

Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2021-49

Anonymous Referee #2

Referee comment on "Atmospheric rivers in CMIP5 climate ensembles downscaled with a high-resolution regional climate model" by Matthias Gröger et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-49-RC2>, 2021

This paper investigates the behavior of North Atlantic ARs in reanalysis and ensembles of global simulations in historical and future simulations. The manuscript is in good shape. It is well-written and has a clear structure. I don't have major concerns for the paper, but some minor suggestions and comments for discussion:

- L193: Guan and Waliser (2015) does not provide a thorough review of AR detection methods, instead, GW15 explained their AR detection algorithm in detail. Since GW15's algorithm is not adopted in this paper, it is better to cite a different paper as the "overview". For example:

- Shields et al. (2018): Atmospheric River Tracking Method Intercomparison Project (ARTMIP): project goals and experimental design, Geosci. Model Dev., 11, 2455-2474, <https://doi.org/10.5194/gmd-11-2455-2018>, 2018.

- Figure 4: I wonder how the duration distribution would change if the duration threshold to tuned to 6 hours or 12 hours. How will the duration (including those excluded short-lived events (<18hrs)) change in the future climate?
- Figure 5a: instead of showing the actual number of R days, it might be helpful to show the percentage of AR days to the number of days of the period.
- Table 3 and L367: Is it possible that the dynamical field is more active in the future simulation as well? Table 3 shows that the number of AR increased in the future runs: it makes sense if the historical AR threshold is applied in the future run – however, here the future ARs are detected with IVT thresholds calculated from future simulation, so the higher moisture load is reflected in the future IVT threshold to some extent. Therefore, I am curious if the change in dynamical filed also contribute to the increase in future AR number.
- L450: I am not sure if I fully understand the methodology. Are the origins of ARs being

categorized by the southernmost latitude? If so, isn't it more related to the curvature of AR's shape than the actual origin?

- L563: please rewrite, grammar problem.