Dear Reviewer,

Thank you for taking the time to review and make comments on the manuscript *DCMIP2016: the tropical cyclone test case*. We have responded to all comments below and modified the manuscript to reflect this.

Evaluating the effects of the dynamical cores coupled with ideal physical parameterization suite by using a ideal test case is an effective way in the scope of atmospheric model development. ReedJablonowski (RJ) tropical cyclone (TC) test case which was documented in DCMIP2016 that has been making significant contributions to the design of ideal numerical experiments for model dynamical core, is an idealized tool to study the impact of variable resolutions, physical parameterizations, and numerical method on the simulation and representation of tropical cyclone–like vortices in GCM. In the previous work, the impact of the physical parameterization suite like a dilute plume Convective Available Potential Energy (CAPE) calculation of deep convection on the evolution of an idealized tropical cyclone within the National Center for Atmospheric Research's (NCAR) Community Atmosphere Model (CAM) (Reed and Jablonowski, 2011b) and of the initial-data, parameter and structural model uncertainty (Reed and Jablonowski, 2011c) have been explored.

In contrast, this manuscript describes and analyzes a tropical cyclone test case namely RJ-TC by comparing 9 models like ACME-A, CAM-SE, SCU, DYNMICO, FV3 , FVM, GEM, ICON and NICAM in which the used numerics include spectral element (SE), finite difference (FD), and finite volume (FV) and the spherical grids cover cubed sphere, geodesic, Octahehral, Yin-Yang and Icosahedral triangular native grids. This is a comprehensive comparison of RJ-TC simulation results in which evolution of minimum surface pressure and maximum 1 km azimuthally averaged wind speed, the wind-pressure relationship, radial profiles of wind speed and surface pressure, and wind composites and so on are conducted.

However, it should be noted that the resulting TC behaviors in the 9 model dynamical core coupled with the simple physics package are very different, for example, as Fig. 1, the evolution of MSP can be classified as three categories: a group of ACME-A, CAM-SE and FV3 , a group of FVM, GEM, CSU-CP/LZ, DYNAMICO and ICON, a special ICON. Similar situations such as azimuthally averaged vertical wind composite of TC happened in quantitative analysis. Unfortunately, the specific reasons for these differences in outputs are not further elaborated in the manuscript. It would be better if the differences of transport scheme, numerical discretization, artificial diffusion etc. in the corresponding dynamical core and nonlinear interaction of TC could be addressed in details. In a whole, this manuscript gives comprehensive TC behaviors which provide a valuable library of solutions that serve as a benchmark for modeling groups. I recommend publishing this submission in GMD with the following concerns.

We thank the reviewer for their detailed and constructive feedback on the manuscript, and for appreciating the value of the manuscript. In addition to the responses below, we do note that it is difficult to elucidate the specific reasons for the differences documented in this manuscript. That being said, the purpose of this paper is to document a set of solutions to the modeling community that provide a benchmark for future model development, as commonplace for GCMs. In response to your, and reviewer 1's, comments we have provided clearer descriptions of uncertainties in the GCMs were added to the conclusion section, specifically describing that the physics-dynamics coupling is an additional uncertainty. We anticipate that individual modeling groups will explore model design sensitivities in more detail now that the results from DCMIP have been presented.

1. For completeness, suggest a table list that describes the simple physics package used in the TC test case. Some physical parameterizations could be addressed in the appendix.

- The same simple physics parameterization package was used in all models, which was clarified in Section 2.2. The simple physics package is identical to the one described in Reed and Jablonowski 2012, and more information about it can be found in that paper.

2. If possible, give the detailed transformation formulation between pressure-based level and height level.

- Information about these transformations was added to Section 2.2. The text now reads "In the intercomparison, height levels were used for analysis. Pressure-based vertical levels were converted to height levels by first converting to pressure coordinates if the model utilized hybrid coordinates. The pressure at level k, p_k, was obtained using the equation $p_k = a_k p_0 + b_k p_s$ where a_k and b_k are conversion constants at level k, p_0 is the reference pressure (table 2), and p_s is the surface pressure at every point (k=0). Then, the pressure levels were converted to height levels using the hypsometric equation $h = z_2 - z_1 = R T_v g \ln(p_1/p_2)$ where z_1 (p_1) and z_2 (p_2) are height (pressure) values at adjacent levels and T_v is the mean virtual temperature between the two levels, calculated by the equation $T_v = T(1+M_v q)$. All relevant quantities were then interpolated to desired height using linear interpolation."

3. Due to the 9 model of comparison, it is recommended that the color selected for figures be able to make a significant difference. For instance, the dot colors of CSU-LZ and NICAM is very close in Fig. 2 and it is not easy to recognize them.

- The colors for the models have been updated to be more distinguishable. Additionally, certain figure legends have been updated to have larger icons so these colors can more easily be associated with each model.

4. Please check list of symbol in the table 1. For instance, $q_{(cl)}$ and $q_{(cl2)}$ seem to be redundant. If some symbols are not used in this manuscript, remove them.

- Symbols that were not used in the manuscript were removed.

5. Please explain the meaning of abbreviation of "CSU-CP"and "CSU-LZ"in Fig. 1.

- Information about the differences between CCU-CP and CSU-LZ was added in the beginning of Section 2.2. The text now reads "CSU submitted two versions of their model, CSU-CP and CSU-LZ, which differ in the vertical coordinate. CSU-LZ uses the Lorenz (Lorenz, 1960) staggering of variables in the vertical, with potential temperature and advected scalars co-located with horizontal winds at mid-layer. CSU-CP used the Charney and Phillips (Charney and Phillips, 1953) staggering of variables with potential temperature and advected scalars co-located with the vertical velocity at the layer interfaces."

6. The superscript of the formula of (4) are prone to ambiguity. Please correct it as $()^{(g/(R_d\Gamma))}$

- We corrected this to make it consistent with other equations in the manuscript including (5) and (8).

7. In Line 472, the paper name of citation is not correct. Please correct it.

- The paper name has been updated.

We hope that these updates and comments have addressed your concerns about this manuscript.

Sincerely,

Willson and co-authors