

Interactive comment on “The characteristics and structure of extra-tropical cyclones in a warmer climate” by Victoria A. Sinclair et al.

Anonymous Referee #2

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This is a very nice study looking at aquaplanet model simulations with a complex model. This provides a step in the model hierarchy between fully complex models (e.g. the CMIP models) and the very idealised models such as a baroclinic channel models. By using a Lagrangian feature tracking algorithm and looking at the lifecycles of extratropical cyclones, the authors have investigated the changing intensity and structure of the 200 most intense cyclones. The paper is well-written and the figures are very clear.

I have a few minor comments and suggestions to make.

1. Line 208: The CMIP5 model projections are not shown here so it would be good to refer to a paper that shows these.

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2. Line 213: Is the poleward change of 2.2 degrees significant? This is much smaller than the shift in the jet.

3. Line 219: Is there an explanation for the much lower average MSLP? Is this an issue with OpenIFS or something to do with the aquaplanet set up?

4. Lines 317-321: It would be good to see figures for the changes in the wind speeds. Both here and in the precipitation section, I think a useful addition would be some analysis of the footprints of the most intense winds and precipitation and how this changes. These footprints were considered in the Tierney et al 2018 and Pfahl et al 2015 papers.

5. Line 350: I think this sentence should be reworded slightly – it seems that what is consistent is that the condensation from the precipitation gives more latent heating and stronger PV anomaly (rather than the latent heating leading to more precipitation).

6. Line 357: It would be good to make it clearer here and elsewhere in the paragraph when it is referring to changes in the SST4 experiment.

7. Line 376-377: I think it might be good to say the warm conveyor belts are further poleward relative to the propagation direction rather than the cyclone centre since the cyclones have been rotated for compositing.

8. Line 416: I think the wrong figure panel is referenced here – it should be 10d.

9. Section 7: It would be nice to see greater discussion of this study in the context of previous literature. For example, how do these results compare with, e.g. Pfahl et al 2015, Tierney et al 2018. Are there any other papers that analyse the structure of extratropical cyclones in the future? Two that I can think of are Yettella and Kay 2017 and Michaelis et al 2017.

10. Section 7: Also, are there any caveats with the study – would the results change if you looked at the 500 most intense storms or the medium intensity storms?

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References: Yettella V, Kay JE. How will precipitation change in extratropical cyclones as the planet warms? Insights from a large initial condition climate model ensemble. *Clim Dyn*. 2017;49(5–6):1765–81.

Michaelis AC, Willison J, Lackmann GM, Robinson WA. Changes in Winter North Atlantic Extratropical Cyclones in High-Resolution Regional Pseudo–Global Warming Simulations. *J Clim*. 2017 Jun 6;30(17):6905–25.

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