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The impact of **winter warming** on arctic-boreal gas-exchange

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encouraged

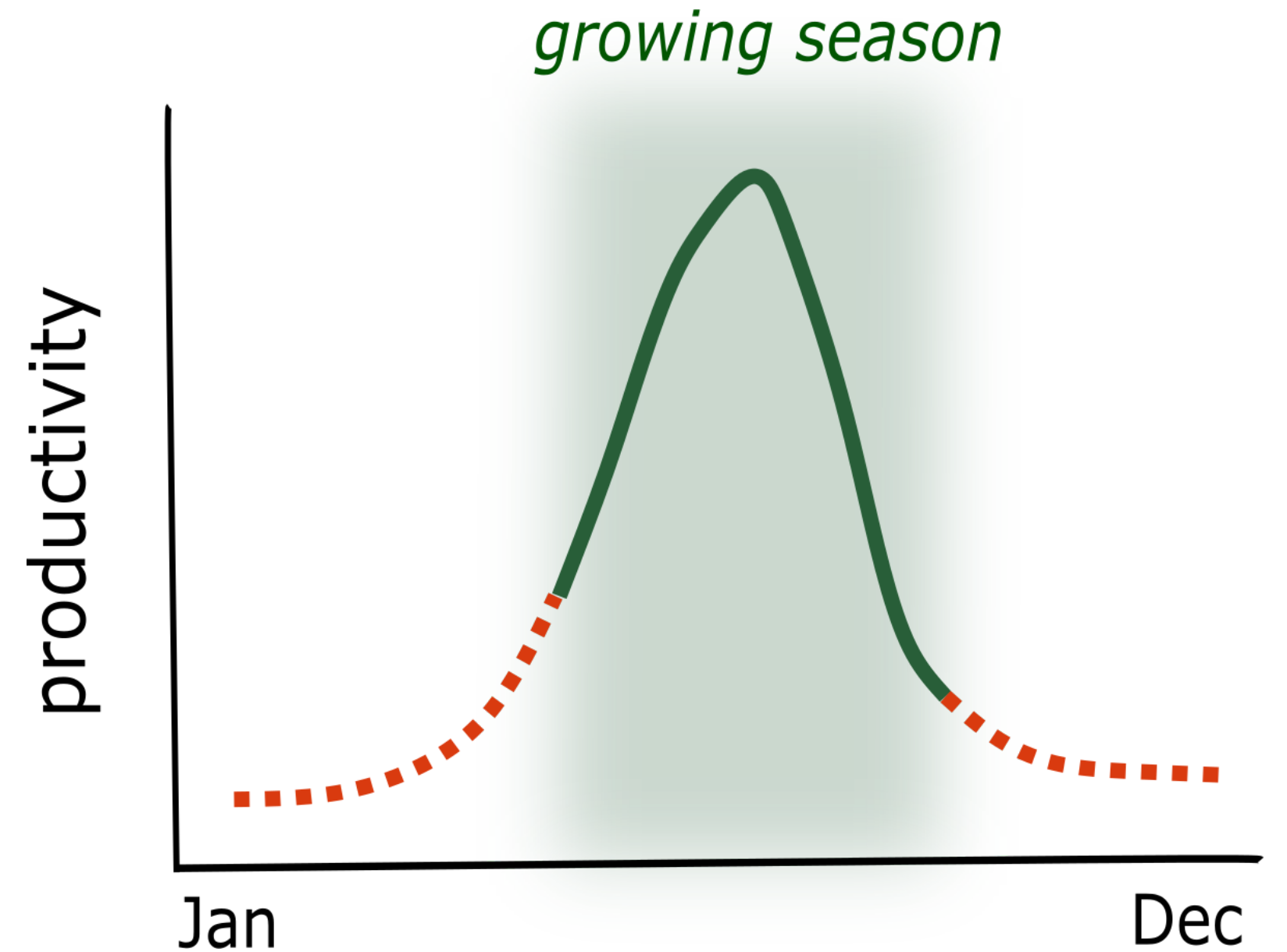
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The Arctic is changing rapidly

fast warming
changes in rain- and snowfall patterns
more frequent extreme weather events



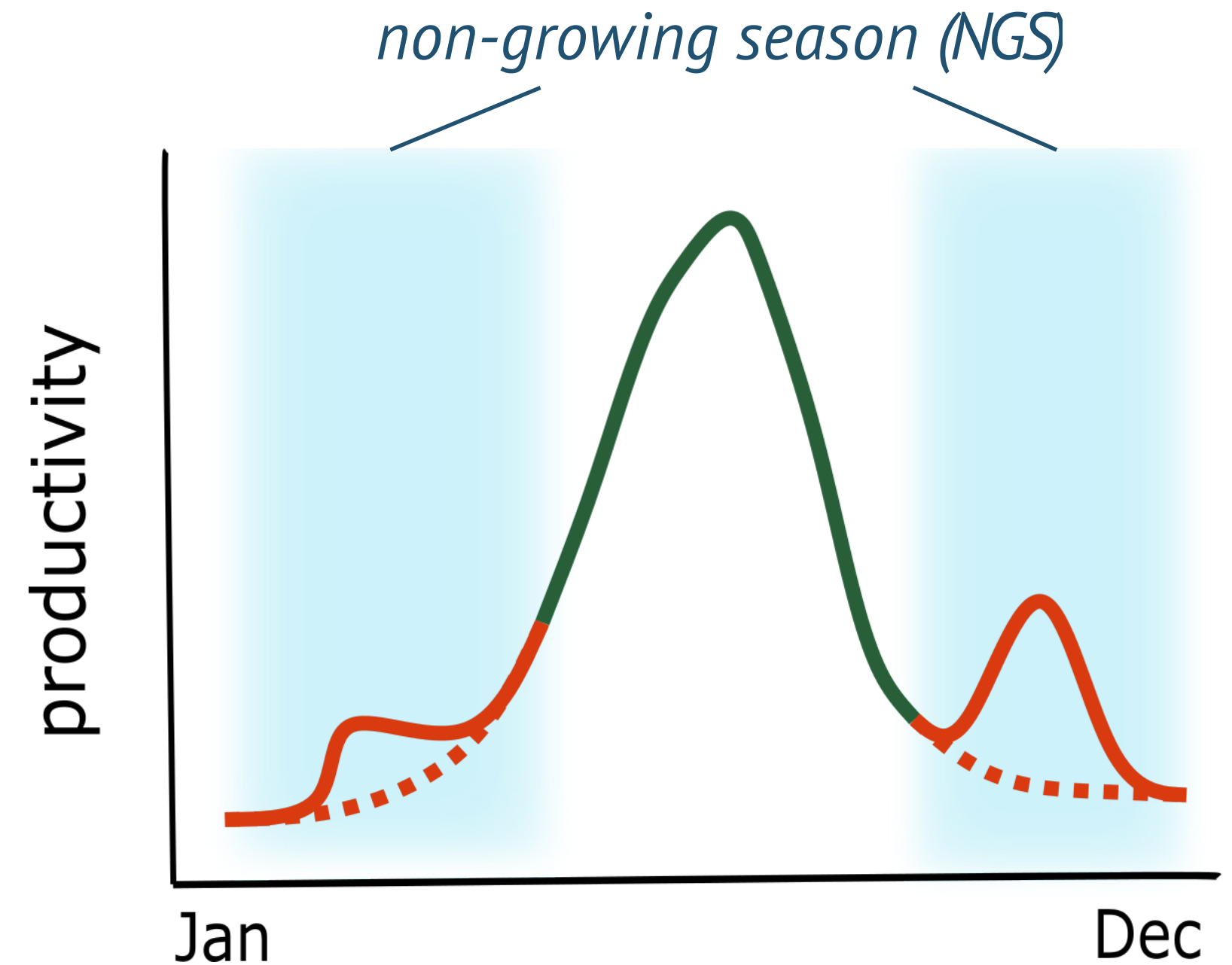
The Arctic is changing rapidly

fast warming

changes in rain- and snowfall patterns

more frequent extreme weather events

winters: largest future changes



Aim

focus on wintertime processes

improve representation in **LPJ-GUESS**

carbon source or sink?



Improved snow dynamics



warmer soil temperatures

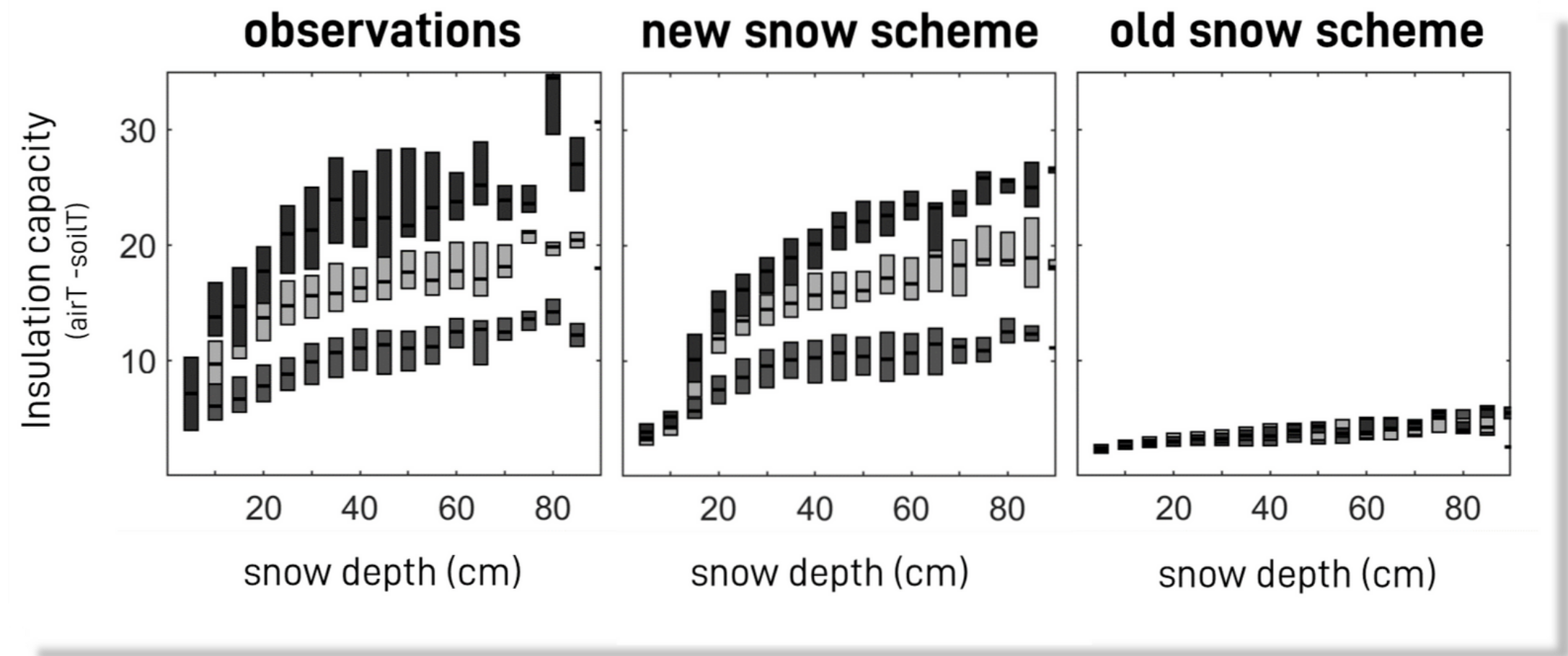
closer to observations



improved permafrost extent

compared to literature

¹ Obu et al. 2019

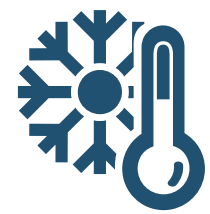


Observed and modelled snow insulation capacity.

Pongracz et al. 2021

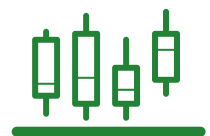
¹ Obu, Jaroslav; Westermann, Sebastian; Käab, Andreas; Bartsch, Annett (2019): *Ground Temperature Map, 2000-2017, Antarctic*. University of Oslo, PANGAEA

NGS greenhouse gas fluxes



allow cold-season carbon fluxes ² Natali et al. 2019

during winter and shoulder periods



influenced annual net carbon fluxes ³ Pongracz et al. 2021

lower summer NPP

increased winter C uptake

² Natali, S.M. et al. (2019) *Large loss of CO₂ in winter observed across the northern permafrost region*. Nature Climate Change 9, 852–857.

³ Pongracz, A. et al. (2021) *Model simulations of arctic biogeochemistry and permafrost extent are highly sensitive to the implemented snow scheme in LPJ-GUESS*, Biogeosciences, 18(20), pp. 5767–5787.

past ————— present ————— **future**

permafrost-carbon feedback

changes in snow depth and snow cover extent → albedo

higher soil temperature → impact on C fluxes



Summary



focus on snow-soil-vegetation interaction

improved snow dynamics in LPJ-GUESS

evaluate the potential permafrost carbon feedback

Thank you !

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