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Land surface-atmosphere feedback mechanisms in high-latitude permafrost areas

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High latitude permafrost regions are undergoing greater environmental change than the rest of the world. Global climate change is leading to amplified air temperature increases, warmer permafrost soils and altered dynamics in the hydrological cycle all around the Northern hemisphere high latitude regions. Additionally, recent findings on the amounts of vulnerable soil organic matter and potential feedback mechanisms within the Earth system are highlighting the importance and the urgent need for advanced models representing relevant processes in high latitudes. This work demonstrates the efforts to incorporate the physical and biogeochemical processes inherent in the permafrost and cold regions into the JSBACH terrestrial ecosystem model to address aforementioned mechanisms. Representing vertical heat and water transfer processes and defining a heat insulating moss cover and layered snow scheme allow the model to simulate soil physical conditions more accurately. Moreover, a multi-layer vertical soil organic matter model with distinct pools is included within the model. Coupled dynamics of the soil physical state and the organic matter will be used in modeling experiments to assess the future response of permafrost carbon to the climate change. Possible feedbacks between soil and atmosphere will elucidate the future directions of the high latitude soil carbon balance and guide further investigations on vital issues.