EGU24-10571, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-10571
EGU General Assembly 2024

Modelling terrestrial vegetation dynamics and carbon-nitrogen cycles over the last glacial using LPX-Bern

Qing Sun[1,2] and Fortunat Joos[1,2]
[1]University of Bern, Physics Institute, Climate and Environmental Physics, Bern, Switzerland (qing.sun@unibe.ch)
[2]Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland

The terrestrial vegetation plays a crucial role in co-regulating global energy, water, carbon, and nutrient cycles. Shifts in vegetation, including changes in forest and peatland areas as well as species distribution, contribute to the large uncertainties in terrestrial ecosystems and their services under increasing disturbances caused by anthropogenic climate change.

To comprehensively assess vegetation responses and feedback to perturbations, particularly regarding carbon-nitrogen cycles and greenhouse gas exchanges, modelling efforts are indispensable. For instance, dynamical vegetation models can be exploited to investigate the terrestrial biogeochemical processes under past climate changes, such as glacial-interglacial transitions. However, such efforts often remain limited by the computational demands of complex Earth system models that struggle to capture multi-millennial timescales, which is further exacerbated by the challenges associated with model validation, leaving the long-term terrestrial vegetation dynamics largely under-constrained.

Here we employ the LPX-Bern model, a cost-efficient Dynamic Global Vegetation Model of intermediate complexity with fully coupled water, carbon, and nitrogen cycles, and present the results for simulations since the last interglacial. We critically evaluate the current model configuration, validated for pre-industrial to present-day conditions, for the last glacial cycle. The challenges in applying the model to these past times, such as the knowledge gaps in process representation, limited data availability for validation, and the limitations in model parameterisations, are addressed. The implications from simulating such long timescales and potentials to enhance the terrestrial biogeochemical processes in DGVMs are discussed. This study thus aims to contribute to advancing model development in carbon-nitrogen cycles for improved future climate projections.