Review of Sohn and Choi "A cautionary use of DCC as a solar calibration target: explaining the regional difference in DCC reflectivity ",Atmos. Meas. Tech. Discuss., 8, 2409–2436, April 8, 2015.

The authors attempt to demonstrate why the TWP DCC reflectances are darker than over the Africa and South America during the A-train overpass times in January. Using collocated MODIS, CloudSat, and CALIPSO data they conclude that IWP difference explains the difference of DCC reflectivity. I also find the contradictory MODIS and CloudSat retrieved DCC particle sizes most interesting. I am also pleased to see that the paper does indicate the most difficult part of the DCC calibration approach is selecting the identification thresholds to obtain only the DCC cores.

I believe the paper is worth publishing after the following issues are addressed.

The emphasis of the paper is not the DCC calibration method but explaining the DCC reflectance difference between TWP and South America and Africa. However the title implies that the paper will address the DCC calibration method. However, it seems to be a side topic of this paper. The DCC method is not outlined anywhere in the paper. It simply uses the DCC identification provided in Doelling et al. 2013 to compare the regional DCC characteristics. There needs to be a greater contribution of the DCC method in the paper in order to be consistent with the title.

Page 2411 line 4. "DCC have radiatively similar behaviors" This is a very confusing sentence. It does not clarify the foundation of the DCC calibration. Must each individual DCC have the same reflectivity for DCC calibration to be successful? DCC calibration is a large ensemble statistical method that does not depend on the reflectance of one DCC cell, but relies on the inter-annual consistency of the spatial and seasonal distribution of all identified DCC over a large equatorial domain. This fact was proposed with the seminal Hu et al. 2004 DCC calibration paper.

Y. Hu, B. A. Wielicki, Y. Ping, P. W. Stackhouse, Jr., B. Lin, and D. F. Young, 2004: Application of deep convective cloud albedo observation to satellite-based study of the terrestrial atmosphere: monitoring the stability of spaceborne measurements and assessing absorption anomaly. Geoscience and Remote Sensing, IEEE Transactions on, 42, 2594-2599, doi:10.1109/tgrs.2004.834765.

Page 2411 line 10. "simple adaption" I do not know what a simple adoption would consist of, since those are not published. Since the title of this paper mentions DCC as a calibration target, then a brief summary of the DCC calibration method needs to be given in the paper. This way the reader can differentiate between the published DCC calibration methods and a simple adaption. The method of DCC detection is critical to the success of DCC calibration. As mentioned in this paper, it is difficult to differentiate the anvil with the convective core.

Fig 2b, Fig 2c. Doelling et al. 2013, DCC calibration method uses the mode of the reflectivity PDF to further limit the contribution of anvil reflectances. The mode reflectance in Figure 2b show that there are differences between South America, which has the greatest mode reflectance, and Africa and the TWP. The authors are concentrating on the mean DCC reflectances, which combines both the DCC core and anvil conditions. Over the TWP more anvil conditions are represented than over South America and Africa. If the TWP anvil conditions could be removed from the analysis, would that significantly change any of the CloudSat based conclusions?

Abstract. The abstract indicates there is a 5% difference between TWP and the land sites. However, this does not take into account the mode reflectance as described in Doelling et al. 2013 DCC calibration algorithm. It represents the mean DCC reflectance with the sparse sampling of CloudSat during January.

Page 2422 line 25, Page 1416 line 23. A follow up question. A reflectance threshold of 0.95 to capture only the DCC cores, indicates to me that Africa and the TWP are within 1% of South America DCC reflectivity. If that threshold were applied in the CloudSat analysis, would that change any of the CloudSat based conclusions?

Page 2413 line 23. There is no mention what the A-train sun-synchronous satellites local equator crossing time is. This is very important information, since the results in this paper are only valid at this local time.

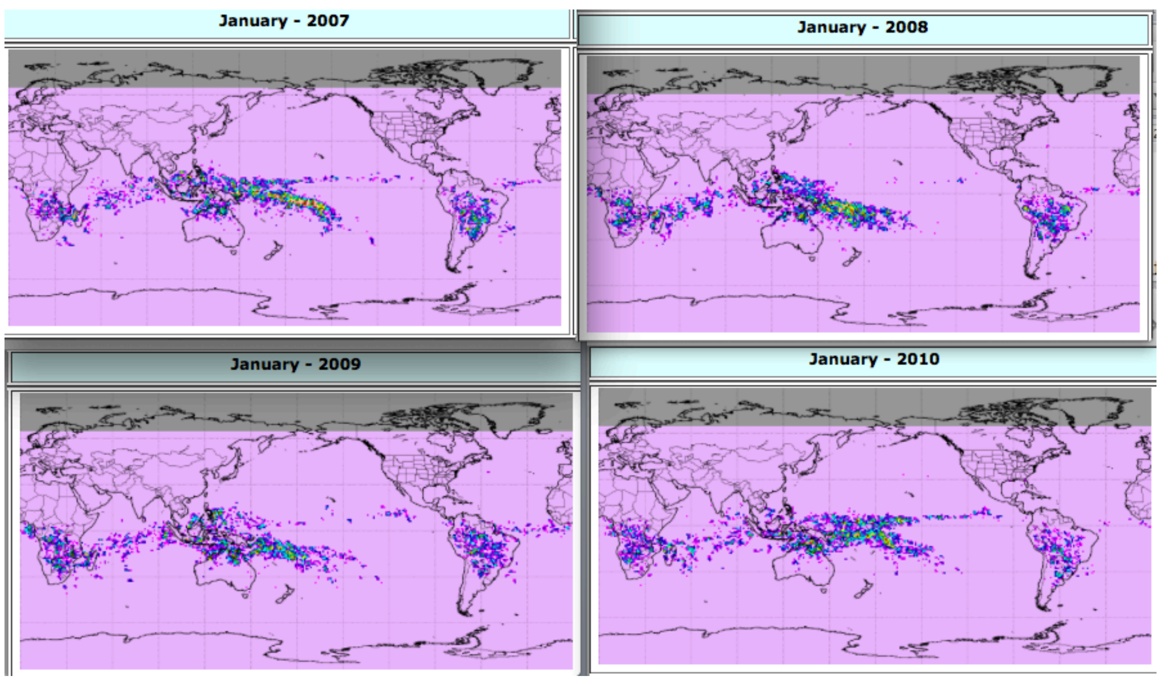
There is another possibility of lower DCC reflectances over the TWP, and that is that the TWP represents all phases of the TWP lifecycle, especially over ocean, whereas over South America and Africa all of the TWP are in the same phase of the diurnal lifecycle, due to the A-train local overpass time of 1:30PM. If the land DCC are in the peak of the convection stage, then there are less anvil conditions and less precipitation, then in the dissipation stage. Are the cloud physics differences more associated with regional atmospheric conditions or dependent on the life-cycle of the DCC?

The TWP also contains land regions yet this paper did not distinguish between ocean and land regions. The TWP domain also has sufficient sampling to stratify between land and ocean. I do agree that the TWP reflectance over ocean and land are darker than over South America and Africa. However, the Doelling et al. 2013 Fig 6 indicates that the TWP land regions have a very different 2.12µm reflectivity than over oceans, which indicate different cloud microphysics over land than oceans. This could be helpful in distinguishing between regional and life-cycle differences adding much value to the paper.

Page 2423 line 18. “regionally different criteria between land and ocean can be introduced”. As mentioned in the previous comment, there is also land over the TWP. Doelling et al. 2013 also shows that the TWP ocean is darker compared to the East Pacific and Atlantic ocean regions. This statement cannot be made unless the TWP land regions are evaluated.

Page 2423 line 29. “A more stringent criteria of TB_{11} = 195K”. Since this criterion is just a subset of the TWP in this study, would that change of the CloudSat cloud physics conclusions, such as the IWC and extinction coefficient profile distribution? Would that help isolate only the cores from the anvils? Do the authors believe the colder TWP criteria would make the CloudSat profiles more consistent with Africa and South America? Is the point of the study to say that consistent DCC reflectivity relies on consistent cloud microphysics?

Page 2415 line 7 and Table 1. I am unconvinced that the African domain has the DCC frequency as shown in Table 1. There are 217 observations in 2007 and only 8 in 2008, which is a 96% drop in frequency. I have displayed the CERES ISCCP-D2like cloud product Aqua-MODIS ice cloud frequency for cloud top pressures less than 180mb and optical depths greater than 60.36. (http://ceres-tool.larc.nasa.gov/ord-tool/jsp/ISCCP-D1Selection.jsp). These plots do not indicate any overwhelming sampling in 2007 and sparse sampling in the remaining years.



If I understand correctly, only MODIS pixels along the CloudSat/CALIPSO line of sight were used to identify DCC. No inter-annual comment over Africa can be made until there is sufficient sampling over the 4 years.

Figure 4d. Is the peak at 5-km for the TWP associated with the melting line in Figure 3C? Does this imply that there is more precipitation in the TWP Fig. 3 profile? If the attenuation is great enough that the surface reflection is missing, this implies precipitation. Is this a possible explanation? Would this suggest that the TWP contains more phases of the DCC life-cycle than over Africa or South America?

Sassen, K., S. Matrosov, and J. Campbell (2007), CloudSat spaceborne 94 GHz radar bright bands in the melting layer: An attenuation-driven upside-down lidar analog, Geophys. Res. Lett., 34, L16818, doi:10.1029/2007GL030291.

Page 2415 line 19. The word contamination is ambiguous, it could mean that there are optically thinner clouds above the DCC core. Does this term relate to “optically thinner convective/anvil-type clouds.”? Please clarify that the DCC identification thresholds were also allowing more optically thinner clouds to be classified as DCC. The word misidentified is more fitting.

Page 2413 line 18. Have the CloudSat collocations been parallax corrected when they were collocated with MODIS? Yang et al. also used CloudSat, CALIPSO and Aqua-MODIS coincident data to examine DCC.

Young, A. H., J. J. Bates, and J. A. Curry (2012), Complementary use of passive and active remote sensing for detection of penetrating convection from CloudSat, CALIPSO, and Aqua MODIS, J. Geophys. Res., 117, D13205, doi:10.1029/2011JD016749.

Wang et al. 2011, “Parallax correction in collocating CloudSat and Moderate Resolution Imaging Spectroradiometer (MODIS) observations: Method and application to convection study”, JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 116, D17201, doi:10.1029/2011JD016097, 2011.