General comment:

We would like to thank all three reviewers for their vey insightful comments. This study has been a humbling experience for the first author who has dedicated several years working on extracting scientific value out of the ARM facility radars and other sensors. A great challenge was to consolidate the differences between the ARM radars and generalized enough an algorithm initially developed by Alain Protat to work on a much larger dataset.

A project website has been developed and gives a graphical overview of the calibration procedure as applied to each site and radar system described in the manuscript. The web site is now available to the ARM radar user community. We hope to continue updating the material on the web site as the ARM program conducts additional field deployments. We also plan to expand our analysis to the European radar network.

http://doppler.somas.stonybrook.edu/CloudSat_GlobalCalibrator/index.html

Anonymous Referee #2

Received and published: 2 May 2019

The present manuscript describes the efforts of the Authors to calibrate a long series of ground-based radar measurements using space-borne radar measurements from CloudSat. This task is all the more important as it can affect the quality of atmospheric retrievals. Moreover, the calibration of such a long time series on a common ground helps greatly the study of the climate on such time scales. The article provides in-depth information into the operation and maintenance of the ARM radar network. As such, it makes publicly available information that otherwise would be known only to the few expert users/members of the ARM program. For that alone, this manuscript is worth publishing.

The Authors follow a clear path to describe their datasets, its quality control, and the methods to collocate and optimize the calibration assessment. Various graphs provide a nice illustration of the performance of the proposed method. Before publishing this article, these are the points I would like the Authors to address:

1. The article needs a serious editorial revision to correct for grammar errors and typos. In particular, the Authors should revise the tenses of the verbs for consistency.

We would like to thank the reviewer about his numerous comments regarding grammar errors and typos in the original manuscript. All the reviewer suggestions and those from the other two reviewers have been included in the revised manuscript. Furthermore, we revise the tense of the verbs when needed for consistency.

2. Please provide a table listing the various acronyms, and please define these acronyms in the article at their first occurrence.

All the acronyms in the text are now defined at their first occurrence.

3. As a general question, would the statistical method that you use (to match the mean profiles) work if you also match the envelope of the CFAD (lower and upper quantiles)? This envelope may have useful information, e.g. on the variability of the reflectivity profile over time or space.

We believe that the statistical method used here (RMSE of the mean profiles) will also work on other CFAD parameters such as the lower and upper quantiles.

4. Would the Authors see any merit/advantage in applying their optimal calibration method to other satellite datasets collocated with ARM radars? Could you please comment on this in your article?

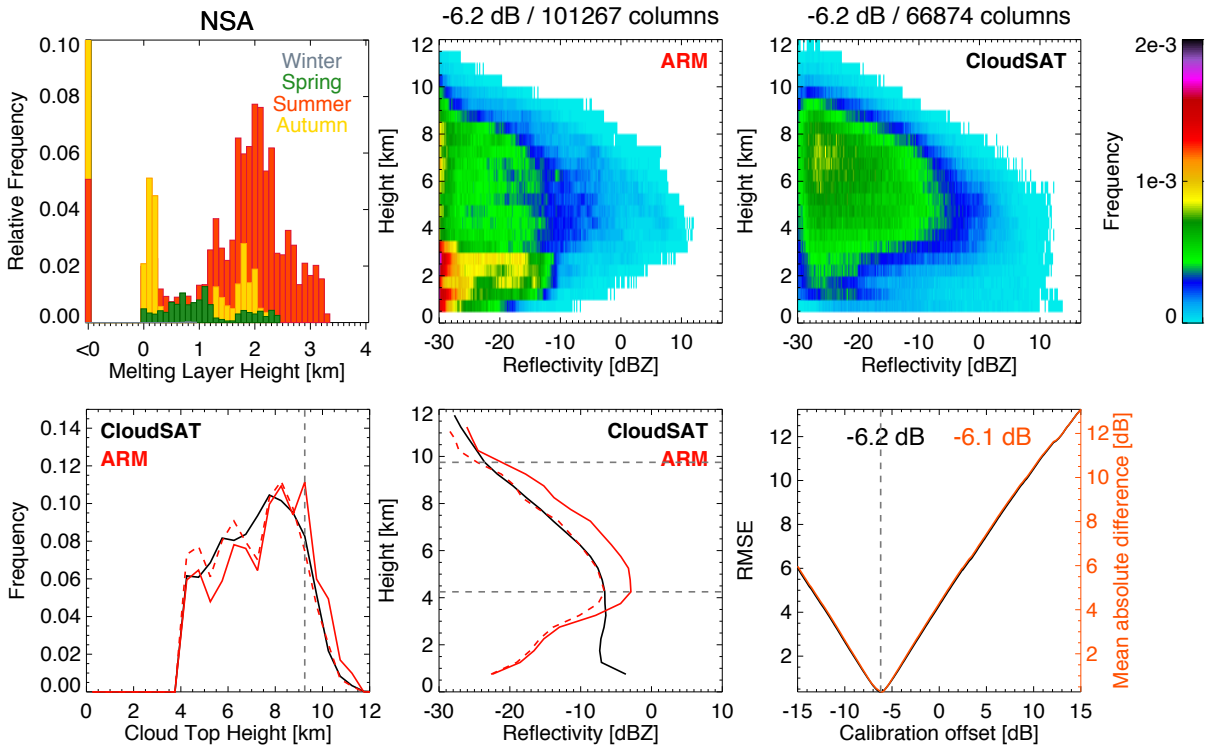
This is an interesting suggestion. Over the recent years, the ARM facility has acquired and operated several cm-wavelength radars that are also in need of calibration. One could see that observations from NASA's GPM Dual-Frequency Precipitation Radar could be used to evaluate the calibration of the ARM facility cm-wavelength radars. In addition to referencing radars, we believe there is great value in evaluating ARM observations against those provided by geostationary satellites (GOES-R, MSG) and the A-train. The following text was added in the revised manuscript at the end of the summary and discussion section:

"Furthermore, there is merit in extending the presented analysis to other satellite measurements. For example, NASA's Global Precipitation Mission (GPM) Dual-Frequency Precipitation Radar (DPR) observations could be used in a similar manner to evaluate the calibration of the ARM facility cm-wavelength radars [Lamer et al., 2019]. In addition to radar calibration, the statistical comparison between cloud and precipitation properties such as cloud base height, cloud thickness, precipitation occurrence and intensity and liquid water path measured at the ARM facility and those derived by research satellites such as NASA'S A-train constellation [Stephens et al., 2018] should be considered. The ARM facility provides a bottom-up view of clouds and precipitation with superior vertical resolution especially in the boundary layer. Statistically significant differences with the top-down view provided by the A-train satellites should be considered when conducting cloud-scale process studies using global satellite datasets."

Please also note the supplement to this comment: https://www.atmos-meas-tech-discuss.net/amt-2019-34/amt-2019-34-RC2- supplement.pdf

Thank you very much for annotated supplement!

Following the reviewer's recommendation Fig. 4 was updated


NSA
Winter
Spring
Summer
Autumn
Relative Frequency
Melting Layer Height [km]
-6.2 dB / 101267 columns
ARM
Height [km]
Reflectivity [dBZ]
-6.2 dB / 66874 columns
CloudSAT
Frequency
CloudSAT
ARM
Cloud Top Height [km]
Reflectivity [dBZ]
-6.2 dB
-6.1 dB
RMSE
Mean absolute difference [dB]
Calibration offset [dB]