Response to Reviewer Comment #2

We thank this reviewer very much for your positive comments on our manuscript. Providing this valuable feedback has helped to improve the current manuscript. Taking into account comments from all reviewers, we reorganized the manuscript sections as described to the previous reviewer and in our comments to this reviewer. The following contains our detailed responses to your comments, with our responses in plain text given underneath your original comments in bold type.

1) In the conclusions, the authors assert "X-, C-, and S-band scanning radars have been used together to pseudo simultaneously": the reviewer is not able to find information about the S-band radar in Table 2 and its role in the study is not clear.

Since we have rewritten section 7, this sentence has been removed from the text. However, the S-band radar in question is a NEXRAD radar (KVNX), for which we have assumed most readers are familiar with its general operation and modes. We have provided an additional reference. Its role in this study includes providing additional surveillance and unattenuated reflectivity coverage of convective cells. We believe the ability to better bound the convective storms from available NEXRAD insights improves these variational retrievals.

2) There are no information about radiosonde location, please provide them updating also Figure 1.

We used the ARM Merged Sounding dataset. This is a 'value added product' from ARM that uses a combination of observations from the radiosonde launched at the SGP CF (e.g., Lamont, Oklahoma), microwave radiometers, surface meteorological instruments, and European Centre for Medium Range Weather Forecasts (ECMWF) model output. The dataset is better described in section 2 of the revised manuscript.

3) The observation simultaneity is the key factor for multi-Doppler retrievals: please provide more details on this topic.

As in response to the previous reviewer #1 (and discussion image provided to that reviewer), this paper did not directly consider advection and time evolution of clouds. We believe this is a subject beyond the scope of this manuscript to address in the proper detail that may be required. As in our response to reviewer #1, we have added discussion on this topic to section 7.

4) The comparison between 3DVAR and iterative retrievals is performed for only one event. It should extended to all cases.

Agree. We extended the comparison analysis between the two techniques to the five MC3E cases listed in Table 1. The RMSE of radial velocity and the normalized mass continuity residual (NMCR) estimated from the 3DVAR and an iterative upward integration method are listed in Table 4. Figure 6 shows an example of comparison of retrieved vertical velocity and horizontal divergence, and vertical profiles of RMSE and NMCR for the May 20 case. As shown in Table 4, the 3DVAR technique provides lower NMCR and radial velocity RMSE values than the upward integration technique for the five cases. However, the NMCR values from the April 25 and May 11 cases are low and relatively similar performance is found between the two techniques. Those two events are nocturnal elevated convection (April 25) and widespread stratiform precipitation with embedded convection (May 11), respectively. Both cases included narrow/weaker convective regions, and the propagation speeds for the cells were slower. This is in contrast to the advantages for the remaining convective cases that featured severe/significant convection and MCS systems having larger convective coverage. The result suggests to us that the iteration upward integration technique is still reasonably-matched for those two weaker convective cases where the mass continuity equation is a dominant parameter (aka, no significant advantage was gained), whereas for severe MCS convection cases, the 3DVAR technique is arguably preferable. We added this discussion to section 5, which has been moved from section 6 in the previous manuscript.