Review of ACPD-2018-636 – revision 1

"Heat Transport Pathways into the Arctic and their Connections to Surface Air Temperatures"

by D. Mewes and C. Jacobi

The authors have extended their analyses to include moisture transport by computing vertically integrated moist static energy fluxes. Accordingly they have redone most of the analyses. In particular, they have fixed the vertical integration by using data on model levels. Furthermore, they have addressed many of my concerns, including those regarding significance testing, leading to an overall improved manuscript. Nevertheless, I still have two major reservations. These are:

- The grouping of the clusters into three groups is not sufficiently explained and it remains unclear what the criteria are; see points (1) and (2) below.
- The patterns of 2m temperature or vertically integrated potential temperature anomalies and the flux of moist static energy do not match very well and their linkage is, therefore, not clear based on the analyses presented. In order to make a more convincing case, this must be supported by additional analyses or the origin of the differences between the patterns must be explained in more detail.

In my view these issues are critical and must be addressed before the paper can be accepted for publication.

Specific comments:

1. Thank you for the explanation of the grouping of SOM clusters. However, I still find it somewhat difficult to understand what the specific criteria for the grouping are. I assume that by "general transports", as stated in the response, you refer to the 2d vector fields of the energy transports. If so, what are the specific characteristics of the general transports that inform the grouping?

2. Furthermore, the following statement is hard to understand:

   P4L5: "The mathematical description of the Euclidean distance might assign distinct fields to patterns that fit mathematically but not under a meteorological point of view."

   What distinct fields does the mathematical description of the Euclidian distance assign to patterns? Maybe the authors want to say, that, in addition to grouping clusters whose mutual Euclidian distance is small compared to the other clusters, also other meteorological criteria could be used. If so, what are these meteorological criteria specifically?

3. Thank you for computing vertically integrated potential temperature anomalies and the divergence of the of the MSE fluxes. I find it difficult to relate these patterns to the MSE

fluxes and the 2m temperature anomalies. More explanation should be given how this linkage.

The missing link is probably contained in the divergence of the MSE fluxes. From the figures provided, these cannot be related due to the strong divergence / convergence along orography (which is likely an artefact from the numerical computation?).

4. Please include letters (a), (b), … for panels in Figures and use these to refer to the inidvidual panels in the text (instead of e.g., "right" panel of Fig. XYZ).

5. P1L17: please rephrase "… and following that … " → " … and the consequent … " (?)
6. P3L18: typo "build" → "built"
7. P5L3: typo "deviation" → "deviations"
8. P7L17: typo "dos" → "does"
9. P11L23: typo "frequent" → "frequently"
10. Figures: refer to panels by a, b, c…
11. P12L9: Awkward phrasing, please rephrase: "… presented by the pathways presented in this work:"
12. P12L12: typo "latent heat transport only."
13. P12L16: "which shows to have a positive trend" → "which features a positive trend"?
14. P12L17: "In connection, … " awkward phrasing, please rephrase this sentence.