Answers to the referee 4

23-Jun-2017

Thank you very much for your comments. Please find below your comments repeated again and our answers. With the help of your advices, we have prepared a new version of our manuscript.

a) The authors mostly describe results based on linear correlation analysis but provide little physical interpretations.

To have a more focused paper we reduced the number of parameters, for that we made a general table of correlations with all our parameters and then chose only 3 for subsequent analysis: temperature, SLP and we added geopotential heights. We separated cold and warm winters (based on Baffin Bay region), similar to Sato et al, (2014); and added following analysis to reveal possible physical mechanisms why the Baltic Sea and the BB winters are in opposite phase relying on 1000 hPa temperature. We look atmospheric circulation differences using SLP, 700 hPa and 500 hPa geopotential height differences between warm and cold winters. We added also a cross-section of geopotential heights (up to 100 hPa) along the 60W vertical slice and plots of annual evolution of 500-hPa height differences at 60N, 70N and 75N (similar to Wu et al., 2013). See figures below:

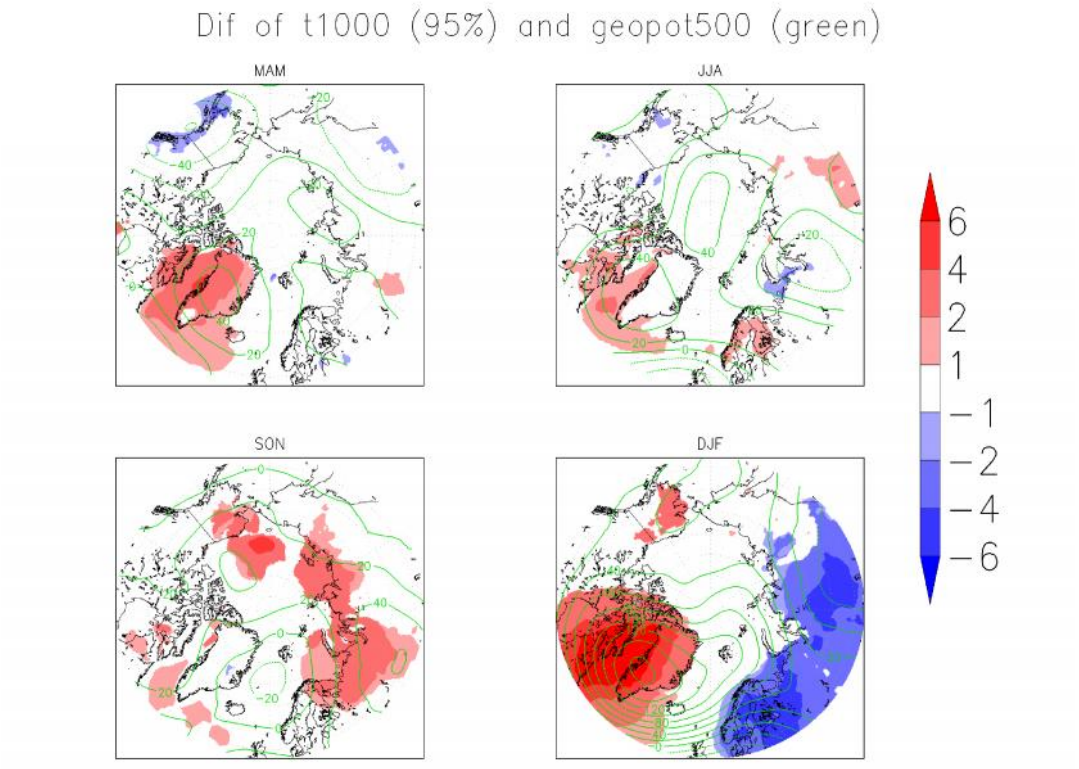

Figure 1. Seasonal difference maps (years with mild winters years with cold winters) in air temperature at 1000 hPa level (shading with confidence level of 95%), and (b) geopotential height at 500hPa level (contours).

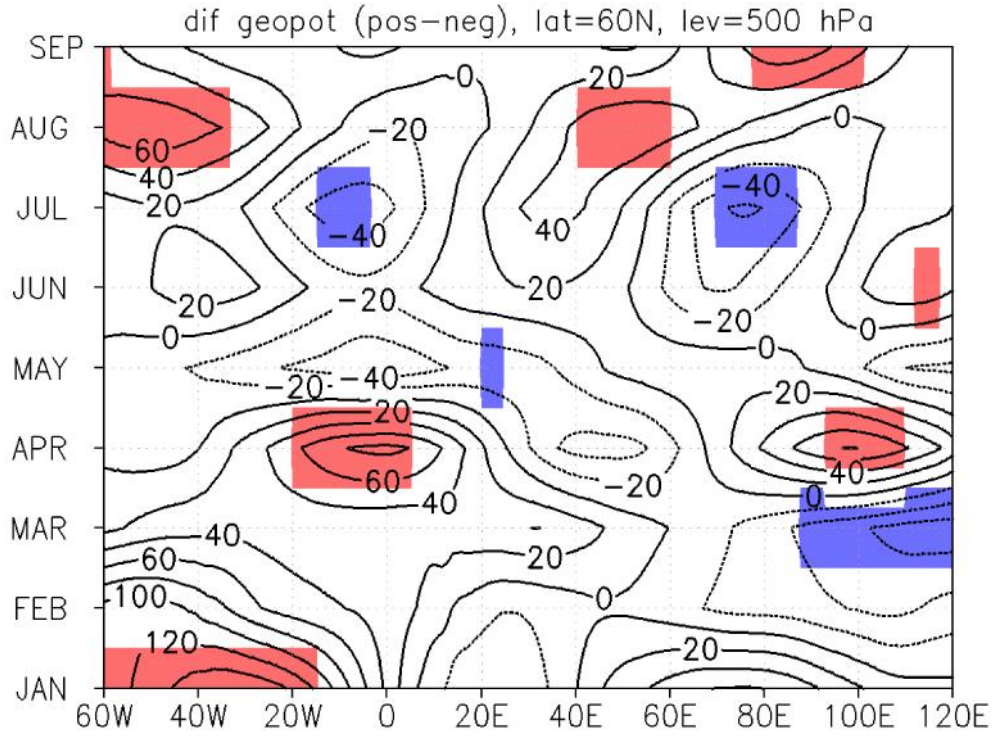

Figure 2. Evolution of 500-hPa height differences between mild and cold winters at 60N; red and blue shading indicates differences at the 95% significance levels for positive and negative height, respectively.

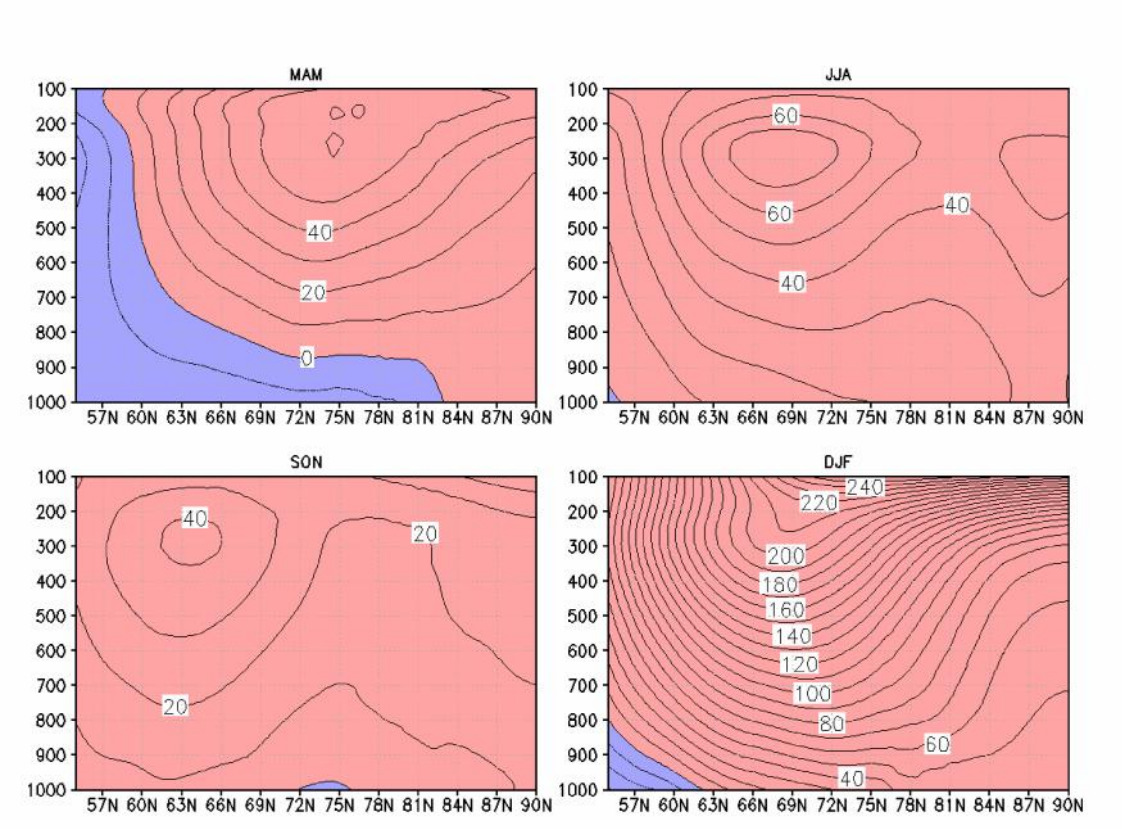

Figure 3. Differences in the mean heights between mild and cold winters along the 60W vertical slice. Contour intervals are 10 gpm; blue represent negative height differences and red positive height differences.

In discussion paragraph we added:

The large scale atmospheric circulation pattern in Figure 1 shows that the geopotential heights of 500 hPa are more than 100 gpm higher in mild winters than in cold ones, and the maximum of this height anomaly is centred over the maximum of the 1000 hPa temperature difference. It means that the whole column (up to 500 hPa) of the air in the Baffin Bay region is warmer than at cold years. Coming down to the lower surfaces (700 hPa, not shown), the maximum height anomaly is shifted to the east, what could be due to warmer sea surface of the Northern Atlantic compared to the regions that lay to west of it. The positive temperature anomaly (with the 500-hPa height anomalies) shifts towards east during the next seasons, reaching to Scandinavia/Baltic Sea region in summer (Figure 2). By Wu et al (2013) proposed mechanism, that associates the summer atmospheric circulation anomalies in the northern Eurasia with the previous winter ice conditions west of Greenland, supports our idea.
Figure 3 exhibit baroclinic structure of spring atmosphere north of 55N due to positive height anomalies in the lower troposphere below the 850 hPa and with further higher the negative ones. Similarly to Wu et al (2013) the vertical distribution of spring height anomalies differs from that of the previous winter when height anomalies show dominantly quasi-barotropic structure (not shown). With regression analysis they show the validity of their hypothesis of eastward propagation of the 500 hPa height anomalies. The same could be followed from Figure 2, where the evolution of 500 hPa height differences between mild and cold winters at 60 N is presented. Also at 65 N the similar pattern is present. At higher latitudes (70N and 75 N) this kind of signal propagation is missing.

b) Also I would like the authors to be more specific regarding novel findings in the manuscript.

We rewrote our Conclusions and besides results that assure (e.g. the strongest teleconnections are present in winter; temperature has strong negative correlation) or contradict (e.g. which has more impact NAO or AO) with results in literature. We added results that we considered to be new:

Although the East Baltic Sea region is downstream from North Atlantic and Greenland – Baffin Bay region is upstream, after removing the general atmospheric circulation influence (we used NAO and AO indices) there still remained significant correlations between parameters of Baffin Bay region and the East Baltic Sea region, except winter.
We showed correlation coefficients between parameters of the Baffin Bay region and the East Baltic Sea region, which was the first time precisely for this region. We hope there will be revealed more physical mechanisms than we were able to reveal this time. This could help long period climate forecast to be more precise in the Eastern Baltic Sea region.

c) Regarding the lagged correlations it would be nice to see how the authors connect their study to those discussing the persistence effect, such as Kolstad et al. (2015).

Kolstad et al. (2015) investigated the persistence of European surface temperature and found that once the persistent weather patterns appear (e.g. temperature anomalies of at least one standard deviation above or below climatology in a month), then the persistence is observed irrespective of the data source or driving mechanisms, and the temperature itself is a more skilful predictor of the temperatures one month ahead. We concentrated on the analysis of the teleconnection between the Eastern Baltic Sea region and the Arctic region. The analysis of the temperature persistence of one region was beyond our scope.

d) Also I found the maps in the figures are too small and they are very difficult to analyse. Some of them mostly repeat each other. For example q1000 and t1000 show very similar patterns. I wonder if it is possible to reduce the number of maps.

We improved figures quality and left out wind speed at 1000 hPa (which is possible to assume from the geopotential heights) and specific humidity at 1000 hPa (which is very similar to temperature at 1000 hPa) to avoid redundancy.

e) Technical comment: the paper by Lehmann et al., 2011 is referred to in the text but not listed in the literature section.

Corrected.

The references you suggested are added to introduction, data and discussion paragraphs .

Thank you once more for your trouble!

Sincerely yours,

Liisi Jakobson
Erko Jakobson
Piia Post
Jaak Jaagus

References

- Kolstad, E.W., Sobolowski, S.P., and Scaife, A.A.: Intraseasonal persistence of European surface temperatures, J CLIMATE, 28:5365–5374. doi:10.1175/JCLI-D-15-0053.1, 2015.
- Sato, K., Inoue, J., and Watanab, M.: Influence of the Gulf Stream on the Barents Sea ice retreat and Eurasian coldness during early winter, ENVIRON RES LETT, 9, 084009, 8pp, doi:10.1088/1748-9326/9/8/084009, 2014.
- Wu, B. Y., Zhang, R. H., D'Arrigo, R. et al.: On the Relationship between winter sea ice and summer atmospheric circulation over Eurasia, J CLIMATE, 26:5523-5536, doi:10.1175/JCLI-D-12- 00524.1, 2013.