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Impact of age-dependent wood harvest on carbon, energy and water fluxes

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Forest management affects the amount of carbon, water and energy that is exchanged between the forest and the overlying atmosphere through changes in the forest age structure. The representation of this effect is currently hampered in most land-surface models because the forest is assumed to be ageless, and the harvest scheme does not account for forest age. We tested the impact of including sub-grid scale forest age in a harvest protocol that is generally applied by land-surface models, e.g. in CMIP5. We used forest regrowth curves from the land-surface model JSBACH and a global age distribution map to create age-dependent carbon density maps on which we applied different harvest rules yielding different age structures. The harvested amount was kept constant in each rule, but for the partitioning of the harvest over the age classes we tested three options: 1) age-independent harvest, i.e. like it is represented in most land-surface models; 2) harvest with fixed rotation cycle; 3) harvest based on product demand. Preliminary results show that including sub-grid scale forest age in the harvest protocol resulted in a decrease up to 32% for global standing biomass and 5% for transpiration. Effects on albedo were small due to compensating effects in visible and near-infrared albedo and regional differences. We conclude that accounting for forest age structure in the harvest protocol is crucial for assessing the biogeochemical and biogeophysical feedback of forest management on the climate.