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Interactive comment on "Recent changes in summer Greenland blocking captured by none of the CMIP5 models" *by* Edward Hanna et al.

Anonymous Referee #1

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Review of

Recent changes in summer Greenland blocking captured by none of the CMIP5 models

by Hanna and others

Major comments Recent studies, among which a significant number published by these authors, have demonstrated that the strong melt in Greenland post-1990 coincide with persistent summer blocking over the ice sheet (negative NAO index) resulting in the advection of warm air and relatively few clouds over the western ice sheet, both enhancing melt. Three all-important but quite distinct questions need to be addressed: 1) what part of that circulation anomaly can be explained by (decadal) natural variability; 2) how well is this natural variability represented in (global) climate models and 3) how

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Discussion paper

will the frequency of these the circulation patterns change in the future? Recent publications suggest that an important part of the circulation variability can be explained by natural variability with forcing originating in the tropics, but others claim that future warming will result in less zonal flow and hence more frequent blocking events, and that the recent anomalies are an expression of that. In order to add to this discussion, this paper should first carefully frame these issues, and indicate which question is addressed in this study. As the paper is organized now, it works confusing: is the main message that CMIP-5 models do not realistically represent Greenland blocking, and/or NH het stream dynamics in general? And does this imply that the projected future decrease in the blocking index is unreliable? And also that we cannot use these models to isolate the contemporary contribution of natural variability?

Another point of concern is the chosen averaging period to smooth the time series. Because the 20/30-yr running mean time series of the 'observed' quantities (Figs. 1/S1) still end close to 2020, we can conclude that the preceding decades are used to calculate the running means, i.e. it is no midpoint running mean. Were a midpoint approach used, the differences in these figures would likely be less dramatic. When looking at Fig. S2, in which three-year running averages are used, the difference between model and observations strikes me as less dramatic. Can the authors also show the annual (non-smoothed) JJA time series? From Fig. S2 it is evident that also for three-year running averages, the recent deviations exceed the intermodel variability for two periods, but recently the values have returned within the model envelope and a negative trend in the following decades appears still possible. Variability in the observed and model time series appear to be comparable. It would be instructive to calculate trend and standard deviation for all (unsmoothed) time series and see how they compare. And also: how sensitive are the plotted results to the choice of the reference period?

Minor (textual and technical) comments

p1, l. 6: please reformulate 'Historical scenario'.

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p1, l. 15 and l. 17; p2., l. 16: please avoid citing the same documents multiple times.

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