures at global and regional scales**

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The impacts of land use and land cover change (LULCC) on tropospheric temperatures are investigated in this study using the fully coupled Community Earth System Model. Two simulations are performed using potential and current vegetation cover. The results show that LULCC can induce detectable changes in the tropospheric air temperature. Although the influence of LULCC on tropospheric temperature is weak, a significant influence can still be found below 300 hPa in summer over land. Compared to the global mean temperature change, LULCC-induced changes in the regional mean air temperature can be 2-3 times larger in the middle-upper troposphere and approximately 8 times larger in the lower troposphere. In East Asia and South Asia, LULCC is shown to produce significant decreases (0.2 to 0.4°C) in air temperature in the middle-upper troposphere in spring and autumn due to the largest decrease in the latent heat release from precipitation. In Europe and North America, the most significant tropospheric cooling occurs in summer, which can be attributed to the significant decrease in the absorbed solar radiation and sensible heat flux during this season. In addition to local effects, LULCC also induces non-local responses in the tropospheric air temperature that are characterized by significant decreases over the leeward sides of LULCC regions, which include the East Asia-western North Pacific Ocean, the Mediterranean Sea-North Africa, North America-Atlantic Ocean, and the North America-eastern Pacific. Cooling in the leeward sides of LULCC regions is primarily caused by an enhanced cold advection induced by LULCC.