

The impact of the Arctic Sea Ice retreat on the Extratropical cyclones and anticyclones: atmospheric model simulations

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The Arctic region has been warming more than twice as fast as the other parts of the world during the last decades. The rapid Arctic warming is accompanied by the dramatic change of the Arctic sea ice cover. Recently, it has been suggested that such climatic changes might have led to the increase of anomalous weather events in winter over Eurasia. An example is anomalously cold spells over Eurasia associated with atmospheric blocking events. However, a large uncertainty remains concerning robustness of the observed relations and associated mechanisms of impact (Semenov and Latif, 2015). The main goal of this research is to explore the connection between the declining Arctic sea ice (most strongly expressed in the Barents-Kara Seas region) in cold season and change of cyclonic and anti-cyclonic activity over Eurasia using simulations with an atmospheric general circulation model (AGCM).

The simulations were performed with the ECHAM5 AGCM (Roeckner et al., 2003) using identical sea surface temperature climatology but different sea ice concentrations (SIC) for the periods corresponding to the high (1966-1969), low (1990-1995) and very low (2005-2012) SIC regimes in the Arctic as well as for the mean climatological SIC for 1971-2000. The duration of each simulation was 50 years.

For the regimes with high and very low SIC, a statistically significant increase of the number of long-living anticyclones (with lifetime of more than 5 days) over Northern Eurasia was found. Long-living cyclones exhibited different changes in their number depending on their intensity (Fig. 1).

The analysis of the spatial patterns of cyclonic and anti-cyclonic activity over Eurasia was performed. We found an increase of the frequency of cyclones over the central region of the European part of Russia (EPR) and anticyclones over the northern region of the EPR for the regimes with a high sea ice concentration in the Arctic. For the regime with very low SIC the shift of the frequency of cyclones and anticyclones towards the central part of Russia was found.

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References

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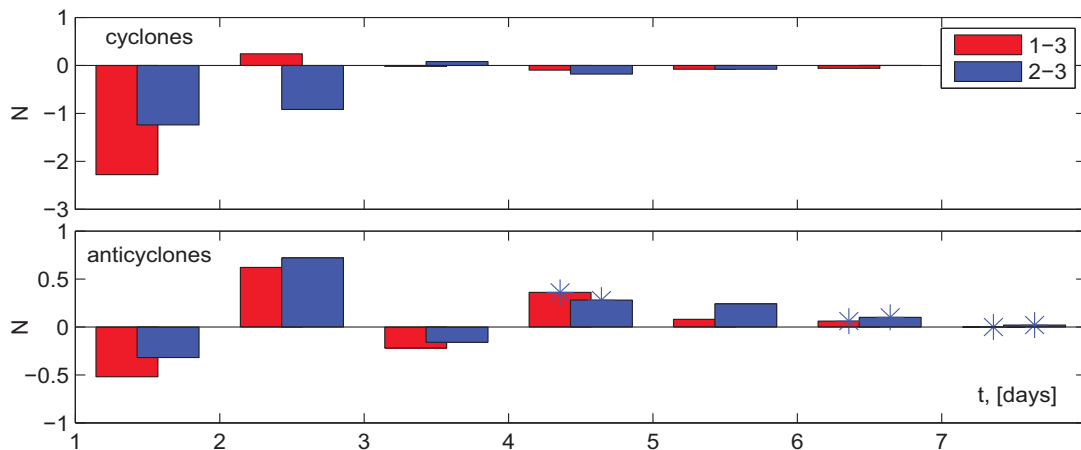


Fig. 1 Changes in the storm lifetime for 1966-1969 (1) and 2005-2012 (2) periods relative to the reference climate 1971-2000 (3).