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Interactive comment on "Atmospheric Blocking: The Impact of Topography in an Idealized General Circulation Model" *by* Veeshan Narinesingh et al.

Anonymous Referee #3

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The authors have used an idealized moist GCM and investigated some of the spatial and temporal characteristics of blocking events in the absence and in the presence of topography. I find the objectives of the paper and its results interesting and important (although further clarifications are needed). The paper is well structured and well written. I have a number of major and minor comments, which are listed below.

Recommendation: major revision

Major comments My major concern is that the paper is focused on too many questions, which have made the answers sometimes a bit too speculative. It appears to me that the three main questions are

1- Do the blocking events in aquaplanet simulations have the same dynamics as those

of the real blocking events? This is a great question and its answer has important implications for our understanding of the dynamics of the blocking events, as for example, some blocking theories require zonal asymmetries in boundary conditions/forcings. The studies of Hu et al. (2008 GRL), Hassanzadeh et al. (2014 GRL), and more recently Nabizadeh et al. (2019 GRL) have shown the existence of blocking events in aquaplanet simulations and report some of their characteristics, but certainly, there is a need for further investigation, and I am glad that these authors have focused on this question. Given the importance of the answer, I believe that the statement in Lines 296-298 needs more support. To start, I suggest that you show the analysis of Fig. 3 for the ERA data as well, so that the readers can see the comparison side by side (rather than being referred to other papers such as TN01).

2- Do the high-latitude blocks have the same dynamics as those of the midlatitude blocking events? The discussion in lines 286-292 is too speculative. I suggest that you show the analysis of Fig. 3 but for high latitude blocks (rather than the single panel in Fig. 4). Regarding the difference in dynamics: given the lack of W and weakness of the anomalies (pointed out in lines 290-291), is it possible that the high-latitude blocks are just cut-off highs that appear stationary because the zonal wind in the high latitudes is weak? (so there is really no maintenance mechanism?) What is the time scale of zonal advection in the high latitudes of the models (and what is it in the midlatitudes?)

3- What is the effect of topography on the duration, distribution, and dynamics? I think here the most interesting analysis is the comparison between Fig. 3 and 9. Whether the life cycle and dynamics are affected by the topography or not is an important question, but is barely explored. I suggest that you further elaborate on these results. Otherwise, given the very idealized nature of topography here, I am not sure how much we can learn from the distribution and duration of different simulations with different topography configurations.

Minor comments

L186: W is given in . . ...

L247: 85% is too low. I suggest using a 95% confidence interval.

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