Reviewer of : „Unexpected characteristics of convective clouds downdrafts in the upper-levels of tropical deep convective clouds“

The authors use the aircraft measurements from the ACRIDICON-CHUVA field campaign to analyze the characteristics of updraft and downdraft in the cloud deck of convective systems. The characterization is related to shape, dynamics, and microphysical properties of drafts in the upper troposphere, but it also includes altitudes in the mid and lower troposphere. The results suggest that downdrafts and updrafts share similar properties. Drafts tend to increase their diameter with altitude, but the mass flux decreases with height. This is explained by the reduction in the vertical velocity. At upper levels (10-14 km), drafts with a diameter smaller than 1000 m are the most frequent, but their mass flux is lower than larger drafts, which are less common. The authors show no linear relationship between the amount of cloud water content and the velocity of drafts at different altitudes. This, in the authors' interpretation, suggests that the drag force due to more condensed water is not applicable for the formation of downdrafts. The authors argue that strong downdrafts are more common in the case of a supersaturated state (RH_i > 110%), and not in a subsaturated state (RH_i < 90%), which is expected because a subsaturated state would require more energy (sublimation) and, as a consequence, more cooling. Moreover, the more intense downdrafts in a supersaturated state are related to high values of droplet number concentration. Strong downdrafts between 5 and 10 km also tend to be related to high concentrations of particles with sizes less than 100 μm.

The analysis presented by the authors shows what they state, but I find the whole manuscript too simple in the analysis and interpretation of the results. It's difficult to get the idea the authors want to transmit. Do they want to say that the way we think about downdrafts is wrong? Or do the characteristics of downdrafts depend on the region or the sampling method? The dynamic of the manuscript is to present a result a then compare it to the other studies. If the comparison goes in the same direction, the authors state that the results are in accordance with the literature. When it is not the case, the authors give different hypotheses to explain the discrepancy, but there is no analysis supporting their hypotheses. This way of interpretation gives the manuscript a direction of too speculative. In the following lines, I give my major concerns about the manuscript:

1. The objective of the paper is difficult to the asses. The introduction, which in my opinion is unnecessarily long, does not provide the problem that the authors aim to tackle. The motivation presented by the authors is that there is not enough literature about observations of upper-level drafts. With this statement, I was expecting an overview of the different structures of downdrafts in convective systems, but the authors only focus on one campaign, and according to the manuscript, the object of sampling is restricted to cloud decks around convective systems, avoiding the convective core. This points out that the sampling region could also play a role in the results of the manuscript. I would suggest stating clearly in the introduction what is the scientific questions that the authors are tackling in the manuscript. Are they stating that not all the downdraft shows the same properties? I also suggest stating clearly what the limitations of their study are.

   Regarding the limitations of the study, I was wondering if the results would change if upper-level downdrafts inside convective cores were included.

2. The results section is difficult to read because it is arduous to get a continuous storyline. The authors explain their results with respect to other studies, looking only for similarities or differences, but there is a lack of deepening the analysis to explain the possible hypotheses stated by the authors. If the authors want to compare their results, I suggest opening a Discussion section.
3. In the same direction as point 2, the authors stated that neither the loading nor the evaporative cooling can explain the downdraft velocity. If this is the case, what is the hypothesis that the authors propose, and can they prove it? The manuscript will tremendously benefit from more analysis to prove or disprove those hypotheses.
4. I had difficulties understanding the mass flux discussion. The authors find that upper-level drafts have less mass flux than lower-level drafts. The discussion in the paper suggests that the vertical velocity is the one explaining the decrease in the mass flux with altitude. So, I was wondering if the authors expected that the mass flux of upper-level and lower-level drafts would be equal. If this is the case, please state this clearly in the manuscript. Moreover, assuming again that the mass flux should be conserved, are the changes of mass flux and velocity related to entrainment and detrainment?

   If it is not expected that the mass flux in upper-level and low-level drafts will be equal, what is the reason for the comparison?

5. The conclusion summarizes the main points of the manuscript, and in the actual structure and storyline of the manuscript, it gives a feel that the document is most like a collection of different analyses rather than addressing a scientific question. I would suggest addressing points 1 to 4 and changing the conclusion section depending on the outcome. Moreover, I find it hard to imagine large eddies communicating dropplets between downdrafts and updrafts without affecting their entropy.

Specific comments:

Line 11: What is Dp? And is it 100 μm?

Lines 11-12: Increases faster than what?

Lines 32-33: “However, the earlier observations …” I agree that this is part of the region analyzed in the manuscript, but as the authors stated, they only analyzed cloud decks.

Lines 101-103: Are you studying the whole spectrum of downdrafts or just a subset of this? What about drafts in convective cores?

Lines 176-178: How many samples do you have in the lower troposphere compared to the upper troposphere? How much does the PDF of the draft diameter vary when the same number of samples is chosen randomly in the lower and upper troposphere?

Lines 196-197: “Drafts in lower altitudes …” I see your point, but I was wondering whether the decrease in density with altitude also explains the difference in the mass flux between upper-level and lower-level drafts.

Lines 212-215: What is the point of comparing if this is a different method?

Lines 219-220: Does it mean that the other 70% come from wider drafts?

Lines 226-228: “We would like to ...“ How do you think that the sampling method affected the results?

Figure 4: If I understood correctly, every point is a draft. So, what about dividing the cloud water content by the draft diameter? This is to see if the concentration of cloud water content with respect to the diameter shows a relationship with vertical velocity.

Lines 236-237: I did not understand the logic of the two sentences. First, atmospheric motion is influenced by hydrometeors, but in the following sentence, which is an example, updrafts influence supersaturation. So, are hydrometeors affecting atmospheric motion or the other way around?

Lines 255-256: “We observe stronger downdrafts …” Are you sure? What I see is that the subsaturated state has equally strong downward vertical velocity as the supersaturated downdraft (< -1 m s-1).

Lines 273-275: How confident are you that this method removes the influence of mesoscale draft in the vertical velocity?

Line 302: “Larger particles”, what does it mean larger particles? Dp>100 μm , or are you talking about particles close to 100 μm.