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Interactive comment on "Realtime WRF LES Simulations to Support UAS Flight Planning and Operations During 2018 LAPSE-RATE" *by* James O. Pinto et al.

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Thank you for your thoughtful comments. I think the edits have certainly improved the manuscript! Please seem my specific responses to each of the issues you raised below.

1. Added pointers and labels to more easily identify key terrain features in Figure 1 and 4. I apologize for the difficulty seeing the black contours in Figure 4. I have increased the size of these figures to aid in interpretation.

2. Agreed. I have added a reference that describes small UAS weather hazards in

detail becuase of their light weight, limited power supply and thrust as well as issues associated with line-of-sight requirements.

3. reworded.

4. True, this sentence has been reworded.

5. All simulations completed without any issues using this refinement ratio and neither has previous investigators listed. This is now noted in the text.

6. The NARR is a reanalysis and is not available in realtime. There were requirements for the forecasts to be available for next-day planning but the HRRR only goes out to 18 hours. Thus, the GFS (22-34 hour forecast lead times) was used to span the required next-day time horizons. The HRRR forcing was used for the day of simulations and were generally more accurate. The analyses only focus on the output from the more accurate HRRR-forced simulations. This is now noted starting at line 253.

7. The wind speeds were generally less than 5 m s-1 across the lower-level lateral boundaries. Thus, convective boundary layer development happened locally and thus did not require time to develop at the inflow boundaries. We have added this definition of weak and some further explanation of why this obviated the need for using the cell-perturbation technique in this study.

8. Yes, this is true. One could certainly evaluate how well the surface heat and moisture fluxes are handled as well via inferences one can make in comparing modeled and observed temperature, dewpoint and winds and an estimate of surface roughness. The point of Figure the model skill at predicting wind components and speed to assess how well the model captures day-to-day variability related to the terrain driven flows.

9. Changed all date references to the following format XX July 2018 where XX is the day of the month.

10. Note sure about this. The morning inversions typical dissipated within a couple of hours of sunset, so the inversion did not likely aid in the build up of CAPE over

the mountains. Other work we have been performing indicate that a key factor in the development of convective storms over the mountains is the low-level moisture. While these datasets could be explored to evaluate the convection vs no convection days further, any such discussion here is beyond the scope of the paper.

11. Yes, part of the problem is that using 111 m resolution is not fine enough to simulate turbulent eddies that occur under strong static stability. In addition, there is fine scale variability that is difficult to capture directly with point to point comparisons regardless of stability. For example, smaller scale convection and thunderstorms in the model might occur at different times of location than observed during the day. At night, finescale flows set up that are heavily influence by local terrain feature and intermittent turbulence associated with breaking waves. Despite these issues, it is evident that the model is able to broadly capture the change in character of the turbulence as seen in the comparison of vertical velocity and wind variance (see updated figure 7).

12. The wind speed is indicated by the colors while the wind direction is given by the arrows - the figure caption has been updated to be more specific. The height of sigma level for which the potential temperature is plotted is also roughly 80 m AGL - same level as the winds.

13. The point of this paper is to provide some subjective comparisons of the model data with observations so that the level of skill is evident. We leave it to future studies to assess skill more quantitatively. Here we can see the complex nature of the flow field in the northern part of the SLV on this day. While the model generally captures the evolution patterns in temperature and moisture, it has more trouble predicting the evolution of winds observed (on this particular day) by radiosondes. For example, the modeled depth of the easterly return flow is 2-3 times that which was observed between 5 and 9 UTC. Additional comparisons at Saguache between model and lidar reveal that the model performed quite well on other days within the canyon (see Fig. 1).

14. This is a good point. Improved treatment of the land surface should be explored

via additional studies and the datasets described in this paper could serve as a benchmark. I have added additional text that discusses how better treatment of the surface - such as including observations of soil moisture as a function of surface type or location could be used to improve the lower boundary condition and thus the result in better simulations of the boundary layer evolution.

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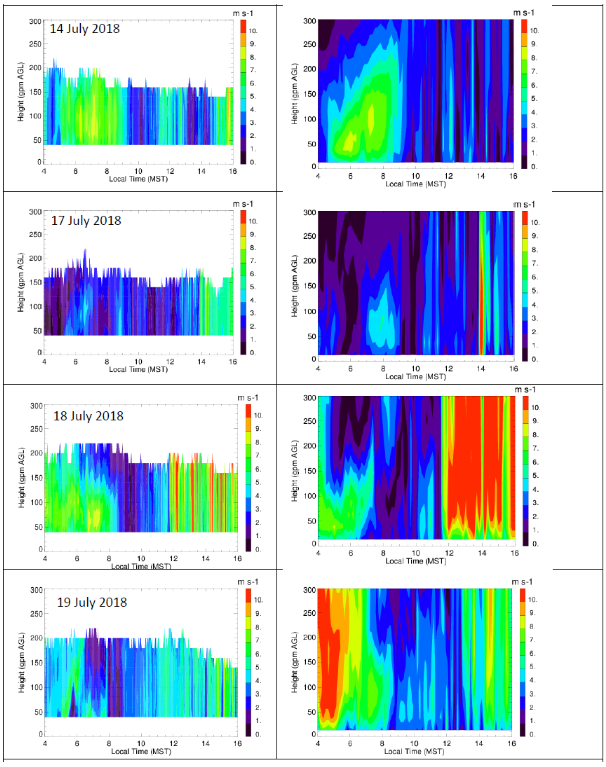

Fig. 1. Evaluation of (left) HRRR-driven WRF LES with (right) Doppler Lidar at Saguache Airport for 4 days during LAPSE-RATE as labeled.