PAMIP Webinar Series

Arctic tropospheric warming from regional Arctic sea ice loss explained by a zonal-mean circulation feedback

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Abstract

As climate warms, sea ice loss may become a potent climate change feedback, both in the Arctic and at lower latitudes.Yet the predicted atmospheric and oceanic response to sea ice loss differ between climate studies, in part because the climate response to specific areas of sea ice loss remains uncertain.

Here, we assess the sensitivity of the atmospheric response to various patterns of sea ice loss, at a pan-Arctic or regional scale, by analysing a set of idealised AMIP-like simulations. Depending on where sea ice is reduced, we find that climatic anomalies can vary widely among experiments, especially the zonal-mean component of the tropospheric circulation: for instance, the subpolar jet and polar cell can strengthen or weaken with sea ice loss, depending on its geographical distribution. We demonstrate that the geometry of the sea ice loss, in particular the degree to which sea ice extent changes is zonally symmetric or asymmetric, is an important predictor for this disparate climatic response through an atmospheric feedback mechanism. In this feedback mechanism, changes in poleward eddy heat flux and latent heat release over the Arctic in response to a specific sea ice loss pattern can interact constructively or destructively, leading to a strengthening or weakening of the polar cell and a concurrent warming or a cooling of the Arctic troposphere.


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