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## Evaluation of soil carbon dynamics after land use change in CMIP6 land models using chronosequences

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Land surface models are used to provide global estimates of soil organic carbon (SOC) changes after past and future land use change (LUC). To evaluate how well the models capture decadal scale changes in SOC after LUC, we provide the first consistent comparison of simulated time series of LUC by six land models all of which participated in the Coupled Model Intercomparison Project Phase 6 (CMIP6) with soil carbon chronosequences (SCC). For this comparison we use SOC measurements of adjacent plots at four high-quality data sites in temperate and tropical regions. We find that initial SOC stocks differ among models due to different approaches to represent SOC. Models generally meet the direction of SOC change after reforestation of cropland but the amplitude and rate of changes vary strongly among them. Further, models simulate SOC losses after deforestation for crop or grassland too slow due to the lack of crop harvest impacts in the models or an overestimation of the SOC recovery on grassland. The representation of management, especially nitrogen levels is important to capture drops in SOC after land abandonment for forest regrowth. Crop harvest and fire management are important to match SOC dynamics but more difficult to quantify as SCC hardly report on these events. Based on our findings, we identify strengths and propose potential improvements of the applied models in simulating SOC changes after LUC.