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## Changes in Land Surface Model Thermodynamics and Hydrology: Implications for Arctic Amplification

Nagore Meabe et al. ▶

The Arctic's response to global warming is primarily intensified by sea-ice and lapse-rate feedbacks. This mechanism, usually known as Arctic amplification (AA), significantly contributes to permafrost thawing, impacting Arctic soil carbon emissions and hydrology. However, significant uncertainties arise in permafrost-related processes. This study will analyze various experiments with different Arctic thermo-hydrodynamic set-ups to comprehend how different soil hydrology parameterizations in permafrost areas affect Earth's climate, particularly AA. Additionally, different vertical discretizations of the land surface model are considered. Although these discretizations show minor differences in surface temperature, the varied model hydro-thermodynamic configurations result in relatively distinct climate background states in the Arctic. A positive sea-ice-snow-albedo feedback is shown to enhance the warming signal under a climate change scenario. The magnitude of the feedback depends on the background state and available snow and sea-ice. By assessing the AA ratio we conclude that all configurations show considerable (internal) AA variability in the 20th and the first quarter of the 21st century, but end up converging to a factor of 2-3 times larger warming in the Arctic regions than globally by the end of the century. This suggests that high AA values recently found in observations are related to internal variability, and that near 0 temperature and sea-ice area trends in the Arctic lead to highly variable and non-significant AA values.

Furthermore, changes in the Arctic have the potential to affect the circulation, not only at a local scale but also up to mid-latitudes and the tropics via a series of teleconnections. The physical processes linking AA and sea-ice loss to lower latitude weather are still being discussed in the community. In this study we also assess how those different hydro-thermodynamical set-ups shape some atmospheric circulation patterns. Preliminary results shown a comparison of the response of extratropical (Arctic and Antarctic oscillations) and intertropical (monsoons and ENSO) modes across the ensemble of simulations.

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