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Predictability of the wintertime Barents Sea ice cover from summertime ocean heat anomalies in the period 1981-2018

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The general ocean circulation transports warm and salty Atlantic water (AW) of subtropical origin towards the Arctic Ocean across the Nordic and Barents seas. Warming pulses observed in the AW layer of the Arctic Ocean during recent decades might have contributed to the observed dramatic shrinkage of the polar ice cap and, consequently, to Arctic amplification of global warming. Arctic sea ice anomalies may also affect climate variations in middle latitudes. Earlier studies have shown that the year-to-year variability of AW temperature (AWT) in the Nordic/Barents seas may be a significant source of seasonal predictability of the regional sea ice cover in winter. A question is whether this predictability has been sustained after the Arctic climate shift in the mid-2000s. Here a favorable answer to this question is given based on in situ observations of ocean temperature from various sources and gridded sea ice concentration data in the period 1981-2018. Empirical forecasts of the winter (December-February) mean sea ice area (SIA) in the Greenland and Barents seas are carried out using a time series of the summer (June-August) mean AWT anomalies in the western Barents Sea/southern West Spitsbergen Current area as the predictor. The forecasts yield a very high (exceeding 70%) proportion of explained variance (PEV) for the detrended total SIA over the Greenland and Barents seas in the recent subperiod (since 2004) as well as in the earlier subperiod (before 2004). For the SIA anomalies over the Barents Sea alone, the PEV score increased from about 50% in the earlier subperiod to about 75% in the recent subperiod. As the Barents Sea is a region with the largest wintertime sea ice variations in the Arctic, the summertime AWT anomalies also provide highly significant predictions of the leading mode of the wintertime variability in the sea ice concentration over the entire Northern Hemisphere.