



Dynamical link between the Barents-Kara Sea ice and the Arctic Oscillation

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The recent accelerated Arctic sea ice decline has been proposed as a possible forcing factor for mid-latitude circulation changes, which can be projected onto the Arctic Oscillation/North Atlantic Oscillation (AO/NAO) mode. However, the timing and physical mechanisms linking AO responses to the Arctic sea ice forcing are not entirely understood. In this study, we suggest the connection between November Barents and Kara sea ice extent and the following winter's atmospheric circulation, in terms of the fast sea ice retreat and the subsequent modification of local air-sea heat fluxes. In particular, we explore the dynamical processes that link November sea ice in the Barents and Kara Seas with the development of AO anomalies in February. In response to the lower tropospheric warming associated with the initial thermal effect of the sea ice loss, the large-scale atmospheric circulation goes through a series of dynamical adjustment processes: The decelerated zonal-mean zonal wind anomalies propagate gradually from the subarctic to mid-latitudes in about one month. The equivalent barotropic AO dipole pattern develops in January due to wave-mean flow interaction, and firmly establishes itself in February following the weakening and warming of the stratospheric polar vortex. This connection between sea ice loss and the AO mode is robust on the time scales ranging from interannual to decadal. Therefore, the recent winter AO weakening and the corresponding mid-latitude climate change may be partly associated to the early winter sea ice loss in the Barents and Kara Seas.