



Simulating the mid-Holocene Green Sahara using the dynamic vegetation model LPJ-GUESS

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The "Green Sahara" is a term used to describe a period when today's Sahara desert was transformed into a region covered with vegetation and lakes by orbital modulation. In this study, the 2nd generation dynamic vegetation model LPJ-GUESS is driven by different atmospheric forcings from coupled EC-Earth model mid-Holocene time-slice simulations in which the vegetation is either prescribed to be modern desert or artificially vegetated consistent with Green Sahara reconstructions. The dynamic vegetation model simulates a vegetated Sahara covered by both herbaceous and woody vegetation types consistent with proxy reconstructions only in the latter scenario. This northward expansion of vegetation is associated with a substantially intensified West African monsoon (WAM), and sensitivity experiments further suggest that the increased precipitation is the main driver of the change. These offline LPJ-GUESS simulations provide constraints on simulated vegetation in CMIP6 mid-Holocene coupled earth system model studies with EC-Earth, and represent the first step towards a fully interactive multi-millennial coupled EC-Earth-LPJ-GUESS mid-Holocene simulation with the aim of capturing the vegetation-climate feedbacks believed to be associated with the observed transitions into and out of the Green Sahara period.