

Reply to Referee #4

Some comments and suggestions are provided below:

Line 92-94: “Such strong turbulence was also observed in Hurricane Isabel (2003) and Felix (2007) at different altitudes (Aberson et al. 2006; Aberson et al. 2007)”. It is better to list the exact altitudes of this “different altitudes” to make sure these are related to TC BL turbulence.

The extreme updraft (~25 m/s) and horizontal wind (107 m/s) was found at about 1.5 km in Hurricane Isabel (2003). The extreme updraft (~ 31 m/s) was found at about 3km in Hurricane Felix (2007). These extreme updrafts are consistent with the analysis by Stern et al. (2016).

The sentence has rewritten as: Such strong turbulence was also observed in Hurricanes Isabel (2003) below 3-km (Aberson et al. 2006; Aberson et al. 2017).

2. Line 94-96: “Understanding of the structure and evolution of the ... severe turbulence.” This sentence doesn’t match the logic. The reason to understanding of this small structure turbulence should be it is important for determining storm intensity, it should not be hard to observe. Using numerical simulation is because it is hard to observe.

The sentence has been revised.

3. Line 132-145: The finest resolution of horizontal resolution of this simulation is 37 meters, while the vertical resolution is only 75 levels. This concerns as the ratio of horizontal resolution and the vertical resolution could play a big role in the 3D simulations.

We understand your concern. The vertical resolution in the innermost domain is relatively coarse compared to the horizontal spacing of 37 m. We did not run experiments to examine the sensitivity to the vertical resolution because of the limit of the computation resource. In fact, we attempted to increase the vertical resolution, but the model cannot run on Tianhe-2 computer. For this reason, we conducted the LES-111 experiment (111.1m horizontal resolution) with 12 vertical levels below 1km. In LES-111 experiment, the vertical resolution and horizontal resolution are comparable in the TC boundary layer. The near-surface linear coherent structures and tornado-scale vortex (TSV) simulated in LES-111 are similar to those in the LES-37 experiment. In the revised manuscript, we have added a brief description about the issue.

4. Line 156-157: “we will focus on the hourly output from 26h to 36h.” Since this is tornado scale feature and the horizontal resolution reaches 37m, hourly output is too coarse and would miss some features. Suggest taking a more aggressive evaluation of output of the order of minutes (at least 15 minutes).

You are right. The hourly output is too coarse to analyze the tornado scale features. For this reason, we stored the 3-second model output to examine the evolution of the simulated TSVs. Since the 3-second output does not contain the thermodynamic variables, we need rerun the experiment for further analysis.

5. It is better to indicate the red dots as tornado-scale vortices in Fig.2a in figure caption.

The figure caption has been rewritten.