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Evaluating dynamic global vegetation models using meta-data analyses on soil carbon changes following land use change

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A major driver of changes in soil carbon in recent centuries has been land-use change. While evidence of land-use-related soil carbon changes exists based on local-scale observations, global estimates of these changes rely on modeling and remain highly uncertain. To understand the applicability of models to making future projections of soil carbon changes due to land use change, it is important to evaluate models using observations on soil carbon. A range of meta-data analyses on soil carbon changes following land use change has been published recently, aggregating local observations to levels potentially applicable to dynamic global vegetation models (DGVMs). However, up to now, this data has not been compared to DGVM simulations. The aim of this work is to develop an approach for evaluating DGVMs using these meta-analyses and apply the approach to evaluate the newly implemented soil carbon scheme-YASSO in the DGVM-JSBACH.

YASSO is driven by vegetation productivity from JSBACH. However, the productivity by JSBACH is known to have biases in some regions as compared to what is observed in reality. To account for these biases, we confine the litter inputs to soils close to observations and constrain the decomposition by forcing YASSO with observed vegetation productivity and climate. Later we assess the bias introduced by JSBACH vegetation productivity on the soil carbon response in YASSO. We perform idealized simulations from one land-use to another to mimic the observational set-ups that the meta-data analyses comprise. To compare the simulated soil carbon response in the model with the meta-data, we select homogeneous physical regions based on the factors identified in literature as to influence the spatial and temporal variability of changes in soil carbon following land use change. Both the simulated equilibrium and the transient response of soil carbon to land use change simulated by YASSO for these regions is then compared with the meta-data analyses.