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Modeled variability of land vegetation and carbon during the Holocene

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During warmer interglacials, major shifts within the vegetation cover took place. For example, the boreal tree line was shifted further north and the Sahara was on average greener than today due to an amplified monsoon system. These orbit-driven features are well known for the Holocene and are much more pronounced during MIS5e. In addition, there is an additional man-made forcing by land use during the last millennia.

From a paleo perspective, it is crucial to constrain these vegetation dynamics to understand the variability in carbon cycle. Carbon storage and vegetation cover are simulated by the land component JSBACH of the Max-Planck Earth System Model (MPI-ESM). The model comprises a module for dynamical vegetation and disturbances by wind and fire and can be driven by climate parameters out of observations, reconstructions, or directly coupled to ESMs of full or intermediate complexity.

We will present a model study focusing on vegetation dynamics and carbon storage on land during warm climates (primarily Holocene) and their variability. Using a factor separation method, an ensemble of transient simulations including / excluding (i) different land use changes, (ii) orbit forcing, and (iii) peat accumulation will be analyzed to disentangle the overall change in the land carbon by including all drivers. For this analysis, JSBACH is coupled to the Earth system model of intermediate complexity CLIMBER2 as this gives a reasonable timeframe for the ensemble of these 8000yrs spanning transient experiments.