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Interactive comment

Interactive comment on "Comparing calculated microphysical properties of tropical convective clouds at cloud base with measurements during the ACRIDICON-CHUVA campaign" *by* Ramon Campos Braga et al.

Anonymous Referee #3

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Title: Comparing calculated microphysical properties of tropical convective clouds at cloud base with measurements during the ACRIDICON-CHUVA campaign

Author(s): Ramon Braga et al.

The paper compares calculated with measured microphysical properties of convective liquid clouds in the tropics.

Unfortunately, calculations are not performed within a microphysical model taking into account important spatiotemporal fluctuations of dynamical and thermodynamical properties, turbulence, entrainment, etc... In this study solely a comparison of calcu-

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lating cloud properties from analytical equations and respective measurements has been performed, which represents a considerable work, however with rather limited outcome.

Conclusions of this comparison study are disappointing and do not gain new insights in liquid convective cloud microphysical processes. The paper barely presents new and noteworthy concepts. As it stands, the work is solely a rather qualitative affirmation of existing parametrizations. Taking these issues into account, the study may better carve out the uncertainties of used cloud parametrizations (equations 1, 2, 3? ...) based on the uncertainties of measured cloud parameters from the ACRIDICON-CHUVA dataset. Also taking into account missed features and uncertainties stemming from turbulence (and more complex droplet activation) and entrainment not captured in this study. Would this be possible at all? The uncertainties of your instruments and derived measurements have been discussed rather honestly in this manuscript. This is why I encourage authors to develop this manuscript into that direction. Otherwise, I would recommend rejection of this manuscript due to its poor contribution to scientific progress.

The manuscript shows some striking and unexplained differences between calculated and measured microphysical parameters (Nd versus NdT, NdT* versus NdCCN* for a series of flights). Is this a principal problem of performed measurements within an environment of complex processes and limited degree of complexity of calculations that are hardly comparable: calculations do not capture measurement data features like turbulence, entrainment, etc...? At least above mentioned differences are more important for higher Wb values!

Specific comments related to above general statement:

Line 36: What is the impact of Wb uncertainty of 0.2 ms-1 on Nd calculation?

Line 98: What is the cumulative impact of Wb and Nd uncertainties on Smax calculation and then N0 and k?

Line 194: CDP sample area has not been calibrated before, during, after flight campaign? In this case you may not claim only 10% of uncertainty in SA?

Do you correct King probe LWC (seems not to be the case), knowing that sensitivity below 10μm and above may be 30-40 μm is reduced. You are using this probe for LWC reference, however Strapp (2003) demonstrated large deviations of King probe LWC also for larger drop diameters of 40 μm (may be already 30μm?). Your effective drop diameters reach 26 μm.... Uncertainty of solely 5% in LWC is difficult to believe.

Line 309: And what if King probe and CAS DPOL are both wrong and CDP is right?

Line 339: Why don't you correct CAS DPOL data for your calibrations? Consequently, in your data the CAS DPOL instrument undersizes large droplets! (40 μm in diameter appear as 35μm drops?). In case your effective diameter droplets of 26 μm would have been 30μm droplets in reality, you are underestimating LWC by 50% for these droplet sizes... Likewise, the King probe is underestimating LWC for other reasons as mentioned above.

Line 386-394: What is the uncertainty in N0 and k calculation and finally the uncertainty in equation (2) calculated droplet number (calculated each second) when averaging CCN2 per time step normalized by FA (with two other averages of mCCN1 per time step and TmCCN1 average of all mCCN1 time steps or may be even all CCN1 data)?

Line 400: equation (3) does not pretend Smax depending on NCCN(S). Please detail how Nd can be used to achieve a closure for NdCCN estimate.

Section 5.2.1.: Gray solid/dashed lines difficult to see in Figs 11 and 12!

Fig 11a & 11c show very weak overlap of NdCCN and NdT including both uncertainties. In addition, real Nd measurements can be considerably outside NdT uncertainties and particularly outside the overlap region. Why? What is the value of this study when measurements are not better matching the calculations with their uncertainties? Are the already large uncertainties still underestimated? Are measurements and calcu-

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lations comparable in their complexity of the respective environments? I don't think so. . ..

Fig 12: Color difference of Nd curves (red) and Nd in legend (blue). Can you also show results for AC13 and AC16? Fig 12b and 12c as well as 11c show Nd that significantly exceed NdT for higher Wb. Explanation? The problem stems basically from NCCN2 calculation?

Line 513: Change 10% to at least 15% if not 20% (AC14!).

Line 513-517: and a factor of 1.5 for other cases AC11 and again AC17. Solely AC 13 and AC16 data points ok. Therefore I don't agree with that improper statement.

Line 566-567: I would call a factor of 2 in NdCCN* to Nd* comparison a pretty bad result rather than a good agreement.

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