

Weather Clim. Dynam. Discuss., referee comment RC2
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Comment on wcd-2021-23

Anonymous Referee #2

Referee comment on "Interaction between Atlantic cyclones and Eurasian atmospheric blocking drives wintertime warm extremes in the high Arctic" by Sonja Murto et al., Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2021-23-RC2>, 2021

Review for

Interaction between Atlantic cyclones and Eurasian atmospheric blocking drives warm extremes in the high Arctic

Sonja Murto et al

Based on document: wcd-2021-23-manuscript-version2.pdf

The manuscript presents a detailed analysis of atmospheric blocking events linked to wintertime warm extremes in the Arctic. They show that most of their 50 warm events taken from the ERA-Interim period can be linked to either Ural or Scandinavian blocking and they analyse the blocks in terms of the diabatic heating experienced by Lagrangian back trajectories and the positioning of nearby mid-latitude cyclones.

The manuscript is clear, and the results are interesting. The manuscript builds on previous work looking at the role of diabatic heating on blocking more generally, with similar methods, but extends it by focussing on the important impact of Arctic warming. As noted by another reviewer, there is a body of literature specifically on the dynamics of Ural blocks and their impact on the Arctic, and the new results here should be placed into the context of these studies in more detail (specifically, how diabatic heating and cyclone interaction relate to other physical mechanisms of block development); however, since other comments already raise this issue, I do not pursue it further. With this caveat, I recommend the manuscript be accepted for publication once the following comments have been addressed.

General comments:

Title: The study focusses on wintertime warm extremes, and this should be mentioned in the title.

L5: The period of study should be mentioned here (1979-2017).

L13: 'the contribution of diabatic heating to these blocks is around 60%' does not make sense. Please be more precise.

L89 and L95: 'wintertime Arctic warm extremes' is more accurate than 'Arctic warm extremes' (unless there are no warm extremes outside of winter, according to your definition, in which case this would be worth mentioning).

Fig 1 caption: It took me a while to see the horizontal blue line (the cyan and light blue lines look very similar, especially against the blue shading!). Is there a better choice of colours?

L135: For clarity, is the overlap condition based on number of grid points or area?

L152: Please describe the release grid more precisely.

Fig 10 caption: I found the terminology here confusing because word the density is ambiguous. Consider rewriting (e.g. perhaps something like: 'Spatial distribution of the locations of maximum heating for the trajectories within the heating regime initialized from Ural (a) and Scandinavian (b) blocks. Shading shows the density of trajectories at the time of maximum 6-hourly heating, defined as the percentage of the total number of heated trajectories per unit area. ...').

Line 499: 'sea-loss' -> 'sea-ice loss'

L564: I do not think your results prove that 'Diabatic heating plays an important role in the dynamics of high-latitude blocking', as claimed. You have shown very clearly that most air parcels entering the blocks do undergo diabatic heating, but of course that does not necessarily mean that the diabatic heating is important for the block evolution. Indeed, you have selected cases whereby warm moist air moves north and enters the

Arctic, and it is hard to envisage that happening without diabatic heating occurring. Having said that, I do agree it is certainly likely to play a role. But the language used here should represent the results of the paper more faithfully.