Summary:

This study analyzes the relationship between upper – level divergence and latent heat/precipitation using numerous large LES simulations of supercells, multicellular convection, or squall lines. There simulations have little stratiform precipitation, so this study mainly comments about divergence in convective regions. It is found that the amount of upper – level divergence is primarily dependent on the amount of latent heat/precipitation and storm morphology. Additionally, storm structure tends to dictate whether the outflow is 2D or 3D as the storm initially forms. Convection without surrounding cells, such as the super cell, multi cell, and the ends of the finite squall line, start with 3-dimensional outflows. Convection consistently has nearby/surrounding convection, such as the infinite squall line and center of the finite squall line, tend to have 2-dimensional outflows. At later times, storms tend to be a hybrid between 2 and 3 dimensions.

First, I want to complement the authors for their hard work in reviewing this manuscript. I found it much improved, especially the second half of the manuscript. However, I still found a few portions unclear, and I still disagree with a few analyses. Thus, I suggest return for minor revisions.

Comments:

1. Introduction: lines 51 – 78: I found this section confusing and hard to follow. The first paragraph in this section describes the potential impact of this study, but the details about what exactly is done in this study is not really discussed until the second and third paragraph. And when it is discussed, it is scattered throughout the paragraphs. I suggest reworking these paragraphs. Start with clear statements of what exactly will be done and what is the objective of this work. Then discuss possible implications of this work. The discussion of the implications of this work could also be fully or partially moved to the conclusions section.
2. Section 3.2:
    a. Line 281: What are you comparing the supercell to? The multicell case? Please specify in the text.
    b. Line 284: Are the boxes in the supercell and multicell only similar in size or are the boxes the same size for all the cases? How does this impact the results since it is later mentioned that results are sensitive to whether just the convective cells are included or if some region outside of the convective region is included?
    c. Lines 285 – 288: Can you provide the x,y location of these regions influenced by the boundary conditions? I am thinking it is the vertical bands are +/- 50-40 x. If that is true, could the slightly arched bands in the finite squall line between +/- 40-60 x and +/- 20 y also be boundary artifacts?
3. Section 3.3:
    a. Line 304 – 310: I got confused in this section. Can you review it and make sure the text is referring to finite or infinite correctly as well as review the panel labels.
    b. In the text, instead of simply stating that the spread is larger based on the spaghetti lines, could you provide a standard deviation or variance of the ensembles to quantify and be more exact?
    c. Figure 4: I understand the importance of the white lines between 4-8 km. However, the white lines above 15 km are never discussed. Those lines tend to make the figures busier and more confusing. Could you remove those upper lines or add text that specifically explains why including them is important?
4. Section 3.4:
    a. Lines 344 – 348: Are the slopes here calculated only using the first and last point in this region? This is not an adequate approach; a linear regression must be

made using all points in this region. I expect that the slopes will be more similar if a true linear regression is conducted.

b. Line 349: Is this supposed to say “finite”? Please review this entire paragraph to make sure it is referring to the correct case.
c. Lines 350 – 355: Please define exactly what is the end point region? Is this comment based solely on the last point in finite distribution and, if so, why is it ok to use a possible outlier as the end point? In my interpretation the end point region would extend from 4000-6000 latent heating flux, and, in that case, the mass divergences are not similar.
d. Line 360 – 383: The introduction of 2D and 3D seemed very abrupt and out of place to me. I had no idea how the 2D and 3D idea came about and how it related to these cases. Lines 373-380 nicely describe how each case fits the 2D and 3D models. I suggest moving these lines up and then stating lines 360-370.
e. Line 391: Least affected by what? Please be specific.

5. Section 3.5:
    a. Lines 410 – 412:
        i. I don’t see the v-component in the southern end initially. I suggest not mentioning.
        ii. Is there any implication for the northern v divergence magnitude being similar to the v convergence in the center of the line?
        iii. It may be worth noting that the u and v divergence magnitudes at the northern end are similar in magnitude to help strengthen the idea that it is 3D.