

### **Referee #3**

“The authors implement a set of new parameterizations in the widely used SNICAR model to account for effects of snow grain shape and the mixing state of BC-snow. Then, they apply the updated SNICAR model with in-situ measurements of BC concentrations in the Tibetan Plateau snowpack to quantify the present-day snow albedo effects. Generally, the results are of great significance, and it’s a very interesting paper with well written, and the expression is clear. I suggest that this manuscript could be accepted with minor revisions.”

We thank the reviewer for his/her constructive comments and suggestions, which help to improve the manuscript. Below is a point-by-point response to the comments.

#### **Minor Comments:**

1. My major concern is that the historical snow sampling sites are very limited in the TP regions, and some of the sampling sites are only representative the high glacier regions. The author should be very careful to use the surface measurement to represent the regional averages. So I don’t think it is quite useful to divide the entire TP and surrounding areas into six subregions as shown in Figure 1 and Table 2.

Response: Thanks for the comments. We agree that the snow sampling sites are very limited over the TP and may not be representative for the entire TP region. This is why we have divided the entire TP domain into six smaller sub-regions for analysis. Within each sub-region, we found that BC concentrations show distinct altitudinal and seasonal variations. Thus, we have further divided each sub-region into high-/low-altitude areas and monsoon/non-monsoon seasons for analysis. As such, we tried to reduce the uncertainty from sample representativeness. Therefore, we believe that dividing the entire TP into smaller sub-regions is still useful. However, we do realize that even after dividing the sub-regions, the current observations in each sub-region are still limited, which may introduce uncertainty in the analysis and highlights an urgent need for more extensive measurements in the region. We have included these discussions in the manuscript (Lines 181–185) as follows:

*“We note that the current observations over the TP are still rather limited spatially and temporally, leading to questions of representativeness and introducing uncertainty in the analysis. Thus, the large sub-regional, altitudinal, and seasonal heterogeneity of BC concentrations in the TP snowpack highlights an urgent need for extensive measurements.”*

2. The conclusion is a little repetitive, which should be reconstructed.

Response: Thanks for the comments. We have re-organized and refined the conclusion section to better summarize and highlight the focus of this study (Lines 544–617). Please see the response to Reviewer #1, Comment #7 for details.