

Interactive comment on “Revisiting the trend in the occurrences of the “warm Arctic-cold Eurasian continent” temperature pattern” by Lejiang Yu et al.

Anonymous Referee #2

Received and published: 31 August 2020

Revisiting the trend in the occurrences of the “warm Arctic-cold Eurasian continent” temperature pattern – review

Recommendation: Minor revisions

Summary

This paper investigates the relationship between trends/changes in the occurrence of the warm Arctic-cold Eurasia temperature patterns and numerous atmospheric variables. This paper refutes that this temperature pattern is due to sea-ice melt, and instead suggests that both temperature trends and sea-ice melt are due to cyclical changes in sea-surface temperatures and atmospheric patterns. The authors show

C1

that the warm Arctic-cold Eurasia temperature pattern has been occurring periodically since the mid 1800s and is associated with fluctuations in the AMO, PDO, and Pacific sea-surface temperatures. Overall this paper is well written and figures are clearly described.

General comments

The description of the SOM and the transition between nodes is good.

Please refer to figures more throughout the results section. I'd cite the figure number each time you change which figure you are discussing. For example, on line 230 you mention Figure 6, but then in the following line you are referring to Figure 5 but you do not give the figure number. It would be easy here (and in other places) for the reader to be looking at the wrong figure. The paragraph starting at line 277 is another instance where figures should be referred to more frequently.

Datasets and methods section – this section provides a good explanation of SOMs, including what SOMs are and how you will apply them to temperature data, but there is no explanation of how you analyse the other variables (i.e. create composites based on the SOM for temperature data), or the use of principal component analysis. Please include this here.

Consider adding analysis to show what portion of the trend in the warm Arctic-cold Eurasia pattern is due to mean warming. What trend is removed from the 20CR data? It seems an oversight to not consider mean warming when so many other variables are being examined.

Specific comments

Lines 23-36 – Abstract nicely sums up the major findings of the paper.

Line 53 – This line states that the warm Arctic-cold continents pattern has been observed on an interannual timescale. Please state here whether the pattern has been strengthening linearly over time, or whether it's a cyclical pattern, or something else.

C2

Line 75 – What changes in the Gulf Stream are you referring to here?

Line 85 – “Using regression method” should probably read “using regression”, or “using linear regression” (if this is correct).

Lines 90-98 – This first part of the Datasets and methods section seems to be replicating some of what is said in section 2.2. I'd suggest starting the datasets and methods section with section 2.1, and incorporating lines 90-98 into section 2.2.

Line 94 – Should this say “41 winters”? Or are you only considering complete winters, i.e. December 1979-February 2019 (thus excluding January and February 1979, and December 2019)? Which months do you use for winter? I assume it's DJF.

Line 102 – What is the resolution of the ERA-Interim data?

Lines 137-138 – What dataset are these lines referring to? Both ERA-Interim and 20CR? If both, which 40-year period do you use? I.e. do you subtract the 1979-2019 mean from both datasets?

Line 150 – Do the SOM-explained trends mean something physically, i.e. are they the fraction of the total trends that are explained by changes in circulation (or something else)?

Lines 161-162 – This sentence compares the “first node” in each group, however node 9 appears to be the second node in group one, and node 1 is the first node in group two.

Lines 164-165 – It is not clear from Figure 1 that the maximum anomalies are centered near Svalbard. Please consider adding contour lines to the SOMs, or use a discrete color scale. When you say maximum, are you referring to the greatest departure from zero (i.e. positive or negative values)?

Line 165 – This line states that nodes 3 and 7 are the second most frequently occurring of their groups, but node 3 occurs most frequently. The comparison of pairs is good,

C3

but needs to be worded more carefully. Maybe pick the most frequently occurring node in group 1 then identify its pair.

Lines 171-172 – Why can't this SOM consider temperature trends? I think this should say “does not” not “cannot”.

Lines 176-180 – Consider moving these lines to the methods section.

Line 193 – Please add figure reference.

Line 223 – Nice explanation of turbulent heat flux!

Line 229 – Maybe refer back to Figures 2 and 3 if that is where this statement comes from.

Lines 229-230 – Are you sure this is the correct order? I.e. over the Barents Sea in node 1, is it possible that the sea ice melt causes a reduction in the albedo which results in an increased turbulent heat flux?

Line 231 – When you say “larger” do you mean larger spatially, or a greater magnitude anomaly?

Line 238 – “composted” should probably be “composited”.

Line 239 – What happens if you do the same lag analysis for sea ice concentration? I think it is important to know that sea ice does not also peak before the day the nodes occur. Similarly, what happens if you do this lag analysis on the geopotential height patterns? It seems strange to say that circulation leads sea ice cover without mentioning the geopotential height patterns.

Lines 250-251 – How does this differ to the other nodes? I assume they only exhibit interannual variability.

Line 255 – I think this should refer to Table 3 (not Table 2).

Line 261 – Figure 8 does not appear to cover a large enough region to determine

C4

whether there are positive trends over southern Europe. This might need re-wording.

Line 262 – Maybe point out that negative trends are mostly not significant.

Line 267 – Arctic–cold should be Arctic-cold

Line 281 – Refer to figure number (Figure 11).

Lines 282-285 – Which node are you referring to? I assume node 1 but this should be clear.

Lines 284-285 – Are you determining the direction of propagation from Figure 11 or Figure 12? From the text it sounds like you are only referring to Figure 11, but I am not sure how you are determining that the Rossby wave moves southeastwards to the Eurasian continent from this figure. Please explain and give figure number.

Lines 285-286 – What figure(s) support the claim that “large SST anomalies over the Nordic Ocean augment the wave signal through local air-sea interaction”? This statement needs more support and/or more of a description on how you came to this conclusion.

Line 290 – Figure number?

Line 302 – Does “these results” refer to the results in Figures 10-12, or to the results you just mentioned in lines 299-302? If you’re referring to Figures 10-12, please state this.

Line 308 – Which figure are you referring to here? If this comparison is not shown, write “(not shown)”.

Line 321 – Where it states that the magnitude is smaller for the 20 CR data, could this be because the 20 CR data are detrended and the ERA-Interim data are not?

Lines 321-322 – This sentence says “frequencies of all the nodes (Figure 14)”, but Figure 14 only shows data for nodes 1, 4, 6, and 9 – please rectify.

C5

Line 322 – Please refer to the corresponding figure that shows node occurrence for ERA-Interim.

Line 325 – The occurrence frequencies at the end of the time series in node 1, Figure 7, appear to be slightly greater than those for node 1 in Figure 14. Could this indicate that mean warming amplifies these trends?

Lines 335-336 – If these results are not shown, please state this.

Lines 343-344 – Why isn’t the central North Pacific Ocean SST index shown in Figure 15 since it is significantly correlated with EOF modes 1 and 2?

Line 347 – And the PDO?

Lines 386-387 – Which figures are you referring to here?

Lines 388-389 – How does this atmospheric process suggest that the relationship between a warmer Arctic and East Asian cold spells are not as strong? If the atmospheric patterns described by your SOMs show changes in circulation patterns lead to increases in Arctic temperatures and decreases in Eurasian temperatures, then there appears to be a strong link. Or are you saying that temperature increases in the Arctic are not the driver of temperature decreases in Eurasia?

Figures

In general - Please add the following to the figure captions: - What years the figure covers (if not shown). E.g. Figure 1 - Whether the data have been detrended or not - Dataset used - Consider making figures more consistent, for example, Figure 10 has the Pacific Ocean in the center, whereas Figure 12 has the Atlantic in the center. It would be easier to compare these figures if they both had the same east/west bounds.

Figure 1 - Please consider adding contour lines to the SOM, or use a discrete color scale so it is clearer where the maximum/minimum values are on these plots. - Please mention years and dataset in the caption.

C6

Figure 2 - Please reconsider the use of a rainbow color scale. Reds and greens can look identical to color blind people. - It appears that the stippling/hatching is plotted on top of the contour lines. The plot might be easier to read if the contour lines were on top of the stippling/hatching. - The caption states that this is the “corresponding 500-hPa geopotential height anomalies”, but you do not mention that it corresponds to Figure 1. - The caption states that stippled areas are significant, but what about the hatched areas? I assume they are also significant. - Please mention what contour lines show in caption. - Maybe consider rotating the nodes so they match Figure 1 better, i.e. put Russia at the bottom of the subplots. Alternatively, adding an outline of the region in Figure 1 to the plots like Figure 2 would be helpful.

Figure 3 - It would be useful to show the contour lines (from Figure 2) on this plot as well (without stippling) so we can see exactly how the contour lines and wind anomalies line up. - What does the gray shading mean?

Figure 6 - Node numbers are missing from Figure 6. Please add them.

Figure 7 - Consider adding trendlines and p-values to each subplot (and other similar figures).

Figures 10, 11, and 12 - Consider arranging these plots the same, i.e. all 2x2 or 1x4 for easier comparison between the figures.

Figure 14 - Can the results from Figure 7 be overlaid on Figure 14? Maybe with gray dashed outlines. This would make it clearer to see the similarities/differences between the results.

Figure 15 - Consider putting r and p values on subplots b and d. Or in caption.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-413>, 2020.