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Modeled vs. reconstructed δ^{13}C variability within interglacials

T. Bruecher (1), V. Brovkin (1), M. Cuntz (2), and C. Reick (1)

(1) Max-Planck Institut f. Meteorology, Hamburg; Germany (tim.bruecher@zmaw.de, +49-40-41173-350), (2) Helmholtz Centre for Environmental Research - UFZ, Leipzig; Germany

Within warm climates major shifts within the vegetation cover took place, e.g. the boreal tree line was further north and due to an amplified monsoon system some 6000 yrs. ago the Sahara was on average greener than today. From a paleo perspective it is crucial to constrain these vegetation dynamics to understand the carbon cycle. Therefore, to (i) model the reconstructed carbon cycle dynamics and to (ii) validate the model a new feature for modeling the carbon fractionation (δ^{13}C) is developed. These processes are build in the land component JSBACH (Jena Scheme for Biosphere and Atmosphere Coupling Hamburg) 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. Basically, the effective fractionation processes for C_3 and C_4 plants are based on Lloyd and Farquhar (1994) with an extension to include leaf- and photorespiration after Wingate et al. (2007).

We will present a model study focusing the Holocene and Eemian (Mis5e) and their variability of modeled δ^{13}C as an effect of shifts in vegetation cover. The boundary conditions are taken from transient climate simulations with the MPI-ESM simulation (Fischer and Jungclaus, 2010) based on a constant atmospheric CO_2 concentration and an orbital forcing following the PMIP-2 exercises.