

Review of the revised submission entitled “Moisture origin, transport pathways, and driving processes of intense wintertime moisture transport into the Arctic” by Papritz et al.

Overall recommendation: Accept with minor revisions

I thank the authors for carefully addressing my major and minor comments on the original manuscript submission. While I find the revised manuscript to be in good shape science wise, the writing needs to be cleaned up in certain areas. The abstract is much improved and clearly summarizes novel findings. However, statements/phrasing or whole sentences in other sections of the manuscript need clarification or rephrasing. I would ask that the authors please consider the following minor comments and suggestions for the final draft. I believe this manuscript will be a valuable contribution to Weather and Climate Dynamics.

Minor comments and suggestions:

1. Line 6 in the abstract. “zonal mean moisture transport”

Suggested change: poleward moisture transport

2. Line 35. “A substantial portion of the poleward moisture transport occurs”

Suggested change: A substantial portion of the poleward moisture transport into the polar cap occurs

3. Line 36. “that account for a substantial portion of the mean poleward moisture transport”

Suggest removing or including in a new follow-up sentence.

4. Line 63.

Suggest removing “zonal mean”

5. Line 120. “the average moisture”

Insert an “is” before “the average moisture”

6. Same as comment 5 on Line 121.

Insert an “is” before “the mass of the polar cap”

7. Line 121-122. Suggest removing the phrase “ $\overline{(\dots)}$ denotes again the daily mean.”, as it seems unnecessary.

8. Line 122-123. Suggest changing “Finally, we remove the ...” to the following:

Finally, since we are interested in the $\overline{H_L}$ anomaly, we remove the ...

9. Line 125-126. “At the beginning and end of the timeseries”

A comma is needed after timeseries

In addition, the next sentence uses the phrase “moist-air intrusion” which is not defined until Line 130. Perhaps “moisture-air intrusion” in this sentence could be rephrased to “ $\overline{H_L}$ anomaly selection” or something similar at this point?

“This is to ensure that neither the seasonality nor the long-term increase of poleward moisture transport bias the selection of **moist-air intrusions** based on a fixed percentile threshold towards the warmer (and more humid) extended winter months or the later years in the study period.

10. Line 129-130. Suggest removing “the” from the following:

“We then select all 597 timesteps for the further”

11. Line 130. Suggest changing the following:

“From here on, these timesteps, will referred to as moist-air intrusions.”

to:

From here on, these anomalous events of daily moisture transport will be referred to as moist-air intrusions or intrusions.

12. Line 138. Suggest changing the following: “points are ranked according to this transport.” to the following:

“transport values at potential trajectory starting points are ranked from highest to lowest.

13. Line 140-142. Suggest changing the following:

“With this approach we ensure that selected trajectories represent the most intense poleward moisture transport and they explain a substantial portion of the zonally and vertically integrated flux of moisture into the polar cap on the day of the intrusion.”

to:

With this approach we ensure that selected trajectories provide a representative sample of the upper half (or top 50%) of the daily moist-air intrusion flux into the polar cap.

14. Line 155-157. Suggest changing the following:

“As opposed to Sodemann et al. (2008), also moisture uptakes above the planetary boundary layer are taken into account in order to include moistening caused by convective transport of moisture from the boundary layer into the free troposphere.”

to:

And in contrast to Sodemann et al. (2008), moisture uptakes above the planetary boundary layer are included to account for moistening caused by convective transport of moisture from the boundary layer into the free troposphere.

15. Line 226-227. Suggest changing the following:

“In the following, we first consider the spatial distribution of the sources of moisture transported into the Arctic across 70° N during all moist-air intrusions (Fig. 3).”

to:

In the following, we first consider the spatial distribution of moisture sources for intrusion events (Fig. 3).

16. Line 239. Suggest changing “if moisture transport is strong” to the following:
if an intrusion is present

This is one example of when the phrase “moisture transport” is better stated as “moist-air intrusion” or “intrusion”, as it has been defined earlier. I believe this phrasing exists elsewhere in the manuscript, and if so, it should be revised for consistency and clarity according to the definition established. Please recheck throughout.

17. Line 240. Suggest changing “of latitude segments” to the following:
by latitude segments

18. Line 260. Should the following”
“warmed by surface sensible heat fluxes”

to:

warmed by surface sensible and latent heat fluxes

19. Line 307. What is the “classical case” of an intrusion? Please defined or rephrase.

20. Line 316. “contribute substantially more”. The usage of “substantially” needs to be quantified. Figure 6 shows that for $\Delta\theta + \Delta T$ – trajectories contribute 15 (10) % more to moist-air intrusions that occur in the Labrador (North Pacific) sectors than the North Atlantic.

21. Line 357-358. Replace “are” with “is” and replace “remain” with “remains” in the following:
“moisture are picked up earlier or remain”

22. Line 393. Change “Ward’s method is to merge element” to the following:
“Ward’s method is to merge elements”

23. Line 398. Is the phrase “in terms of zonal mean poleward moisture transport” needed here? Confirm phrase usage of poleward moisture transport, with and without zonal mean qualifier, moist transport etc.. Please use the moist-air intrusion phrase which defines anomalous moisture transport into the Arctic greater than 90th percentile. I realize sometimes both phrases are needed in a description but there are redundancies and/or combined usage sprinkled throughout.

24. Line 429. “substantially”
Again, this should be quantified. Check on this word throughout.

25. Line 447. Rephrase “in the one single”

26. Figure 7 caption should describe SST contours and label increment.