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Evaluation of Grassland Carbon Pool Based on a TECO-R Model and a Climate-Driving Function: A Case Study in the Xilingol Typical Steppe Region of Inner Mongolia, China

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While researchers worldwide have spent much effort on quantitatively evaluating organic carbon at the regional scale, few studies have examined organic carbon pools at different levels, or their driving factors. Comprehensive analysis in this field would facilitate a deeper understanding of carbon pool mechanisms and lay a foundation for future work. In this study, the improved Terrestrial Ecosystem Regional (TECO-R) model was modified and parameters were calibrated for local application. The vegetation, litter, soil, and ecosystem carbon pools in the Xilingol typical steppe region of Inner Mongolia, China were quantitatively modeled for the 2011–2018 period. The organic carbon pools at different levels were compared and analyzed in terms of their spatial distribution, inter-annual variation, and climate-driving factors. Overall, the modified TECO-R model accurately simulated carbon storage, revealing that the various organic carbon pools increased overall and were characterized by different degrees of clustering in their spatial distribution, inter-annual variation, and climate-driving factors. Clear formation mechanisms were observed in the soil, litter, and root carbon pools. As the soil depth increased, the carbon stock of the root carbon pool and the soil carbon pool decreased. Climate factors exerted different degrees of constraints on each carbon pool. Integrated studies, such as this, promote understanding of the compositional differences in grassland carbon pools and the driving mechanism for these carbon pools, which, taken together, can help shape the policy for carbon sink management in grasslands.