



Arctic sea ice modes and connections to the atmospheric circulation

Patrick Stoll and Rune Grand Graversen

Department of Physics and Technology, University of Tromsø, Tromsø, Norway (pst019@post.uit.no)

The Arctic sea ice cover has severely declined during the last three decades. Previous studies have observed that autumns with reduced Arctic sea ice cover tend to coincide with cold conditions of the Northern continent during the succeeding winter, often called the "warm Arctic - cold continent" pattern. Also connections between the Arctic sea ice and the Arctic Oscillation (AO) have been drawn.

Here, we study the effect on the atmospheric circulation of sea ice anomalies of different Arctic regions. September Arctic sea ice Empirical Orthogonal Functions (EOFs), providing modes of simultaneous year-to-year variability, were derived based on de-trended data from ERA-interim of 1979-2014. We found that both the AO and the "warm Arctic - cold continent" pattern can be connected to specific EOFs.

The first September sea ice EOF is a dipole with highly reduced sea ice cover in the Pacific Arctic and simultaneous increase in sea ice cover in the Atlantic Arctic. A similar first EOF was confirmed in coupled atmospheric oceanic simulations of the Community Earth System Model (CESM).

In ERA-interim, EOF 1 of the September sea ice anomaly is often followed by a positive phase of the AO in winter. A sensitivity experiment of the response to the first EOF was performed with CESM with prescribed sea ice cover anomalies from summer to the end of the winter associated with this EOF. Another sensitivity experiment with prescribed sea ice cover anomalies to October only was performed. Both of them produced a positive phase of the AO in winter. This suggests that the summer and autumn, but not the winter sea ice anomalies are responsible for the positive phase of the winter AO.

The fourth September sea ice EOF mainly shows reduced sea ice cover in the Barents and Kara Sea. In ERA-interim it is often followed by a Siberian high pressure intensification in winter, the "warm Arctic - cold continent" pattern. A sensitivity experiment with prescribed sea ice cover anomalies of EOF 4 does not confirm that low sea ice in the Barents and Kara Sea is responsible for an Eurasian cold anomaly in the following winter.