

## ***Interactive comment on “A numerical modeling investigation of the role of diabatic heating and cooling in the development of a mid-level vortex prior to tropical cyclogenesis. Part I: The response to stratiform components of diabatic forcing” by Melville E. Nicholls et al.***

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Specific comments:

“1. The model sensitivity tests of the study are fine and very useful. It might be more helpful for the reader to understand the model results and associated mechanisms if the simulation scenarios could be introduced more explicitly. Specifically, the authors might consider merging the last second paragraph (page 6, line 4-8) and perhaps also

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some parts of the last third paragraph (page 5, line 12 – page 6, line 3) of the Introduction section into the Methodology section (page 8, line 5-7). Then, detailed simulation scenarios need to be listed (perhaps in a table or at least with numbering), and so does other forcing than diabatic heating and cooling described in the last paragraph of Sect. 3 (page 8, line 8-13).”

These are some useful suggestions that we will definitely consider.

“2. The manuscript focuses on the effect of cloud microphysical processes on a mid-level vortex. However, the basic principles that link the microphysics and the dynamics are not sufficiently described in some cases. I can see the results shown in the figures, but I do have some difficulties to follow the clues of the story. The authors might consider reorganizing the subsections of the Results section including the figures according to the model simulation scenarios mentioned above. Although precipitation drag has been taken as another forcing earlier in Sect. 3, it is not fully discussed with a subsection or paragraph in the Results. If this forcing is not so important, it might be omitted in Sect. 3.”

We will carefully consider these recommendations for reorganizing the subsections. We thought precipitation drag should at least be examined to see if it was important. Maybe there is a better way of saying that the issue of precipitation drag has been investigated.

“3. It might be helpful if the vertical sections of mixing ratios of each hydrometeor could be shown with the figures in Sect. 4.1, which gives a general overview of the reference simulation. For the first sentence of Sect. 4.2 (page 11, line 1), what does “the changes discussed in section 3” mean specifically? Few previous studies are referred and compared in the discussions except for one part (page 10, line 25-26).”

We will consider the suggestion of including the mixing ratios of each hydrometeor. We have shown the aggregates in Fig. 6a and cloud water and rain mixing ratio for a convective cell in Fig. 9, but it might help to add another figure. By changes we mean

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the method to achieve a near gradient balanced state. This could be reworded. We will see if there are other previous studies that are relevant to this work that can be referred to.

Technical issues:

“Page 2, line 31-32: For “the cold air minimum”, do you mean the minimum temperature or the coldest air?”

This could be reworded to be clearer.

“Page 3, line 4: For “cod” pool, do you mean cool pool?”

Thank you for catching this error.

“Page 3, line 9: “try and” can be omitted.”

Yes, this would be better.

“Page 3, line 21-22: The literature “Raymond et al. 2011” and “Gjorgjievska and Raymond 2013” cannot be found in the References list.”

Thank you for noticing these errors.

Page 3, line 11: “of Atlantic systems” should appear in front of “by Davis and Ahijevych (2012)”.

Yes, this would be an improvement.

“Page 3, line 13: It should be “Bister and Emanuel (1997)”.”

This will be corrected.

“Page 4, line 17-19: This sentence is vague and too long and it should be rephrased.”

We will rephrase this sentence.

“Page 4, line 22-24: What observational studies are needed, and are they available at

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time? What do you mean by stating “that will emerge in the future”?”

Well we think further observational studies would help to clarify the physical processes causing mid-level vortices to form and their role in tropical cyclogenesis. A statement like this might fit better in the conclusions section where it could be elaborated on.

“Page 4, line 27: Better to use “Many MCSs”.”

Yes, this is better.

“Page 4, line 32: Should be “for them to be”.”

Thank you for noticing the error.

“Page 5, line 4: Should be “found that”?”

We will make this correction.

“Page 5, line 15: Should be “For this purpose”.”

We will make this change.

“Page 5, line 29-30: Do you mean reasonable agreement between the balanced model cloud model? It should be rephrased.”

This sentence will be rephrased.

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