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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An examination of two pathway to tropical cyclogenesis occurring in idealized simulations with a cloud-resolving numerical model" *by* M. E. Nicholls and M. T. Montgomery

Anonymous Referee #1

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Review for "An examination of two pathways to tropical cyclogenesis occurring in idealized simulations with a cloud-resolving model,"

by Melville Nicholls and Michael Montgomery

Summary:

This paper describes the results of numerical simulations of tropical cyclogenesis from pre-existing mid-level circulations. The simulations have varying degrees of initial size, intensity, moisture, SST, and some have different physical processes. The paper fo-

cuses on two "pathways" to genesis. One corresponds to a steady strengthening and contraction of the surface circulation, while the other corresponds to sudden formation of a small, more intense surface vortex after there has been substantial intensification of the mid-level vortex; this latter pathway was previously identified in a paper by Nolan (2007). Generally, it is found that ice physics, more intense convection, and a drier atmosphere favor the second pathway over the first.

This paper could contribute to the TC genesis literature by clarifying the different causes of pathways one and two, but unfortunately the article as it is now needs substantial revision. Firstly, it is much too long. There are several long sections that should be removed or shortened (described below). Secondly, the analysis is incomplete, there is a lot of speculation about physical processes, and in the end we do not know why either pathway one or pathway two would be preferred in a given set of circumstances.

Recommendation: May be acceptable after major revisions

General comments on the text:

(Note: I had trouble with the printer-friendly version, so pages and line numbers refer to the on-screen PDF version.)

The paper is fairly readable, but as noted above, it is quite long. There are many sections that should be cut or shortened. The first is the text from pp. 768-769. This is a rote summary of the marsupial paradigm, which is a good theory, but it is really irrelevant to the processes studied here. Another is the astonishingly long discussion in section 3.5, wherein the genesis process of many of the simulations are described in wordy detail, without any figures for Experiments 4, 8, 9, 12, 14, 15, and 16! This section should be reduced to two-three representative cases, with figures showing time series of the relevant fields (e.g., vorticity and low-level theta-e).

Analyses:

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The time-series plots, such as in Figures 2 and 3, are quite informative. But the authors seem to have chosen to not use time-height diagrams that are used in several previous papers on the same topic, such as Nolan (2007), Montgomery et al. (2010), and Wang et al. (2010). It seems like they would be helpful for many of the discussions.

Many passages of the paper have speculation about physical processes, such as what causes the intensification of the mid-level vortex. As speculated, it probably indeed is evaporation and melting of falling precipitation, but the paper should show plots (azimuthal mean or time-height) of diabatic heating rates, with and/or without radiation included. The second paragraph of Section 3.4 discusses heating profiles and mass fluxes; why not just show them?

As noted above, one or two of the pathway two genesis events should be illustrated in detail with time series of the same fields, showing the development of the primary updraft(s) and the intensification of the low-level vorticity.

Specific comments on the text:

Generally there are too many commas. There is a frequent tendency to include a comma after the first clause of a sentence even when it is not needed. Some examples are on p. 768, line 26, p. 772, line 18, and p. 784, line 5.

Other comments, by page and line number:

p. 769, 19-20: "thermodynamic nature" ... see Rappin et al. (2010, QJRMS).

p. 772, 24-26: If NHC saw a closed low-level circulation, then they would definitely identify the system as a TC, even if it were that small.

p. 773, 22: Does this version of RAMS have an number designation?

p. 781, 10-14: Recent papers by Yuqing Wang and Daniel Stern (separately) show that TC size is related to the size of the initial disturbance and to the amount of moisture in the environment.

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p. 785, 24-26: Yes, there is Coriolis, but there is probably more intensification from converging the pre-existing circulation.

p. 795, 19: Eliassen

p. 800, 19: pathway two

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 765, 2013.