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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The genesis of Typhoon Nuri as observed during the Tropical Cyclone Structure 2008 (TCS-08) field experiment – Part 3: Dynamics of low-level spin-up during the genesis" *by* L. L. Lussier III et al.

Anonymous Referee #1

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The authors examined the spin-up of Nuri using dropsonde data and analyses from a variational scheme (SAMURAI). The specific focus is to examine the thermodynamic control mechanism for tropical cyclogenesis proposed by Raymond and colleagues. By comparing the circulation between Nuri 1 and Nuri 2, the authors showed that the spin-up of the low-level circulation occurs at different distances from the pouch center. The examination of virtual temperature also revealed strong mid-level warming (consistent with a warm-core structure vortex) and weak cooling away from the pouch center near the surface.

Major comments: 1. A question lingering in my mind when reading through the manuscript is what causes the differences between the results presented in this study and those by Raymond. Besides the different analysis frameworks and methods (such as circulation center and averaging areas), visual differences are also evident in the vorticity field between this study and RL11 (see their Figs. 5 and 6). Does the difference in the analysis data contribute to any significant differences in the results? 2. While this study provides detailed analyses to test Raymond's theory, it is desirable to include a brief review of other theories for TC genesis, such as Wang (2012) and Davis and Ahijevych (2013). Wang (2012) is particularly relevant to this study since the thermodynamic control mechanism proposed by Raymond was also discussed in that study and a new theory was proposed.

Specific comments: 1. P26797: Isn't it better to cite "AMS Statement"? 2. P26798, L28: Did you mean global model analyses? 3. P26799, L14: Change to "larger scales". 4. Introduction: Wang (2012) also discussed the circulation tendency presented in RL11. She suggested that the vorticity or circulation evolution is different at different spatial scales. Due to the concentrated convection near the pouch center, spin-up occurs in the inner pouch region first while the low-level circulation at the meso-alpha scale (or the wave pouch scale) may spin down at the early stage of tropical cyclone formation. 5. P26805: add "the" before "flux form". 6. P26805- P26806: Aren't the horizontal advection term and the vertical advection term also included in the vorticity and circulation equations? 7. P26807, L14: Did you mean different spatial scales (or radii)? 8. P26807, L18: It is better to move the justification for using 1.5 km to section 2.1 9. Section 3.2: Does the SAMURAI analysis include any model analysis or reanalysis data? The data coverage shown in Figs. 5-8 is larger than what is shown in RL11. 10. Fig. 9: What feature of the vorticity PDF represents vorticity aggregation, a small spread (a sharp peak) or large frequency of occurrence of strong vorticity? Since aggregation is an upscale growth process and the PDF here does not provide any information about the spatial scale, the large values of low-level vorticity within small radii are mostly a reflection of strong convection organized near the pouch center. I am

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also wondering if the sample size is large enough in Fig. 9a. 11. P26813, L2: This sentence is misleading as vorticity advection does contribute to the local tendency of vorticity. 12. P26813, L8: High mid-level radar reflectivity does not necessarily represent deep convection, and strong stretching may not be associated with cumulus congestus (see Wang 2014). Also note that large stretching is not well collocated with strong reflectivity in Nuri 1. 13. P26813, L28: see comment #9. I don't think the analysis provides a strong support for vorticity aggregation. 14. P26814, L6: Is the net tendency here simply the sum of the three terms on the rhs of Eq. 7? 15. P26814, How is the circulation tendency in Fig. 12 compared to Fig. 4? 16. Section 4.1: Wang (2012) examined the evolution of virtual temperature at different radii from the pouch in a model simulation, and showed that the inner pouch region is characterized by mid-level warming and that weak cooling is only found at larger radii at the early TC formation stage. 17. P26818, L13: remove "the". 18. P26819, last few lines: doesn't the mid-level warming also stabilize the lower troposphere? 19. P26821, L16: see comment 9. 20. P26821, L21-22: Fig. 4 shows that the maximum increase in the tangential wind occurs around 600 hPa, which is not close to the top of the PBL.

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