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The projected impact of dynamic vegetation on climate change over the pan-Arctic

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The pan-Arctic land surface is warming rapidly, favoring longer growing seasons, increased productivity and shifts in the distribution of vegetation. These changes in vegetation are expected to strongly influence climate at the regional scale through biophysical pathways, such as changes in surface albedo and in the land-atmosphere fluxes of energy, water and momentum. Substantial feedbacks between vegetation changes and regional water cycles are expected in cold regions, as vegetation-snow and vegetation-permafrost interactions also play important roles.

In this study, the projected impact of dynamic vegetation on climate change in cold regions is assessed by comparing two pan-Arctic simulations of the fifth generation Canadian Regional Climate Model (CRCM5) – one with dynamic and the other with static vegetation, both driven by Earth System Model output. Dynamic vegetation is represented in CRCM5 by means of the Canadian Terrestrial Ecosystem Model (CTEM) coupled to the Canadian Land Surface Scheme (CLASS). Preliminary simulations of the pan-Arctic land surface using CLASS coupled to CTEM suggest that springtime albedo exerts significant control on summertime soil temperatures and active layer thickness. The presence of two-way interactions in CRCM5 allows the impact of dynamic vegetation on the projected regional climate change and hydrology to be assessed, focusing on the biophysical feedbacks and the interactions of vegetation with snow and frozen soils.