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Parameterisation of Biome BGC to assess forest ecosystems in Africa

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African forest ecosystems are an important environmental and economic resource. Several studies show that tropical forests are critical to society as economic, environmental and societal resources. Tropical forests are carbon dense and thus play a key role in climate change mitigation. Unfortunately, the response of tropical forests to environmental change is largely unknown owing to insufficient spatially extensive observations. Developing regions like Africa where records of forest management for long periods are unavailable the process-based ecosystem simulation model - BIOME BGC could be a suitable tool to explain forest ecosystem dynamics. This ecosystem simulation model uses descriptive input parameters to establish the physiology, biochemistry, structure, and allocation patterns within vegetation functional types, or biomes. Undocumented parameters for larger-resolution simulations are currently the major limitations to regional modelling in African forest ecosystems. This study was conducted to document input parameters for BIOME–BGC for major natural tropical forests in the Congo basin. Based on available literature and field measurements updated values for turnover and mortality, allometry, carbon to nitrogen ratios, allocation of plant material to labile, cellulose, and lignin pools, tree morphology and other relevant factors were assigned. Daily climate input data for the model applications were generated using the statistical weather generator MarkSim. The forest was inventoried at various sites and soil samples of corresponding stands across Gabon were collected. Carbon and nitrogen in the collected soil samples were determined from soil analysis. The observed tree volume, soil carbon and soil nitrogen were then compared with the simulated model outputs to evaluate the model performance. Furthermore, the simulation using Congo Basin specific parameters and generalised BIOME BGC parameters for tropical evergreen broadleaved tree species were also executed and the simulated results compared. Once the model was optimised for forests in the Congo basin it was validated against observed tree volume, soil carbon and soil nitrogen from a set of independent plots.