Interactive comment on "How much snow falls in the world's mountains? A first look at mountain snowfall estimates in A-train observations and reanalyses" *by* Anne Sophie Daloz et al.

Anonymous Referee #1

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This paper discusses several assessments of snowfall accumulation in mountainous areas over the globe. Apart from one observational dataset (CloudSat), also several reanalyses datasets are considered. The paper is short and limited to giving an estimate of mountainous snowfall within the different datasets. Some short explanations for specific behavior are given. The methodology in the paper is rigor, but the results / conclusions are not very exciting or novel. I also question the relevance of the main conclusions of the paper.

My main comments:

- Mountainous precipitation or snowfall is very difficult to capture in models or reanaly-

sis. The precipitation scheme, orography, horizontal and vertical resolution and large-scale forcing all highly influence how precipitation develops and where precipitation is falling. The range of snowfall in the reanalyses is also extremely high (from 489 till 1891 mm (table 1)) which makes it almost impossible to state anything about 'how much snowfall is falling in the world's mountains' based on these datasets.

- The second research question the author's want to answer is 'what percentage of continental snow falls on mountainous regions?'. While reading the paper, I was wondering why this number matters? In the conclusions, the authors state that it is important for researchers who use snowfall estimates from reanalyses or observations, but I don't see how the 4-5% can help these researchers... The only conclusion I can draw from this analysis is that this percentage is similar in reanalysis and CloudSat, which states that the large-scale precipitation events are well captured in reanalyses, which is expected since these processes are assimilated herein. Is there another extra value of this result?

- Generally, I think the authors maybe have to rethink the scope of the paper. In my opinion, there are two options which are both already a bit discussed in the outlook of this paper. Option 1 would be to focus on CloudSat only, making advantage of the high-resolution product it offers and discuss in more detail mountainous or orographical snowfall by zooming in on specific features or large-scale processes and see how well these are captured by CloudSat. Option 2 would be to include other models (e.g. CMIP5?) and focus on the differences between these models in mountainous regions. This would also have a much higher impact and relevance for the scientific community.

Smaller comments:

- L76: This section deals about previous snowfall research using reanalyses. This section is very short compared to CloudSat. Has there been no more research on snowfall / precipitation in mountainous areas using reanalyses which could be added here?

- L166: The study of Maahn et al. (2014) is used to state that the height acquisition level of CloudSat has no huge influence on the ground precipitation estimate. However, this study focusses on polar regions. I think conditions might be very different for other mountainous regions. It is difficult to prove this of course for other regions without ground-based observations. Maybe add a line which refers to Grazioli et al. (2017) which gives a vertical profile of ERA-Interim precipitation compared to observations and clearly shows differences between both.

- Are any of the CloudSat observations assimilated in any of the reanalyses used? If this is the case, it should be noted and the results should be discussed with this in mind

- The discussion in section 4 is in my opinion a bit too short. Some results are discussed, but only a few times the behavior is explained and put in relation with the results of previous studies. For example, on line 275, it is stated that JRA-55 underestimates the intensity of snowfall. But what is the cause of this? Is JRA-55 not holding enough moisture? Is only snowfall underestimated? Are the number of events similar, but is there just too little precipitation? These are interesting features that are currently missing in the discussion, which might be retrieved from literature or small extra analyses. The same is true for line 285

- Figure 2/3: why is mm/month shown? Would mm/year not be more appropriate?

- Figure 4: the frequency of occurrence could maybe be replaced by events/year? This is more easy to understand by readers