Answers to Reviewer 2

We thank the reviewer for spending the time and effort to review our study. The comments are very constructive and helped to further improve the manuscript. In this document we reply to every reviewer's comment. The comments of the reviewer are marked in black and our replies in blue. In the revised document, all changes are marked in blue.

Line 142-143: Please rephrase the end of the sentence

We rephrase line 142-143 as follows:

„For this study, we accessed all airborne data via the ac3airborne module that, among other things, stores all links to the data (Mech et al., 2022)."

Line 432 : replace "ClaudSat" by "CloudSat"

We corrected the typo.

Figure 3: You could add the histogram with all data (separated by CWT)?

We added a fourth group of histograms to Figure 3 that consists of all data separated into the four CWT classes and an additional remark in the caption.

„Analyzed flight hours during the different Circulation Weather Types (CWTs) for each campaign and over all campaigns."

Figure 7 and lines 288-289: I suppose the 2 dB difference you mention between Z_{sim} and Z_C comes from a linear fitting ? I suggest you add it on the figure.

Thanks a lot for this suggestion, you are totally right. We added the linear fit to Figure 7 and an additional remark in the caption.

„Comparison of the equivalent radar reflectivity obtained from forward simulations Z_{sim} and CloudSat Z_C over four underflights of Polar 5 below CloudSat with the corresponding linear fit (black). The bin size equals 2 dBZ."

Line 410: what is the assumption of crystal habit for Z-S law in the 2C-Snow-Profile product? Please add a few details on this product to facilitate de further discussion on the differences.

We appreciate the comment of the Referee. The snowfall rate of the 2C-Snow-Profile product is not directly calculated with help of a specific Z_e-S relationship. Instead, snow size distribution parameters and their uncertainties are retrieved for radar bins that contain snow and snow-producing clouds via optimal estimation from which the snowfall rate is derived. Wood (2011) confirms that the results represents a range of scene-dependent Z_e-S relations. Radar reflectivity profiles of the '2B-Geoprof' product, temperatures from ECMWF-AUX, and a priori snow microphysical properties, radar scattering properties, and size distribution parameters serve as input (Wood et al., 2018). A priori microphysical parameters, scattering properties and their uncertainties are obtained from field campaign measurements that represent dry snow (Wood, 2011). Radar backscattering and extinction cross-sections are calculated with a dipole model for irregularly-shaped particles. The snowfall rate of the 2C-Snow-Profile product is then calculated from these retrieved snow size distribution parameters and uncertainties via optimal estimation as well. If the surface precipitation type is snow, the surface snowfall rate is estimated using the snow properties at the base of the snow layer which is at least inside the near-surface bin but not closer to ground due to ground clutter.

We added the following in line 411: "The snowfall rate of the 2C-Snow-Profile product is calculated for bins that contain snow or snow-producing clouds via optimal estimation from snow size distribution parameters and uncertainties that are obtained by optimal estimation as well (Wood and L'Ecuyer, 2018). To calculate these snow size distribution parameters, radar reflectivity profiles of the '2B-Geoprof' product, temperatures from ECMWF-AUX and a priori snow microphysical properties, radar scattering properties, and size distribution parameters are required as input. These microphysical parameters represent dry snow and the scattering properties hold for irregularly-shaped particles (Wood, 2011)."

Wood, N. B., 2011: Estimation of snow microphysical properties with application to millimeter-wavelength radar retrievals for snowfall rate. Ph.D. dissertation, Colorado State University, 248 pp. [Available from Colorado State University, Digital Collections, http://hdl.handle.net/10217/48170].

Wood, N. B. and T. S. L'Ecuyer, 2018: Level 2C Snow Profile Process Description and Interface Control Document, Product Version P1 R05. NASA JPL CloudSat project document revision 0., 26 pp. Available from [https://www.cloudsat.cira.colostate.edu/cloudsat-static/info/dl/2c-snow-profile/2C-SNOW-PROFILE_PDICD.P1_R05.rev0_.pdf].

Figure 12: I suggest adding the profile of S_M along that of $A_{M,norm}$.

We added the S_M profile to Figure 12 and the following sentence to the Figure caption:

„The profile of S_M with height is shown in the right column."

Moreover, we added a reference to Fig. 12 in line 428: „Over all campaigns, the total precipitation amount obtained from MiRAC (A_M) is 1.0 mm (S_M of 111 mm yr^{-1}) at 1.2 km and with 2.1 mm (S_M of 229 mm yr^{-1}) more than twice as much at 150 m (Fig. 12)."