Referee report

Title: Asymmetric and axisymmetric dynamics of tropical cyclones
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General comments: This paper presents a thorough comparison between the three-dimensional version (3D) of the tropical cyclone model CM1 and its axisymmetric version (AX) by simulating idealized hurricane-like vortices. Comprehensive reviews on the dynamics and physical processes contributing to the intensification of tropical cyclones are provided in the introduction as well as in the relevant parts throughout the paper.

In general, the results of the simulations with CM1 presented here are consistent with pervious studies in which the AX version produces a stronger vortex than the 3D version. Furthermore, this study performs in-depth analyses to reveal and explain the differences between the 3D and AX versions. The paper offers several new insights into the dynamics of tropical cyclone in the 3D and AX frameworks.

a) The 3D simulation shows that, in contrast with previous studies, eddy processes associated with the vortical plume structures may help the intensification.
b) The average heating rates in the AX model are much greater than that in the 3D model and, hence, consistent with the higher intensity achieved by the AX vortex. In turn, the higher mean heating rates in the AX version are explained in terms of a less hostile environment and an inherent ring-like structure of convection in the AX version compared with the 3D version.
c) As the 3D vortex takes longer time to organize convection into the annual ring-like structure, its intensification rate is lower than the AX counterpart and ultimately a weaker mature vortex is resulted after 12 days.
d) The parameterizations of subgrid-scale turbulence above the boundary layer in both versions are shown to be inconsistent with the resolved eddy momentum fluxes.
e) The analyses from the 3D simulation do not support the role of small-scale vertical mixing processes in the outflow layer in the upper-troposphere in controlling the intensification.
f) The 3D and AX versions respond significantly differently to the changes in the surface drag. This difference is explained partially by the role of surface drag in organizing convection in the azimuth for the 3D version. This process is not present in the AX version.

Overall, the paper contributes significantly to our understanding of the intensification processes in the frameworks of three-dimensional and axisymmetric models. Intrinsic limitations of the strictly axisymmetric assumption are pointed out and explained by comparing with the three-dimensional counterpart. This knowledge is useful for the interpretation of axisymmetric model outputs for studying intensification processes in tropical cyclones.

Recommendation: Accept for publication with minor revisions.

Specific comments:

1) Abstract, line 17: " … not represented properly by the subgrid-scale parameterizations in the AX configuration". This sentence is not fully consistent with the conclusion (page 13387, line 19), where the subgrid-scale parameterization in the 3D configuration also differs from the resolved horizontal eddy momentum flux.

2) Figures 11 and 13: Missing the plots for the sum of all tendency terms. I can imagine that these plots could be very noisy. Since the averaging periods are long (12-24 hours), the tendencies may cancel each other, resulting in near-zero noisy fields. However, it is worth to show here for completeness.

3) Page 13366, Equation 17: I have some troubles understanding this expression of Dv for the 3D version of the model. This expression is certainly true for the axisymmetric version. But for the 3D version, perhaps there is another term representing the gradient of the subgrid-scale stresses in the azimuthal direction. Please clarify.

4) Page 13366: The definition of τ_{rz} could be added after equations 18 and 19. Although this term is not present in the expression for sub-grid scale tendency (Eq. 17), it is calculated and presented in Figures 14-18.

5) Page 13369, line27-13370, line 1: " *In the AX simulation, the sub-grid flux (Fig. 16d) becomes comparable with …. (Fig.15g), but its dipole pattern in the low to mid-troposphere updraught region is essentially the reverse of the 3-D resolved-eddy pattern*". The 3-D resolved-eddy flux is shown in Fig. 15d. Comparing Figs. 16d and 15d, I am not quite convinced with your interpretation that they are reverse patterns of each other.

6) Page 13372, line 1: " *there is some pattern similarity in the negative -<v'w'> and <τ_{rz} > …* ". Did you mean "<$\tau_{\lambda z}$ >" ? (e.g. Figs. 15f and 15i have similar patterns but different magnitudes.)

Typing errors:

Page 13335, line 21: remove 'should'

Page 13372, line 7: change 'not' to 'no'