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Applying LPJ-GUESS on the Arctic: A model evaluation and benchmarking study

The Arctic is warming up much faster than the rest of the world, and this has significant effects on the balance of carbon in the region. As the previously frozen ground melts, substantial amounts of carbon are released into the air, further contributing to climate change. Yet interestingly, the growth of more vegetation, like shrubs and trees, might help offset these carbon emissions. To better understand how all of this will evolve in the future, scientists are using models to simulate how plants and carbon interact in the Arctic.

The aim of this study was to see how well one of these models, called LPJ-GUESS, could capture important ecosystem processes in the Arctic. Variables that were considered included things like how much carbon plants take up, how much they release, how deep the ground thaws in the summer, and how much snow accumulates. The model was tested at 20 sites in the Arctic and predictions were compared to observations.

The study found that LPJ-GUESS often underestimated how much carbon plants were taking up and releasing, especially in the high Arctic regions. The model also had performed poorly when predicting how deep the ground thawed at different times of the year, and it did not do a good job with estimating snow depth.

Given these findings, it is clear that improving the LPJ-GUESS model is crucial for truly understanding the complex ways carbon behaves in the Arctic. Additionally, this study highlights the potential of using models to mimic how plants behave, which could greatly enhance our understanding of how the Arctic carbon cycle might change in the future.

Keywords: Physical Geography and Ecosystem Analysis; LPJ-GUESS; Arctic; FLUXNET; Gross Primary Productivity; Ecosystem Respiration; Permafrost; Active Layer Thickness; Snow Depth

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Master degree project 30 credits in *Physical Geography and Ecosystem Science*, 2023
Department of Physical Geography and Ecosystem Science, Lund University. Student thesis series INES nr 630