On assessment of the relationship between changes of sea ice extent and climate in the Arctic

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Background
An increase of surface air temperature (SAT) in the marine Arctic (a part of the Arctic covered with sea ice in winter) shows a good relationship with reduction of sea ice extent (SIE) in summer. This connection was used to reconstruct September SIE in the Arctic from the beginning of twentieth century on base linear regression relationship. Winter SIE in the Arctic is changed under influence of warm Atlantic water inflow to the Nordic Seas. As a result the link arises between SST anomalies in the Northern Atlantic and winter SIE in the Barents Sea and in near-Arctic Arctic. Our evaluation reveals a coherent spatial pattern of the Atlantic SST influenced on SIE and air temperature in the Arctic.

Data and method
Sea ice data are taken from the National Snow and Ice Data Center (NSIDC) site (http://www.nsidc.colorado.edu). The sea ice extent data in the marine Arctic can be found at the AARI website (http://web.aari.ru/datasets). The sea surface temperature (SST) is taken from the HadISST dataset (http://www.metoffice.gov.uk/hadobs/hadisst). SST in tropical Northern Atlantic (NATL, 0-20°N, 60-30°W) is taken from http://www.cpc.noaa.gov/data/indices/. Estimates of atmospheric transport into the Arctic (see EGU2016-6996, poster X3.32 “Influence of atmospheric energy transport on amplification of winter warming in the Arctic”) were calculated on base ERA/Interim data (Dee et al., 2011). Method – multivariate correlation analysis.

The goal
To investigate impact of the Atlantic SST change on sea ice extent and air temperature in the Arctic

RESULTS:
1. Recent climate change in the Arctic

1.1 Surface air temperature (SAT) in area north 60°N (1) and in marine Arctic (2)

1.2 Close relation of SIE in September and SAT in summer

1.3 Reconstruction of September SIE on base connection with SAT

SUMMARY
- Winter 2016 in the Arctic was the warmest for the period of observations.
- February 2016 SIE in the Northern hemisphere was minimal.
- There is close relation between summer SAT and September SIE in the marine Arctic.
- Reconstructed September SIE shows the minimum in 1936 that is twice higher than minimum 2012.
- It is revealed remote influence of SST anomalies in tropical Atlantic on SIE and SAT in the Arctic with lags from 2 to 4 years.

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2 Remote influence on Arctic SAT and SIE change

2.1 NA Sept/Oct SST influence on Arctic SIE

Correlation with December SIE (lag 38 months) and with July SIE (lag 33 months)

References:

Publications:

Winter 2016 in the Arctic was the warmest winter