Responses to Reviewer 2

We appreciate the reviewer's comments and his/her careful reading of our paper. Their comments definitely helped us improve the quality of the manuscript. We address the reviewer's questions/comments below:

1. "…..The one major issue I had with this study was the unrealistically high values of Nd retrieved; this sticks out as a problem since Nd is a major parameter in the various analyses associated with this study. The authors do make an attempt to address this issue in Sections 3-4, but it still is problematic in the big picture of the manuscript. I will leave it to the authors to decide how to handle this issue knowing that other readers will have the same issue that jumps out when reading the paper."

Regarding the histogram (Figure 6b), we noticed that, contrary to the rest of the analysis, the histogram included all the samples, irrespective of LWP or τ. For consistency, in the revised manuscript we only showed the N_d histogram for samples with LWP >20 gm^{-2} and τ>2. In addition, we found that the remote sensing N_d was dependent on the solar zenith angle (SZA). When removed samples with SZA>35, we observed a significant reduction in the number of samples with unrealistically large N_d (Figure 6b, black lines) and the histogram better agreed with the in-situ one. Although unfortunately we do not count on the appropriate dataset to further investigate this dependence, this might reflect the sensitivity of the retrievals to 3D radiative transfer effects, or a plausible dependence of the pyranometer performance on SZA. In our latest Figure 6, we also included N_d calculated from the 15-s averaged LWP (Figure 6b, blue line). We only highlighted the sensitivity of the analysis to SZA, and limited our investigation to samples with SZA<35˚.

- Despite the better agreement of our retrievals with their in-situ counterparts, we still consider valuable the analysis of the dependence of $ACI\tau$ on N_d (figure 10 and 11). Nevertheless, given the difficulty of defining an appropriate N_d threshold, this time we mostly emphasized those results that are less sensitive to N_d (i.e. LWP larger than 60 gm^{-2}). What is interesting about our findings is that they agree with in-situ observations and a recent modeling study over the same region (Yang et al, 2012, ACP) in the sense that ACI_τ is close to the upper physical limit. Moreover, the similarity between satellite estimates and our results suggest the physical robustness in our results.

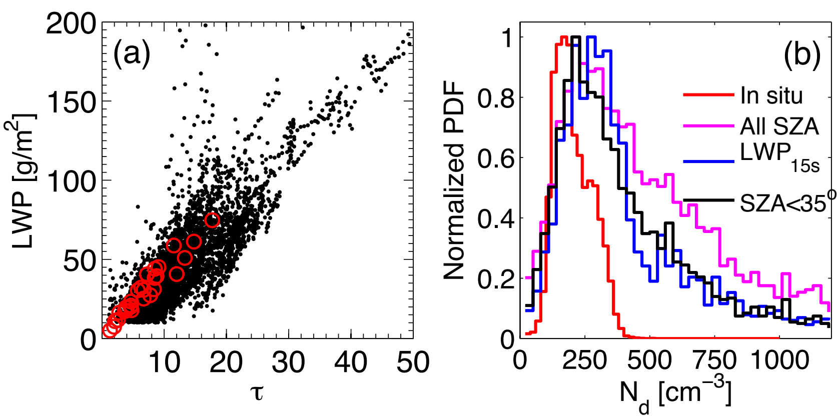

Figure 6: a) LWP versus τ. Black dots represent the remote sensed values, and the red circles are the values derived from the cloud probes. b) Normalized probability density function (PDF) for the remote sensing-based N_d (magenta, black, and blue lines, eq. (8)) and the in-situ N_d obtained during in-cloud legs (red line). The remote sensing-based N_d was estimated from samples with LWP>20 gm^{-2} (magenta line) and solar zenith angle smaller than 35° (black line). Blue line corresponds to N_d calculated with the 15-s averaged LWP. Remote sensing-based N_d retrievals were calculated for τ>2, LWP>20, overcast at 1.4 km scale, and column-maximum reflectivity <-17 dBZ.

2. Comments: Pg 25444, Line 15: the subscript on the letter "S" is missing in the equation.
Figure 1. How was Nd obtained in these maps?
The missing subscript was incorporated, thanks.
We estimated N_d and LWP from the MODIS cloud effective radius and optical thickness, assuming an adiabatic-like behavior of the water content, a linear increase of the effective radius with height, and a vertically constant number of droplets. The calculation is described in our paper Painemal and Zuidema (2011, JGR). We added this information in our revised manuscript.

3. Pg 25445, Line 3: Perhaps some mention is warranted for the work of Lehahn et al. (2012) who investigated how coarse aerosol influences drop size in this region. This is related to ACI. Reference: Lehahn, Y., I. Koren, O. Altaratz, and A. B. Kostinski (2011), Effect of coarse marine aerosols on stratocumulus clouds, Geophys. Res. Lett., 38, L20804, doi:10.1029/2011GL048504.
We appreciate the reviewer for drawing our attention to Lehahn et al (2011). Although we will keep in mind this reference for a future manuscript, our statement in P25445, line 3 pointed to the lack of quantification of the first aerosol indirect effect (that is: ACI_τ and S_R), which is something that was not directly addressed by Lehahn et al. (2011). Nevertheless, we cited this time a recent modeling study by Yang et al. (2012, ACP) that reported ACI values close to the physical maximum over the southeast Pacific, supporting the findings in our study.

4. Pg 25446, Line 14: Did the authors mean to write "..do not consist of physical. . ."?
The sentence was changed to:

"The two excluded flights either did not sample much cloud, and/or encountered frequent precipitation, both of which are unfavorable for retrieving LWP and τ and do not represent physical realms for which the first aerosol indirect effect is significant."

5. Pg 25449, Line 20: "above-cloud"
Done, thanks

6. Pg 25449, Line 25: report altitude units
Done, thanks

7. Pg 25450: Probably would read better to write ". . .with a constant re as a function of

height."
Modified, thanks

8. Pg 25451, Line 6: Did the authors mean to write "two-stream"? This applies to many other areas where "two-streams" is written.
We modified to two-stream, thanks

9. Pg 25453, Line 16: should say "underestimate". Pg 25455, Line 4: remove "a"
We removed "a" from page 25455. In addition, we slightly modified the sentence in page25453 to:
"This could imply a LWP underestimate or a cloud optical depth overestimate."

10. Discussion PaperPg 25456, Line 2: "correlations" instead of "correlation" Pg 25456, Line 14: "by applying" Pg 25456, Line 18: should say "dependencies" and also "is" should be "are" Pg 25460, Line 8: "impact on" Figure 5: Why is Nd so high, especially relative to Na? This doesn't make much sense.
The typos were corrected accordingly, thanks.

N_d in Figure 5 is indeed large at times, and likely to be the consequence of artifacts in our retrievals. As explained in the manuscript, the occurrence of this large N_d was commonly associated with samples with sharp decrease in LWP, in which the smoothed τ (due to the instrument field of view) cannot follow the fast LWP transition, especially when LWP decreases rapidly. Moreover, large N_d might be related to the fact that uncertainties in τ are larger (in percentage) for smaller τ. As discussed in our response to comment #1, we partially circumvent the problem of large N_d by removing samples with SZA>35˚, and focusing our attention on the LWP interval insensitive to a N_d threshold (LWP>60 gm^{-2})

11. Figure 6 and associated discussion: Contrary to what the text of the paper indicates, I do not find the histograms to agree too well. The remote sensing Nd values are too high, as noted above.
Please, see our response to comment #1