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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 #2

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Review of "An Examination of two pathway(s) to tropical cyclogenesis occurring in idealized simulations with a cloud-resolving model" by M. E. Nicholls and M. T. Montgomery.

General Comments: This paper presents an in-depth examination of various microphysical, radiative, and environmental conditions in idealized simulations of developing TCs using a newer version of the RAMS model. The set of simulations are well-designed, and shed some new light on the physical processes involved in tropical cyclogenesis. The authors attempt to discern whether one of two pathways is a preferred

mechanism for genesis within the parameter space of the simulations. All in all the paper is well-written and there appear to be no major flaws in their experiments. However, the length of the paper distracts from the central arguments. A primary recommendation is to shorten the manuscript to focus on the key conclusions. A few other comments listed below may help to improve the manuscript.

Specific Comments: 1) While I appreciate that it is difficult to concisely summarize 17 different numerical experiments, I feel that the level of detail in the individual experiments was too much. In particular, section 3 is very detailed and could stand to be shortened considerably. In the effort to describe each of the simulation combinations, the details distract from the aggregate results which I found to be more relevant. For example, Section 3.5 describes the SSCV formation in multiple different ways over nearly 7 pages, but the relationship between the parameter choices and the differences in SSCV formation mechanism was unclear (see comment #2 for further discussion on this point). I would recommend shortening the manuscript, and possibly moving some of the details of the individual experiments to an appendix for interested readers.

2) Several key results emerge from this study: the importance of ice microphysics in the idealized simulations, the importance of the radiation parameterization, and the possibility of a bifurcation point in the genesis pathway. At the end of it all, I wonder how much the results depend on stochastic effects that are partially obscured by variations the parameter space. The 2nd author has shown previously that small perturbations in boundary layer moisture can impact the resulting intensity – could similar perturbations change the mechanism from pathway one to two? The parameter space explored here does consider changes in initial conditions, and an ensemble of outcomes is well captured. However, the SSCV formation mechanism appears to be distinct in the different experiments. Given the variety of conditions which can lead to either pathway, it does not appear to be conclusive that the pathway is dependent on any one set of physics or initial conditions, but may result in various combinations. Some further comments on the stochastic aspects of the SSCV formation and genesis problem would improve

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the manuscript.

3) The phasing of the radiative and boundary layer recovery timescales is very interesting. One parameter that was not varied was the surface layer scheme. While another set of simulations is beyond the scope of this revision, a comment on the potential implications of this particular fixed parameter would enhance the paper. Do the authors think that the results are particular to the boundary layer parameterization chosen for this study? It is possible that phasing between diurnal and convective timescales may change for different implementations of the radiation and surface flux schemes.

4) Another reference the authors may want to consider is Hausman et al. (2006). They also show the sensitivity to ice microphysics in an idealized setting using an axisymmetric model. A reduction in final intensity similar to Exp. 1, which they attribute to reduced terminal fall velocity of precipitation, is consistent with the current study.

Technical Comments:

The title should be pathways, not pathway

Eliassen is misspelled on p. 795.

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