

Interactive comment on “Tornado-Scale Vortices in the Tropical Cyclone Boundary Layer: Numerical Simulation with WRF-LES Framework” by Liguang Wu et al.

Anonymous Referee #4

Received and published: 30 October 2018

The manuscript demonstrate that it is possible to successfully simulate tornado-scale vortices in WRF integrations set up as a Large Eddy Simulations, with 6 telescopic grids and the smallest grid point distance being 37m. Because the findings are roughly consistent with the limited observations, successful numerical simulations have the potential to be the most reliable source of turbulent scale statistics for coarser simulations. The study defines a criteria for finding tornado-scale structures and identifies several of them clarifying them into three categories based on structure. It is shown that the tornado-scale vortices are associated with horizontal rolls and it is speculated that strong vertical shear in the inward side of the eyewall convection is relevant in the development of tornado-scale vortices. Dipoles of updrafts and downdrafts and drastic

C1

changes on wind speed are documented. Because the findings are roughly consistent with the limited observations, successful numerical simulations have the potential to be the most reliable source of turbulent scale statistics for coarser simulations.

The manuscript shows that model could simulate the tornado-scale vortices in TC boundary layer at inner eyewall region, also groups these tornado-scale vortices into three categories. It is important to study the small features of TC and impact of these features to TC intensity and structure. This manuscripts is well written. So, recommend minor revision.

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.

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.

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.

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).

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

C2

Line 228: change “full” to “full”

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-787>, 2018.