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Transient simulations of historical climate change including interactive carbon emissions from land-use change.

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Carbon fluxes from land conversion are among the most uncertain variables in our understanding of the contemporary carbon cycle, which limits our ability to estimate both the total human contribution to current climate forcing and the net effect of terrestrial biosphere changes on atmospheric CO2 increases. The current generation of coupled climate-carbon models have made significant progress in simulating the coupled climate and carbon cycle response to anthropogenic CO2 emissions, but do not typically include land-use change as a dynamic component of the simulation. In this work we have incorporated a book-keeping land-use carbon accounting model into the University of Victoria Earth System Climate Model (UVic ESCM), and intermediate-complexity coupled climate-carbon model. The terrestrial component of the UVic ESCM allows an aerial competition of five plant functional types (PFTs) in response to climatic conditions and area availability, and tracks the associated changes in affected carbon pools. In order to model CO2 emissions from land conversion in the terrestrial component of the model, we calculate the allocation of carbon to short and long-lived wood products following specified land-cover change, and use varying decay timescales to estimate CO2 emissions. We use recently available spatial datasets of both crop and pasture distributions to drive a series of transient simulations and estimate the net contribution of human land-use change to historical carbon emissions and climate change.