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Interactive comment on "Contributions from intrinsic low-frequency climate variability to the accelerated decline in Arctic sea ice in recent decades" *by* Lejiang Yu and Shiyuan Zhong

Anonymous Referee #2

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The authors used the Self Organizing Maps (SOM) method to examine both the variability and trend of autumn Arctic sea ice over the past few decades. They found that about 60% of the recent autumn Arctic sea ice decline can be explained by 9 intrinsic modes, and specifically, SST anomalies over the North Pacific and North Atlantic, resulting atmospheric circulation and water vapor radiative processes.

The application of the SOM method to Arctic sea ice looks new to me and some interesting results are found. However, I have some major comments about this manuscript. I would recommend publication in ACP when they are addressed.

Major comments:

Discussion paper

1. About the number of nodes selected. Although the authors claimed that they chose 3x3 SOM grid because there is a large increase in correlation from 2x4 to 3x3, I feel the correlation increase looks pretty gradual to me and thus the choice of 3x3 is not very convincing. As the authors also claimed that "larger grids, . . ., do not alter the results and conclusions", I would suggest the authors include this information perhaps in the Supplementary Materials to better support the conclusions. Since, based on Table 1, increase of nodes after 3x5 does not seem to increase the correlation anymore, I would suggest the authors provide the results using 3x5.

2. About reference of previous studies. Although the application of the SOM method to Arctic sea ice is new, some of the results and conclusions drawn from the analysis have been found in previous studies but the authors failed to include them. Some of the relevant studies are listed below -

Gong, T., S. Feldstein, and S. Lee, 2017: The Role of Downward Infrared Radiation in the Recent Arctic Winter Warming Trend. J. Climate, 30, 4937–4949, https://doi.org/10.1175/JCLI-D-16-0180.1

Lee, S., Gong , T., Feldstein, S. B.,Screen, J. A., & Simmonds, I. (2017).Revisiting the cause of the 1989– 2009Arctic surface warming using the sur-face energy budget: Downward infraredradiation dominates the surface ïňĆuxes.Geophysical Research Letters, 44,10,654–10,661. https://doi.org/10.1002/2017GL075375

I would suggest the authors cite these references and add discussions on the consistency/inconsistency as compared to previous studies.

Minor comments:

Line 36: "natural processes"? why are these processes all natural?

Lines 40-45: The authors failed to explain the advantages of the SOM method here. The EOF method also provides "a manageable number of representative patterns".

Line 48: NAO has been defined before

Line 49: ENSO has not been defined

Line 80: The authors might want to better define what is "Euclidean distance" in the SOM method

Line 85: smaller number of grids

Line 86: larger number of grids

Lines 96-98: The authors should reference Fig. 4a here?

Line 134 and 152: It's not easy to tell that it is zonal wave number 2 here.

Line 193: "decadal-scale natural climate variability to Arctic climate change", why the authors concluded natural here? Can't the SOM nodes include anthropogenic components too?

Fig. 4: I don't see dots in (a)?

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