General Comments:
This work compares estimates of cloud droplet number concentration (CDNC) from two different algorithms and A-Train data streams. The presentation is a bit sloppy with some details unmentioned, assumptions unaddressed, and poor grammar. In general, I'm left with the impression that CDNC estimation is sensitive to the effective radius input but effective radius itself varies quite a bit depending on retrieval methodology. This is a fairly minor result as a number of papers have highlighted this effective radius problem lately. I want to know why there are differences and how might they be reconciled. I recommend major revisions to correct some of the presentation flaws.

Specific Comments:
line 2, pg 29036: superfluous 'it'
Done.

Line 6, pg 29036: define MODIS. Same for CALIOP and CALIPSO later in the paragraph. Also POLDER/PARASOL in the next paragraph.
We have defined the three instruments (MODIS, CALIOP and POLDER) and explained their resolutions at the beginning of sections 2.1, 2.1 and 2.3.
"CALIOP (Cloud-Aerosol Lidar with Orthogonal Polarization) is an active two-wavelength polarization-sensitive lidar with a horizontal resolution of 333m and vertical resolution of 30-60m (Winker et al., 2003). The level 2 official products are derived at horizontal resolution of 5km."
"MODIS (MODerate Resolution Imaging Spectroradiometer) is a relatively high spatial resolution (1 km) and wide spectral (0.41-15μm) imaging radiometer that provides global observations of atmospheric properties (Platnick et al., 2003). The level-2 official cloud products are derived at resolution of 1 km (for both cloud optical thickness and re) or 5 km."
"POLDER (Polarization and Directionality of the Earth Reflectance) is multi-polarization, multi-directional (16 directions) and multi-spectral (443-1020 nm) imaging radiometer with a native resolution of 6 km × 7 km to provide global and repetitive observations of the solar radiation and polarized radiance reflected by the earth-atmosphere system (Deschamps et al., 1994)."

Line 16, pg 29038: is delta the cloud layer integrated or layer mean quantity?
Delta in CALIOP products represents "layer integrated depolarization ratio", which is the ratio of integrated cross-polarization component ($\beta_{\perp}$) and copolarization component ($\beta_{//}$) of a cloud layer.

Line 16, pg 29038: Does the term layer refer to the cloud layer or the cloud top. Effective radius is heavily weighted towards the first unit or two of optical depth. Is there an inconsistency here. Or is the retrieval of cloud top CDNC with the inference that CDNC is relatively constant with height in the cloud. If so there is an assumption about cloud vertical structure here too and the authors should discuss. There is also a horizontal (footprint size) inconsistency in the observations that requires some explanation.

Layer refers to cloud layer that CALIOP can detect (mostly corresponds to $\tau < 5$, winker et al. 2009). CDNC calculated with CALIOP theoretically corresponds to the value of detected layer. If CDNC is relatively constant with height in the cloud, the retrieval can also represent values for the whole cloud. The best effective radius used in the algorithm should be effective mean value of detected layer. Both POLDER and MODIS effective radius may be inconsistent with CALIOP detected layer. Because of this, we use both POLDER and MODIS effective radius in CALIOP algorithm to see how different effective radius could impact the retrieval. We add more detailed explanations in section 2.4 as follows:
"In addition, as CALIOP signal could only detect the most top of clouds with $\tau < 5$ (Winker et al., 2009), the effective radius corresponding to this layer are needed to calculate the CDNC corresponding to this layer. If CDNC is vertically constant, the retrieval can represent the true value for the whole clouds. But in real atmosphere, due to cloud top entrainment, CDNCs at cloud top are smaller than those in clouds."
MODIS effective radius averaged at 5km are used, larger bias corresponds to horizontal inconsistency of MODIS and CALIOP pixels that are mostly falling into heterogeneous clouds, which can also refer to section 4.2. Although the POLDER effective radius is averaged at 200 km, the retrievals can be only obtained for homogeneous clouds. As clouds are homogeneous at 200 km, smaller bias is related to spatial resolution differences.

Equations 1 and 2: There are multiple combinations of r_e that could be used in these equations. You should be more explicit about where the r_e information is coming from.
In section 2.1, we stated more clearly as follows: "We use both MODIS (Figures 1-6) and POLDER (Figure 7) r_e for our calculations in the following"

Line 21, pg 29036: 'the' needed
Done

Line 19, pg 29039: cloud height may come from CALIOP but pressure certainly does not.
We modified the sentence as follows: "pressure (we used cloud top pressure calculated from CALIOP cloud top altitude)." Cloud top pressure (P) is calculated from CALIOP cloud top altitude by using P=101300*exp(H/(-8.5)).

Line 4, pg 29040: 3-D photon transport doesn't seem to explain all the difference. I think you are using this term incorrectly to describe both true 3D effects and spatial heterogeneity effects. Also what about drizzle (nakajima et al. 2010)?
We modified it as follows: "Droplet effective radius derived from MODIS tends to be larger than the true value, mostly because of neglecting cloud entrainment and horizontal photon transport (the 3-D radiative bias) within heterogeneous clouds (Zhang and Platnick, 2011)."

Line 20, pg 29040: grammar
We modified it as follows: "MODIS retrieves r_e in three bands in the near infrared (1.6μm, 2,1μm and 3.7μm). The retrieval is based on absorption in these bands that

provides sensitivity to r_e (Nakajima and King, 1990). In our study, we used only the MODIS 3.7µm effective radius ($r_{e,3.7}$) retrieval to calculate MODIS and CALIOP CDNCs. The 3.7 µm retrieval is expected to represent the droplet size closest to the cloud top (Platnick, 2000) and to be the least sensitive to the 3-D radiative bias (Zhang and Platnick, 2011), and is therefore the best choice for our calculation"

Figure 1: Is the data filtering identical? It should be otherwise this would not be an appropriate comparison. There should also be some discussion of the sampling biases which are implicit in the data filtering. Should these values even be compared to models given the number of pixels thrown out of the analysis?

Yes, both data are collocated in the CALIOP track. They are filtered the same, and then averaged from level 2 to level 3. We explain our filtering criteria in section 2. "Overcast water clouds are filtered with a combination of CALIOP, MODIS and POLDER products. In the study, we also remove thin clouds with an optical thickness of less than 5 as detected by MODIS. Those thin clouds have large uncertainties to retrieve cloud optical thickness and effective radius (Zhang et al., 2013)."

Line 24, pg 29041: slops -> slopes. Error in figure also

Done

Line 12, pg 29042: underline -> underlying

Done

Figure 3: What fraction of the difference is due to the difference in effective radius from POLDER vs MODIS versus the use of equation 1 and 2. To test can't you compute a CDNC using equation 2 but with POLDER r_e as input and compare this to the CALIOP estimate. The differences shown in figure 3 suggest about a 25% difference which is about what I would expect the effective radius differences to be. So does effective radius explain everything?

We modified Fig 7 to the comparison of CALIOP CDNC using MODIS and POLDER r_e. In our opinion, effective radius differences cannot explain all CDNC differences between these two methods. The POLDER and MODIS effective radius may not be ideal to calculate CALIOP CDNC because it could be different to the layer mean effective radius that CALIOP can detect. As we explained in the paper, CDNC differences combine biases due to different effects: effective radius retrieval accuracy, vertical and horizontal cloud heterogeneity and cloud entrainment.

Line 12, pg 29043: 'unit' -> unity

Done

Line 24, pg 29044 I think that it is too simple to just call this a drizzling effect because $r_e > 15$ micron. Just present the result as it is without over interpretation.

We modified it as follows: "Large droplets or drizzle lead to more important differences between the CALIOP and MODIS CDNCs (about 0.3 of bias) compared to the differences between $r_{e,\ 3.7}$ and $r_{e,\ 2.1}$ (about 0.2 of bias)."

Section 4.2: I think that you are interchanging 3D and heterogeneity as one in the same thing when in fact they are not.
Heterogeneity can induce 3D effect, however, 3D effect do not solely come from cloud heterogeneity. We modified section 4.2 title as follows: "Impact of 3-D radiative effect due to horizontal heterogeneity"

Line 25, pg 29047: grammar
We modified it as follows: "It may suggest the POLDER r_e represents droplets size quite close to the cloud top, which may be significantly affected by aerosols and the entrainment of dry air, or it may be less impacted by 3-D radiative effects. These could result in a smaller retrieved value of r_e corresponding to an altitude somewhat above the level contributing the majority of the CALIOP backscatter signal."

Line 18, pg 29048 grammar
We modified it as follows: "More accurate CDNC values from CALIOP would, in combination with MODIS, allow the study of important cloud processes such as cloud entrainment. This calls for the development of better r_e retrievals and an improved description of r_e vertical profiles. Finally, the preliminary work reported points toward future studies of cloud-aerosol interactions - especially the impacts of marine biogenic aerosol on cloud microphysics."

Winker, D. M., M. A. Vaughan, A. Omar, Y.-X. Hu, K. A. Powell, Z. Liu, W. H. Hunt, S. A. Young, 2009: Overview of the CALIPSO Mission and CALIOP Data Processing Algorithms. J. Atmos. Oceanic Technol., 26, 2310–2323.

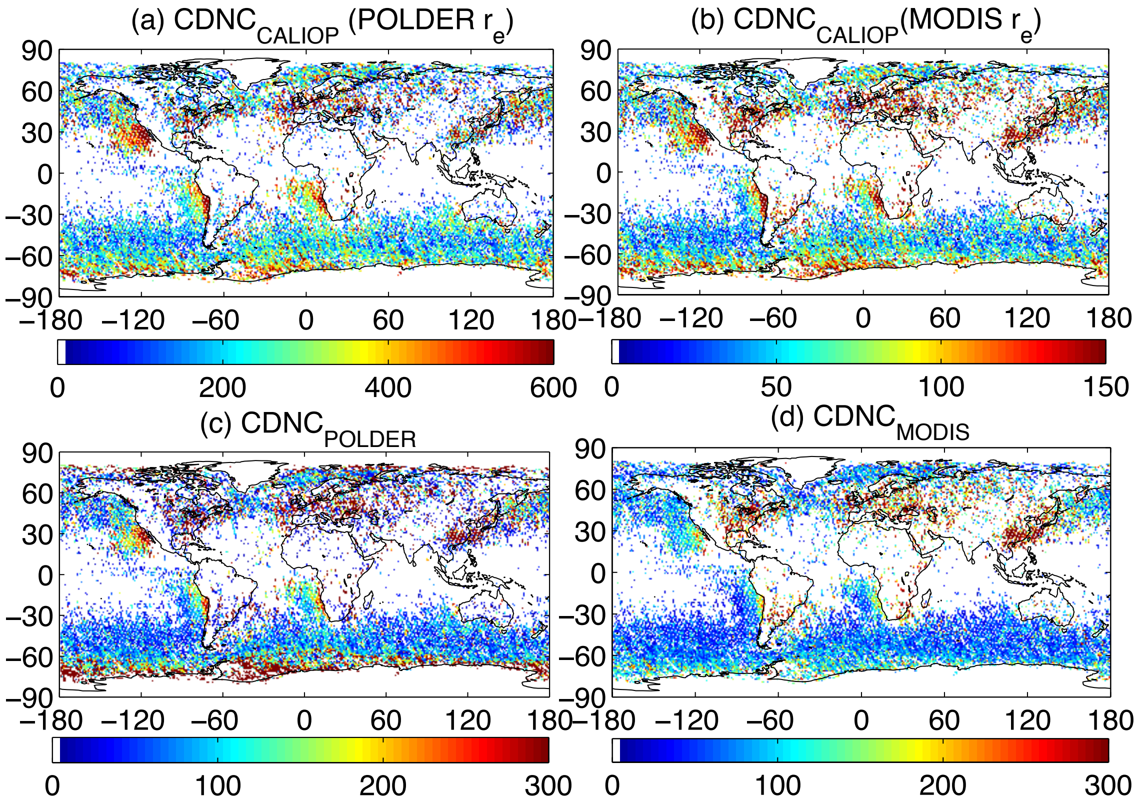

Figure 7. Geographic distributions of CALIOP CDNC derived using POLDER r_e (a), MODIS $r_{e,3.7}$ (b), POLDER CDNC (c), and MODIS CDNC (d).