PAMIP Webinar Series

The midlatitude responses to polar sea ice loss in different complexity GCMs

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Abstract

Can it? Has it? Will it? There are many open questions regarding the impact of polar sea ice loss in midlatitudes. The climate model hierarchy has proven to be a critical tool for simulating and understanding the response to climate change. Here we use the climate model hierarchy (slab-ocean aquaplanet GCM, prescribed SST atmosphere GCM from PAMIP, slab-ocean atmosphere GCM, and coupled GCM simulations) to simulate and understand the midlatitude response to polar sea ice loss. We test an energetic mechanism that predicts a weaker storm track in response to polar sea ice loss. The mechanism assumes sea ice loss increases the absorption of surface shortwave radiation and thereby drives increased surface turbulent flux into the atmosphere via thermodynamic ocean coupling. The result is a reduced equator-to-pole energy (temperature) gradient and hence a weaker storm track. We show the mechanism operates across the climate model hierarchy except in atmosphere-only PAMIP simulations where the mechanism is disabled (no ocean coupling) and consistently the storm track response is negligible in those simulations. The temperature and zonal wind responses also depend on thermodynamic ocean coupling. The results highlight the fundamental role of thermodynamic ocean coupling for the midlatitude response to polar sea ice loss and illustrate the value of using the climate model hierarchy to simulate and understand the response to polar climate change.

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