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Modeling and evaluation of vegetation and carbon dynamics of European forest sites with CLM-FATES

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Vegetation plays an important role in global carbon and water cycles. Long-term environmental changes modify vegetation distributions and consequently impact fluxes of carbon, water and energy. Vegetation dynamic models are useful tools to analyze terrestrial ecosystem processes and can simulate the impact of vegetation structure changes on carbon and water cycles and their interactions with climate when coupled to land surface models. Because of the complexity to represent plant growth processes, these models typically have a large number of parameters that can potentially contribute to uncertainty in model results and need to be adequately parameterized. In this study, we used the Community Land Model (CLM v5) coupled to the Functionally Assembled Terrestrial Simulator (FATES) and applied it to four forest sites from the database of European Long-Term Ecosystem Research Infrastructures (eLTER) which provides a wide range of observational data to calibrate and evaluate vegetation models. Using this database, we performed sensitivity analysis to evaluate parameter uncertainties in model results for forest growth, gross primary production, leaf area index, evapotranspiration, soil water content and soil temperature. We also explored the sensitivity of model parameters for different vegetation distributions and climate conditions. The results of this study allow us to understand the vegetation dynamics and their impact on carbon and water fluxes which will be helpful to improve model parameterization and to provide more accurate estimates of carbon and water fluxes and climate model projections.