



Assessing global climate-terrestrial vegetation feedbacks on carbon and nitrogen cycling in the earth system model EC-Earth

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There has been great progress in developing an improved European Consortium Earth System Model (EC-Earth) in preparation for the Coupled Model Intercomparison Project Phase 6 (CMIP6) and the next Assessment Report of the IPCC. The new model version has been complemented with ocean biogeochemistry, atmospheric composition (aerosols and chemistry) and dynamic land vegetation components, and has been configured to use the recommended CMIP6 forcing data sets. These new components will give us fresh insights into climate change. This study focuses on the terrestrial biosphere component Lund-Potsdam-Jena General Ecosystem Simulator (LPJ-GUESS) that simulates vegetation dynamics and compound exchange between the terrestrial biosphere and the atmosphere in EC-Earth. LPJ-GUESS allows for vegetation to dynamically evolve, depending on climate input, and in return provides the climate system and land surface scheme with vegetation-dependent fields such as vegetation types and leaf area index. We present the results of a study to examine the feedbacks between the dynamic terrestrial vegetation and the climate and their impact on the terrestrial ecosystem carbon and nitrogen cycles. Our results are based on a set of global, atmosphere-only historical simulations (1870 to 2014) with and without feedback between climate and vegetation and including or ignoring the effect of nitrogen limitation on plant productivity. These simulations show to what extent the addition degree of freedom in EC-Earth, introduced with the coupling of interactive dynamic vegetation to the atmosphere, has on terrestrial carbon and nitrogen cycling, and represent contributions to CMIP6 (C4MIP and LUMIP) and the EU Horizon 2020 project CRESCENDO.