



Investigation of the atmospheric mechanisms related to the autumn sea ice and winter circulation link in the Northern Hemisphere

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The relationship of Barents-Kara sea ice concentration in October and November with atmospheric circulation in the subsequent winter is examined using reanalysis and observational data. The analyses are performed on data with the 5-year running means removed to reduce the potential effects of slowly-varying external driving factors, such as global warming, on the variables independently. The month-to-month variations in the lag relationships of the atmospheric anomalies related to October and November sea ice concentration are presented. It is found that positive (negative) Barents-Kara sea ice concentration anomaly in autumn is associated with a positive (negative) North Atlantic Oscillation-like (NAO) pattern with lags of up to three months. Evidence of the role of the stratosphere in providing the memory in the system by downward propagation are presented. Positive (negative) sea ice concentration anomaly in November is associated with a strengthened (weakened) stratospheric polar vortex and these anomalies propagate downward leading to the positive (negative) NAO-like pattern in the late December to early January. This evidence together with analyses involving Eliassen-Palm, eddy heat and momentum fluxes suggest that forcings of the zonal winds are relatively strong in November. In the final part, our results suggest that the autumn sea ice and winter atmosphere linkage found by statistical analyses may have a partial atmospheric origin in the pre-winter months with sea ice anomaly driven by the winds.