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Calibration and Validation of the LandscapeDNDC Model for Simulating Biomass Production in West African Savannah Ecosystems

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Abstract

Savannah ecosystems, as a valuable component of the West Africa's vegetation types, cover more than 80 % of its area and provide a wide range of ecosystem services from both ecological (e.g. regulating climate) and economical (e.g. producing biomass for humans and animals) perspectives. According to the recent surveys, West African savannahs are experiencing rapid land cover and climatic changes and these changes will at the end affect their biodiversity and productivity. However, from modelling perspectives, there is still a need for parameterisation of process based biogeochemical models for modelling the behaviour of these highly dynamic ecosystems. Here, we report simultaneous calibration of LandscapeDNDC model, which is a process-based ecosystem model that simulates C, N and water cycling, using multiple observation types from flux towers and satellite images and for various typical land cover types (i.e. grasslands, shrublands, arable lands, and woodlands) in West African Sudanian and Sahelian zones. Model performance of the newly parameterised vegetation module of LandscapeDNDC was assessed on basis of several *in situ* aboveground biomass production measurements gathered from different sources across the Sudanian and Sahelian agro-ecological zones. Our results indicate that the LandscapeDNDC model is able to simulate biomass growth as well net ecosystem CO_2 exchange (NEE) and Leaf Area Index (LAI) realistically over periods of several years. In addition, potential applications of the LandscapeDNDC model for managed and natural ecosystems in semi-arid environments, such as impacts of climate change on seasonal biomass production and changes of regional C exchange due to land use change will be discussed.

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