

Weather Clim. Dynam. Discuss., referee comment RC2  
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## Comment on wcd-2021-26

Anonymous Referee #2

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Referee comment on "Dynamical drivers of Greenland blocking in climate models" by Clio Michel et al., Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2021-26-RC2>, 2021

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### Review of "Dynamical drivers of Greenland blocking in climate models"

The present manuscript explores the driver of Greenland blocking events using a set of multi-model large ensembles. This is a nice way to analyze blocking events as they are rare events. The authors showed that two (MIROC5 and ECHAM6.3-LR) out of five models fairly capture the frequency of blocking events compared to the ERA-Interim reanalysis. Then they used these two models to understand the main driver of Greenland blocking events and found an inconsistency in the dynamics of blocking events between the models. More specifically, the author found a link between CWB and Greenland blocking events in ECHAM6.3-LR model in contrast to MIROC5, which CWB is largely underestimated. They further expand their analysis to future climate and report the changes in RWB and eddy-driven jet to investigate the connection with blocking frequency.

I found the topic and contents relevant, and the paper is falling within the scope of Weather and Climate Dynamics. I have no major comments, and I strongly suggest that for publication after some minor revisions, which I believe are needed to improve the quality of the paper and make it clear.

L7: The authors mentioned "four out five models" but then throughout the paper, they focused on the two models which they believe have better performance compared to the other models. Even in conclusion (L324) they mentioned "three out of five" and I suggest they change it in the abstract to be consistent with the analyses in the paper.

L42: "have shown"

L85: I think it sounds better if the authors rephrase the sentence and mentioned 100 and 501 members instead of "times"

L112: Shouldn't it be "Blocking grid points are identified" instead of "Blocking events are identified" as the index identifies each grid point that satisfies the condition, which does not necessarily mean they are separate events.

L115: I am unsure if I can follow the time fraction (%) definition that the authors explained here. Since it is an important point, they need to explain that clearly. Is the

fraction defined as  $(\text{total blocked gridpoints}/(\text{total gridpoints}*\text{number of days}))$ ?

L116: Have the authors thought about performing clustering analysis to separate Greenland blocks instead of subjective criteria to count the number of blocked days as I think the Greenland region will show up naturally as a region of frequent blocking events base on what the authors have shown in Fig. 1(f).

L133: "GB" spell it out

L166: Over Greenland, negative bias in the frequency of blocking is not significant in the ECHAM6.3-LR model in addition to MIROC5, and it needs to be added. Also, in the following sentence (L168) the author mentioned "strong negative biases in the ensemble mean." which I think is not true for those two models over Greenland based on what has been shown in Fig. 1.

L211: I believe that ECHAM6.3-LR is the only one that has the smallest mean-state bias in Fig. 3, and biases in MIROC5 are the same as the other models (specially CanAM4 seems to be even better compared to MIROC5).

L247: Fig. 5d-f not Fig. 5c-e

L269: Can weak absolute vorticity gradient be why the frequency of blocking events is captured with less bias in MIROC5? If yes, I think the authors need to expand this part.

L275: Fig. 6m-o not Fig. 5l-n

L279: I think the authors mean Fig. S8 instead of Fig. S9.

L293: I understand the numbers are not significant compared to previous studies but are the changes significant compared to each models' current climate?

L297: It is unclear what the authors refer to by saying "large decrease". Isn't it a weak decrease as they found here, and it is mentioned in L293?

Last comment: Captions of figures are vague and ambiguous, making it hard for readers to follow. They should be clear as much as possible that readers understand the figures just by reading the captions. Also, if the anomalies are significant (by any t-test) please mentioned that in the caption, otherwise please do statistical significance analysis for those cases that anomalies are shown.