Weather Clim. Dynam. Discuss., referee comment RC2
https://doi.org/10.5194/wcd-2021-52-RC2, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on wcd-2021-52

Anonymous Referee #2

Referee comment on "Impact of Eurasian autumn snow on the winter North Atlantic Oscillation in seasonal forecasts of the 20th century" by Martin Wegmann et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2021-52-RC2, 2021

Summmary

This study uses a novel experimental setup that allows the authors to test the impact of different Eurasion snow states on the seasonal evolution of the polar vortex and NAO. Regression analysis and compositing high and low snow dipole scenarios are used to show a relationship between 1st November Eurasion snow and the NAO.

Overall I think this is a well written paper, and an interesting study with a novel use of the exerimental setup. My only concern is that a discussion of non-linearities in the results seems to imply a large difference between the impact of high and low snow, and this difference may be hidden by the use of linear regressions. I believe this should be explained, or investigated briefly, before publishing.

Major Points

Section 4 e. Non-linearities, Fig. 11. This was very interesting to separate the effects of a high and low snow dipole, but then it seems to call into question the core result of the paper, i.e. the statement from the abstract: "Subsampling the perturbed forecast ensemble and contrasting members with high and low initial snow dipole conditions, we found that their composite difference indicates more negative NAO states in the following winter (DJF) after positive west to east snow cover gradients at the beginning of November." this statment is still true, but it seems to imply that high snow leads to a negative NAO (i.e. the canonical view of the snow-polar-vortex-NAO connection). But then Fig. 11b doesn't show a signal for high snow. Does this imply that the regressions, e.g. in Fig. 6 would also include this strong non-linearity (which, of course, would not be picked up the a linear regression). Perhaps this could be explored with a scatter plot, or something similar (I trust the specific details to the authors discetion), showing the snow dipole index plotted against indices of the NAO or an appropriate polar vortex index. If

these plots showed a fairly linear response of NAO/polar vortex to a high/low snow dipole, then I think the conclusions are valid. If there is a strong non-linearity and the NAO response is mostly driven by low-snow, then perhaps the conclusions need to be modified somewhat, but this it still a very interesting result.

Minor points

Would it be practical to show Figure 1 and 4b together? Since it is interesting to compare these.

Line 64: "memory" (quotation marks in english are always up top)

Line 94 and 141: Is there a reason, or proposed mechanism, for why a snow dipole is a better index than a snow extent index used in many earlier studies, and can this be briefly mentioned in the introduction?

Line 171: For land surface perturbed runs I assume the SSTs, sea ice, etc, are not changed, can this be stated.

Line 244: "positive snow dipole, as depicted in Figure 4," Do you mean Figure 3?

Line 248. Do the numbers in the brackets mean the values for plus/minus one standard deviation? Please write as a separate sentence if it's important.

Figure 6. Rather than Dec and DJF, perhaps showing Dec, Jan, Feb would be better so we can see the seasonal progression of Z and slp anomalies. If Nov was included too then we couls also see the SLP associated with the snow anomalies.

Line 276: Why is the initial response shown for December, and not November?

Figure 6, 7, 10, Supp Fig 4: Short titles above. or on the left side of each plot with the variable, e.g. 500hPa Z, SLP etc, makes it easier to read, compared to relying on the captions.

Line 303: "ca." I think this abbreviation is usually used for historical dates. It's not incorrect, but perhaps just using "about" would aid coprehension for most audiences.

Line 319, Fig 8: Is the tropospheric jet shift related to the snow anomaly?

Line 336/413: "preceding", "precedes"

Figure 11: missing 'a' and 'b'

Line 448: Using parentheses to describe opposite effects can make sentences very difficult to understand, see article: Robock, A. (2010), Parentheses are (are not) for references and clarification (saving Space), Eos Trans. AGU, 91(45), 419–419, doi:10.1029/2010EO450004. https://eos.org/opinions/parentheses-are-are-not-for-references-and-clarification-saving-space