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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Advective mixing in a nondivergent barotropic hurricane model" *by* B. Rutherford et al.

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The authors would like to thank the referee for the helpful and valuable comments. We will address each of the numbered comments directly.

1. We will include the additional references, and add comments relating the significance of our work to these studies.

2. We have used only the viscosity value provided by Schubert et al (1999), but it is possible that the diffusive mixing that results after long-time integration could be sensitive to this value. We have attempted to minimize the sensitivity of diffusive processes by choosing an integration time that allows the detection of short-lived structures which are not significantly affected by diffusion. In the approach of Hendricks and Schubert

(2009) a longer integration time is used, which could be more appropriate for addressing the sensitivity of diffusive mixing to viscosity.

3. The formation of mesovortices certainly has a role in the intensification process of hurricanes. A similar question was posed by referee 2. We will insert a comment relating the ideas to actual hurricane formation, but the shear in this model influences structures associated with the mesovortices in a way that they appear quite different from the structures associated with vortical hot towers (VHT's), in terms of the Lagrangian fields. However, the methods of detection remain consistent. Since the structures are dynamically different, we prefer to not make the connection in this study, but will thoroughly address LCS's in VHT interaction in another study.

4. Our definition of the eye and eyewall is likely too loose, and generally refers to the inner and outer regions separated by some distinct boundary. Our methods motivate the definition of the eyewall as the annular region of minimal shear. Thus the eye is the interior of the eyewall. We will carefully examine the use of the words "eye" and "eyewall boundaries" to make the formulation more consistent, in particular regarding the inconsistency in the description of the monopole stage.

5. We will add the proper vorticity fields to improve clarity.

6. We will change the figure to show the same scaling.

7. There are several issues that we have considered regarding this comment, and a related comment by referee 2. In order to give a spatial context of the locations of structures, we will overlay vorticity contours onto the R-field, which will show location of the structures, as well as address the azimuthal preference of the location of R-ridges. The question regarding temporal resolution of the vorticity versus a plot at the initial time can be addressed by including an integrated Q-field. The integrated Q-field shows similar structures as the R-field, and marks regions that show persistent interaction with mesovortices. The azimuthal mean vorticity maximum will be added to the S-field.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 16085, 2009.