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Quantifying the impact of winter warming on arctic-boreal ecosystems and greenhouse gas exchange

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Future projections suggest that the Arctic will undergo extreme changes in the near future, with the largest changes occurring during the wintertime. Still, cold season processes and their impact on the annual carbon and water budgets are often understudied.

We aim to assess and quantify the impact of winter warming on the arctic carbon cycle by improving the representation of cold-season processes in the LPJ-GUESS DGVM. Firstly, we developed and implemented a new, dynamic snow scheme into the model to enhance the simulation of snow-soil-vegetation interaction. These updates improved the simulation of modelled soil temperature and permafrost extent compared to observations. In our latest study, we are assessing the physical controls on non-growing season methane emissions in the model, focusing on potential burst-like methane emissions during the zero curtain period. We set out to evaluate whether enabling non-growing season methane emissions may influence the annual methane budget.

So far, we found that changes in the cold season significantly affect arctic biogeochemistry. We also observed that wintertime changes affect vegetation dynamics and composition over the Arctic. Improving the model representation of wintertime processes enables to further investigate the future snow-soil-vegetation interaction. These simulations can be used to assess the impact of warming on the arctic carbon cycle and its global consequences.