

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.

Anonymous Referee #2

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The manuscript presents a model study on the role of stratiform components of diabatic forcing in the development of a mid-level vortex. The authors implement the diagnosed diabatic forcing term into the model RAMS to examine the dynamic response to imposed latent heating and cooling. By several model experiments, they show that sublimation cooling at the base of the stratiform ice region is the main factor that causes the strong mid-level vortex to develop. The results of the study are interesting and the paper should be a welcome addition to the current literature on cloud microphysics and

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tropical cyclogenesis. I would recommend that the manuscript be accepted after minor revisions especially in presentation. Below are my questions/suggestions in detail.

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 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).

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.

3. It might be helpful if the vertical sections of mixing ratios of each hydrometer 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).

Technical issues:

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

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

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

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

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

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

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

Page 4, line 22-24: What observational studies are needed, and are they available at present time? What do you mean by stating “that will emerge in the future”?

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

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

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

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

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

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