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Interactive comment on "Interaction between dynamics and thermodynamics during tropical cyclogenesis" *by* S. Gjorgjievska and D. J. Raymond

G. Zhang

gzhang13@illinois.edu

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The existence of the interactions between thermodynamics and dynamics in tropical cyclone development has been long speculated. This study explores some of the most intriguing aspects related with the interactions between thermodynamics and dynamics during cyclogenesis, using the data from two recent field campaigns. The authors insightfully linked the stratification with the vertical mass flux and thus the convergence of mass, vapor and vorticity. Furthermore, this link was nicely used in supporting the "top-down" perspective of tropical cyclone development, which features with the mid-level vortex that tends to stabilize the atmosphere. This study also suggests some

counter-intuitive ideas on TC genesis, e.g., the enhanced low-level vorticity aggregation can spin down the protective mid-level pouch circulation, given certain stratification profiles.

The paper was also written with great clarity and overall reads very smooth. The following are some comments and questions:

1. In the original draft and the reply to Dr. John Molinari, the authors have shown considerable efforts in addressing the subjectivity of averaging area choice when analyzing individual disturbances. But in some circumstances this subjectivity can become a more severe issue.

Wang (2012) demonstrates some interesting sensitivity related with the area of averaging in its Fig. 12. In Karl's case, the vertical profile of equivalent potential temperature seems to evolve differently when the wave pouches were examined on different spatial scales. In Gaston's case, the vertical profiles calculated with a smaller averaging area appear quite different from those with a bigger averaging area. Besides, a bigger averaging area tends to include more stratiform precipitation samples and potentially contribute to a vertical profile that seems more "top-heavy". The sensitivity may also have different implications for the "top-down" and "bottom-up" perspective. For example, the numeric simulation in Wang (2012) suggests "bottom-up" development follows the very brief "top-down" period and dominates the ensuing development on the meso-beta scale (its Fig. 2a).

Since this paper mainly focuses on the meso-alpha scale, this aforementioned sensitivity probably will not hurt the conclusions. Nevertheless, it remains interesting to check whether the vertical profiles in this paper will show sensitivity on the size of averaging areas.

Wang, Zhuo, 2012: Thermodynamic Aspects of Tropical Cyclone Formation. J. Atmos. Sci., 69, 2433–2451.

2. Line 3-5 on Page 18924: Could you offer more details that link the strong stratification with bottom-heavy mass flux? You may want to consider adding a brief but self-contained discussion of Raymond and Sessions (2007) to better illustrate the context. The current discussion of the context seems scattered and inadequately emphasized for readers who are less familiar with topic. Alternatively, a nice scheme figure that illustrates the theory will also be welcome.

3. Could you speculate whether the link between stratification and vertical mass flux (as well as the convergence) works for more mature tropical cyclones? Emanuel (2012) speculates that major properties of tropical cyclones depend on small-scale turbulence in the outflow, which acts to set the thermal stratification of the outflow. Physically, this bears some similarity with the case in the genesis stage.

Emanuel, K., 2012: Self-stratification of tropical cyclone outflow: Part II: Implications for storm intensification. J. Atmos. Sci., 69, 988-996.

4. Relevant with Comment 3, the vertical temperature profiles (thus the stratification) are modulated by convection and storm dynamics. A possibility is, the driver in the feedbacks may vary with the storm development or the genesis condition, e.g., the environment temperature profiles may dominate the feedbacks when convection is weak, but become a more passive component in the feedbacks given strong convective activity grown from the feedbacks or the impacts of pre-existing convective activity. Therefore, the stratification emphasized in this study seems not necessarily contributed or caused by a mid-level vortex alone.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 18905, 2013.