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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characteristics of Vertical Air Motion in Convective Clouds" *by* Jing Yang et al.

Anonymous Referee #1

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This paper provides a valuable contribution since there is not a huge amount of updraft information of this type in the literature. The results are valuable for a variety of reasons such as for providing better realism for numerical models on convection vertical motion scales and magnitudes. The results are also very useful for microphysical studies such as rain/snow growth mechanisms that require a vertical motions as a key input. The authors provide a good summary of past work and the manuscript in general is well written except for numerous typographical errors and some poorly worded sentences. The technical details are sufficient for the material presented. There is too much detail in some sections, and only the key points should be included (e.g., section 4.3).

The paper deals with what shallow to moderate convection. The authors need to add some discussion in the abstract and conclusions on the fact that the measurements presented are still a biased sample of convection. Are the measurements truly repre-

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Discussion paper

sentative of all convection in the three regions presented, or did for example the planes used stay away from stronger, and/or deeper convection, or ones with higher reflectivities. What the paper points out is that there are some similarities between the regions, but that there is really a wide variety of convective types over the globe. This is a good point to make in the paper that there are few measurements of this sort so they are greatly needed, but they represent specific regions and types of convection, more from other regions are needed, and one should not interpret the results that these results can be generalized globally. A few summary sentences (abstract, intro, and conclusions) on this point would make the paper better.

While I find the paper quite interesting, there could be more connection between the convection dynamics and microphysics. Processes such as mixing are barely mentioned in the text. It would be interesting for example to make connections between the updraft characteristics such as mass fluxes, diameters, and entrainment.

Technical and other details:

Lines 128-138: What are typical reflectivities in the convection. I know this will be from the W-band radar but this information would still be useful.

Lines 171: Define strong updrafts since these are still relatively weak compared to deeper convection.

Line 189: This accuracy (0.2 m/s) is quite good. Is there any chance there are biases rather than random errors on the vertical velocity?

Line 209: Footnote. This is roughly the sensitivity of CloudSat. Is this the reason -30 dBZ was chosen since there will be cloud at lower reflectivities?

Lines 233-235: How do you know the 2D symmetry of the updraft since you might not fly through the peak up and downdrafts? Both the W-band radar and in situ measurements will not tell you this.

Line 236: “there is no” should be “there are no”

Line 238: Excluding MCS biases the results. This comes down to emphasis in this paper on small to moderate convection rather than deep convection in MCSs. Might mention this to keep the scope of your study in perspective.

Figure 4: need labels for field experiment associated with each color.

Lines 264-268: It might be useful to plot one example of a trace through one of the updraft/downdraft penetrations. This would be helpful to understand some of the averaging performed.

Line 268: “turbulences” to “turbulence”

Line 300: “convections” to “convection”

Line 294: “strong draft” – I would again put this in perspective since it is strong in your study, but not necessarily strong with respect to MCS updrafts for example.

Line 323-324: Again, this point should be more prominent in the paper.

Lines 386-387: This statement should be in the summary/conclusions since these measurements are important but we need a lot more.

Line 397: “results” to “result”

Line 403: “relatively” to “relative”

Figure 10 and similar plots: I find these plots a little complicated and confusing but probably acceptable for publication. I can’t think of an alternative but possibly there is a better way to plot.

Line 422: Some of the statements in this section should go in a summary and conclusions section. Points like lines 468-473 are important summary statements. You should consider pulling some of the summary points like this and putting them in the conclusions.

Line 469: “pervious” to “previous”

Lines 509-510: “While in this study” should be something like “In contrast, this study shows the strongest. . ..”

Line 522: “When exclude” to “When we exclude”

Line 536: “convective cloud” to “convective clouds”

Lines 539-540: Can you say anything about the two-dimensionality of drafts from the remote sensing data?

Line 553: “with expectation” to “expected”

Line 564: “Since . . ..to better”. This is an obvious fact. May want to just say that the aircraft just provides a line of data through drafts, and not vertical information unless the plane makes multiple passes through the same cell.

Line 568: in the Summary section, you should reiterate the criteria for considering up/downdrafts, i.e., >xx m/s.

Line 596: Flux calculations assume two-dimensionality of drafts and this might not be the case. Should mention this as a weakness in the study, i.e., using a single line penetration through drafts to make flux calculations.

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