Geophysical Research Abstracts
Vol. 15, EGU2013-3302-1, 2013
EGU General Assembly 2013

Does past vegetation productivity determine future carbon allocation patterns? A practical application with dynamic vegetation model LPJ-GUESS

Marleen Vermeulen (1), Bart Kruijt (2), and Pavel Kabat (3)

(1) Wageningen UR, Earth system science & climate change, Wageningen, Netherlands (marleen.vermeulen@wur.nl), (2) Alterra, part of Wageningen UR, team climate change & adaptive land and water management, Wageningen, Netherlands (bart.kruijt@wur.nl), (3) International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (kabat@iiasa.ac.at)

Long term measurements of terrestrial fluxes through the FLUXNET Eddy Covariance network have revealed that carbon and water fluxes can be highly variable from year-to-year. This so-called interannual variability (IAV) of ecosystems is not fully understood because a direct relation with environmental drivers cannot always be found.

We investigate how current vegetation productivity (GPP and photosynthetic capacity parameter vc_{max} may govern future productivity by incorporating memory effects of vegetation variability into dynamic global vegetation and ecosystem model LPJ-GUESS. This model uses a mechanistic representation of biogeochemistry and ecosystem dynamics, and its ability to accurately simulate monthly carbon and water fluxes for different FLUXNET sites has been demonstrated. The model, however, does not simulate IAV very well and this appears to be linked to changes in vegetation properties from daily to monthly time scales.

While photosynthesis and thus vc_{max} are calculated daily in the model, carbon allocation is currently handled on an annual time sale using a set of allometric equations to divide NPP over leaves, roots and stem. Leaf area and root biomass therefore do not change during the growing season. Hence, subsequent changes to the carbon pools due to disturbances in the environment on sub-annual time scales (e.g. drought events and late spring frost episodes) are not accounted for with the model.

We will change the allocation scheme by implementing carbon allocation at sub-annual time scale and introducing a time lag for adaptation of photosynthetic capacity parameter vc_{max} to changing environmental conditions.

We expect that introducing seasonal variability into the model improves estimates of annual productivity and IAV, and therefore the model's representation of ecosystem carbon budgets as a whole.