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Impact of land use change on climate in HadGEM1

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Changes in land cover affect climate through the surface energy and moisture budgets. Previous work, using the third generation Hadley Centre Climate Model (HadCM3) has shown that historical deforestation in temperate regions caused an increase in surface albedo, leading to a net cooling effect on climate, conflicting with the suggestion that land use change is responsible for the warming observed over the 20^{th} century. The present-day global mean radiative forcing by anthropogenic surface albedo change relative to the natural state was comparable with the estimated forcings relative to pre-industrial times by stratospheric and tropospheric ozone, N_2O, the halocarbons, and the direct effect of anthropogenic aerosols. In contrast, afforestation or reforestation in cold regions was shown to decrease the surface albedo and induce a positive radiative forcing (warming) which could partly or completely offset the negative forcing (cooling) due to carbon sequestration. Here we use the most recent Hadley Centre Climate model, HadGEM1 to assess the importance of these biogeophysical effects for present-day climate, and quantify the forcing of historical and future climate change by land use change for comparison with forcings due to anthropogenic changes in greenhouse gases and aerosols. Our simulations use time-slice experiments using land cover data for 186 and 2000, and for 2100 under the IPCC SRES A2 and A1B scenarios.