

This manuscript investigates the effects of slope on snow albedo measurements both theoretically and practically and provides different correction methods based on auxiliary data availability. The analysis is comprehensive. The flow is coherent. The language is concise. First, the introduction provides adequate background knowledge to inform and intrigue readers, including the importance of the topic, previous practices to mitigate this bias in measured snow albedo, and the potential obstacles. Next, the theoretical analysis is thorough and clear. The authors break down this complicated problem into well-considered aspects in a well-paced manner. The mathematical forms are clear. So are their physical meanings. Last, the application is practical. The authors elaborate when and how to apply their methods and discuss in-depth the caveats caused by some of the assumptions. Researchers working on snow albedo and surface energy budget would benefit greatly from this manuscript. I suggest “minor revision”.

We thank the reviewer for these general, supportive, comments. We have taken into account all the detailed corrections listed below, almost as proposed.

Please see my comments below.

1, Page 1 Line 5: “Here we investigate...”

At this point, the significance of the topic is not clear yet. The statement of “what we did” would appear immature. Like what Dr. Joshua Schimel said, “you try to give me a solution when I do not know I have a problem”. Since broad vs spectral albedo is not the No.1 priority of this manuscript, I suggest emphasizing the effects of slope on albedo in the first few sentences instead.

The beginning of the abstract is reformulated in a more symmetrical way. However, we kept the mention of spectral albedo in the objective: “Here we investigate the sensitivity of spectral albedo measurements to surface slope”, because even though the theory is not spectral, the corrections and the examples are most relevant for spectral only. The application of the correction to broadband albedo would require significant changes.

2, Page 2 Line 13: Section 5 → Section 5 and 6

done

3, Page 2 Line 23, Both → Both surfaces

Done

4, Figure 1a, correct me if I am wrong, should $\theta_i \rightarrow \theta_n$. Please see my drawing in the figure below

The figure is indeed incorrect. It is now corrected.

5, Figure 1b, I suggest making the periphery of the horizontal hemisphere as dashed lines to prevent from confusing with “horizontal neighborhood plane”.

Done

6, Section 2.2, will sensor viewing angles make a difference in upwelling and downwelling radiation on sensors (eg, 160° rather than 180°)?

The sensors not being perfect, i.e. they have a reduced field of view or they do not have a perfect cosine response, implies that an “instrumental response” function should be added and it would be very difficult to track the equations. We have added a sentence in the beginning of Section 2.2 to make our assumption of perfect sensors explicit: “The upward and downward looking sensors are considered to be horizontal and to have a perfect cosine response with a 180° field of view.”

7, Page 7 Line 8, A first case → The first case

Done

8, Page 8 Line 17, INSERT TABLE 1 HERE. I believe these will be deleted in the final version?

Yes, this is to help the editor in positioning the table.

9, Table 1: Please highlight the first row and column (including the dividers) to make it clearer.

That would be better but we have followed the template provided by The Cryosphere. We will contact the editor to discuss how this can be improved.

10, Page 11 Line 7, would you please inform us during which months these data were measured?

The information is added.

11, Page 11 Line 9/20, Solab or Solalb?

Solalb, we have corrected.

12, Figure 3

- 1) Legend missing
- 2) Please use a different line style to separate North and South (different from the “small slope”)
- 3) y-axis, how about using “albedo change by slope” (Apparent albedo minus 0.8) which will make the effects of slopes clearer?
- 4) I suggest moving panel titles to left-aligned or inside the panels. Otherwise, titles of the second row look like x-axis labels of the first row.

We have applied the suggested changes 2, 3 and 4. Regarding point 1, we understand “legend missing” as to repeat the legend box in the four panels. We have tried, but this results in an overload of the graphs for a weak benefit.

13, Page 12 Line 8-9, “Neglecting ...”

This sentence involves too many numbers. Please break it down. One way to do it is to summarize the idea here (a revised form of the next sentence would do) and mention these numbers as you describe each SZA below.

We have split the sentence.

14, Page 12 Line 19, remove “which is very large”
done.

15, Page 12 Line 19, lowest → smallest

16, Page 12 Line 20-22, the active sense and the use of “observed” and “measurements” make it confusing whether this is theoretical analysis or not.

Suggestion: Incoming radiation at the downward-looking sensor has a deficit ...

Use “estimate” or “calculate” instead of “observe” and “measure” here.

We have reformulated the two sentences, using “position” to indicate where the sensors is, thus avoiding the word “measurement”. Observed is replaced by estimated.

17, Page 12 Line 25, how about a figure same as Figure 3 but for diffuse radiation in the supplement? Or a more quantitative description here.

The information is already in Fig 3. To point the reader to the figure again, we have added a reference to the bottom right panel, because it is true that the last reference to the figure was high above in the text.

18, Page 13 Line 32, Fig. 4 → Fig. 4) (missing the right parenthesis)

Done.

19, Page 14 Line 18, simulated → calculated Please keep it consistent. There are already enough types of albedo here.

Done.

20, Page 15 Line 15, please break down this long sentence.

Done.

21, Page 15 Line 23-25, “The correction method ...” → “This method yields better results than that with the measured slope parameters”

Done.

22, Page 15 Line 26, suspect → suspicious? spurious? false?
Or state the problem directly, eg, too flat?

We have use “seems too flat”.

23, Page 19 Line 32, increased → excessive; decreased → deficient

We have reformulated using “change” since “excessive” or “deficient” are not neutral.

23, Page 19 Line 32, “additional illumination ...” → “the upward and downward-looking sensors affected by additional illumination coming from ...”
“Illumination” and “coming from” were too far away.

Done.