



EGUsphere, referee comment RC2
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Comment on egusphere-2022-36

Anonymous Referee #2

Referee comment on "Impact of atmospheric rivers on Arctic sea ice variations" by
Linghan Li et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-36-RC2>, 2022

This paper uses reanalysis model output (ERA-5) to assess the contribution of atmospheric rivers (strong advection of water vapor; AR) to melting of ice in the Arctic. The authors describe two episodes of strong AR events in the Arctic and map the various heat flux terms associated with each event. They also plot time series of the contribution of various terms over a span of days centered on those events. A statistical analysis of heat flux terms over a multiyear period is used to suggest the spatial pattern of association between AR activity and ice loss.

Although the authors do show some correspondence between AR events and ice loss, I got the impression that these AR events were rare, and that shortwave input was by far the dominant term in the net heat flux melting ice (as an aside, I assume the shortwave term refers to input after reflection by the ice, but the authors need to make this explicit). This is not to say that ARs do not melt ice, and potentially advect it northwards - they authors clearly implicate this mechanism in their two case studies. What is less apparent is whether a year with a few strong ARs would necessarily yield less ice than a year without them. The use of rank correlations, as opposed to standard Pearson's r , is similarly unconvincing to this reader.

Similarly, the authors suggest at several points in the text that enhanced net downward longwave radiation is an important contributor to the ice loss - yet the contributions shown in Figures 1 and 2 are exceedingly small.

In summary: while I appreciate the authors attempt to quantify the contribution of ARs to melting ice (i.e. this is an important issue), I do not think they have made a convincing case that such events are big contributors to the ice budget of the Arctic.

More detailed comments are as follows:

l.16 - "longwave radiation" - not shown to be a big contributor

l.70 - change "estimate of Arctic" to "estimates of the Arctic"

l.71 - change "near Arctic" to "near the Arctic"

l.74 change "2" to "two"

l.79 change "timescales and to" to "timescales to"

l.90 change "2" to "two"

l.110 This important point regarding the relative magnitude of the fluxes (net longwave being **much** weaker than turbulent flux) needs to be reflected in the Abstract, which had implied that longwave flux was important.

l.115 change "important" to "an important"

Figure 2 - need to specify whether GMT or local time is plotted, and whether the dates on the axis are centered on midnight or noon

Figure 2c - a plot of wind vectors would be more revealing (would show both direction and magnitude, illustrating northward winds)

l.152-153 "moisture and wind are both important in contributing to the strong IVT". This statement seems rather circular, since the IVT is basically defined as moisture times wind. Are the authors trying to make the point that the **variance** of the the IVT signal is due equally to both elements?

l.189 - "southerly" and "westerly" - for consistency, use "northward" and "eastward", and is done earlier in the text

I.209 - "moisture content is more important than wind speed in strong downward surface heat fluxes and rapid sea ice decrease" - I don't see this demonstrated in Figure 4; instead, I see a period of high wind speed associated with a steady loss in sea ice concentration.

I.226 - "longwave radiation" - I do not see a strong influence of longwave radiation in the shaded plots or line graphs. Its contribution appears to be minor.

Section 3.2.2 - what is the justification for using rank correlations, as opposed to Pearson's r ? The existence of a rank correlation, by itself, does not make a very convincing case for the importance of a forcing term.

Figs 8 and 9 - I think it would be far more convincing to show the Pearson's r correlation of ice loss with northward IVT - has this been attempted?