

General assessment ===

In this manuscript, Picard et al. describe various correction procedures for broadband and spectral albedo measurements performed over sloping surfaces. Out of many possible assumptions and simplifications, they opt for a theoretical treatment differentiated by surface conditions of the horizontal far-field (dark or snow-covered) and location of the observation platform (mid-slope or near the top of the slope). This yields a matrix of 4 possible correction procedures. Several practical recipes are provided for slope corrections, depending on the available information (e.g. slope parameters, time series, etc.). The combination of rigorous theoretical approach and practical applicability makes this a very useful and accessible text for anyone involved in observations of (spectral) albedo in sloping terrain.

I recommend publication of this article in The Cryosphere following only textual improvements detailed below.

We thank the reviewer for the general analysis of our paper and the detailed comments.

comment

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P1L4 properties -> processes

We have removed this sentence based on RC1 comments. In any case, we do agree with the proposition.

P1L8 appointment -> partitioning

Done.

P1L20 barely invisible -> barely visible or almost invisible

We have changed to “almost invisible”.

P2L5 such as -> such that

Done.

P2L7: an -> the

Done.

P2L20: I understand that this is a sensitive remark, but Pirazzini (2004) is an appropriate example of a publication where slope effects are mistakenly interpreted as a diurnal change of snow properties, so this could be cited here.

The short answer: It is a legitimate and interesting remark in an open discussion journal. For the final version of the scientific paper, however, we can only claim that there is a mistake if we can prove it. This would require to reanalyze the data, and most probably to know the actual slope under the sensor, which is not possible anymore. Furthermore the 2004 paper was about broadband, which is not cover in the present paper. The lack of direct/diffuse partitioning would prevent anyway to conclude.

The long answer by the author of the study (Pirazzini, 2004):

The interpretation of the diurnal cycle of broadband albedo in the 2004 paper was given after ruling out other possible explanations, starting from the slope of the surface. The surfaces under the sensors located at Neumayer and Hells Gate were as much horizontal as a natural surface can be. After the publication of the paper, AWI colleagues were surprised by my results and analysed other data from Neumayer. They have visited the site several times, and confirmed that there are no persistent sastrugi, and that the diurnal behaviour that I saw in two selected clear-sky days is common also in periods that I did not analyse. They finally agreed on (or did not oppose to) my conclusions that the most reasonable explanation for the observed diurnal cycle is that snow metamorphism dominated over the solar zenith angle effect in summer.

In the case of Dome C I had less data and less information on the site, so my interpretation was based on the visual observations made by the colleagues from CNR who collected the measurements, and on the similarity with the diurnal cycle observed also in other snow covered Arctic sites (not presented in the paper).

Anyhow, whatever is the case for Dome C, the conclusions in the paper hold for Neumayer and Hells Gate, and the effect of sastrugi is demonstrated through the observations taken at Reeves Névé before and after the rotation of the horizontal arm holding the pyranometers. So, I consider the present reference to the 2004 paper very appropriate: “the local slope in the footprint can be significant because of sastrugi or dunes (Grenfell et al., 1994; Warren et al., 1998; Pirazzini, 2004; Wang and Zender, 2010)”, but I disagree with using this reference for the preceding sentence.

P2L25 insert comma after "Similarly"

Done.

P2L30 Suggest "Such an accuracy cannot be achieved in practice, because the measurement"

Done.

P3L11: algea -> algae

Done.

P4L3: I understand what you want to say here, but as it is formulated, it is not correct. Suggest "and to this end, analytical formulations using simplifying assumptions are preferred at the cost of model complexity."

We have changed to “ and to this end, analytical formulations using simplifying assumptions are preferred over complex models”.

P5 and further: I would like you to make sure that you mean to write \dot{E} instead of E' (similarly with θ_0 instead of θ')

Yes. Although it is an unusual symbol, it represents a tilted terrain. A longer line, with constant width would be better but does not exist.

P6L2: titled -> tilted

Done.

P6L11: an horizontal -> a horizontal

Done.

P6L11 and L13: cover -> surface type

Done.

P7L15: slightly slopes -> small slopes or gentle slopes

We have changed to “Small slopes”.

P7L20: perhaps this is a good place to reiterate once more the meaning of the abbreviations: D and S for dark and snow, and M and T for mid-slope and top measurements.

Done.

P8L19: moderately -> moderate

P12L25: Suggest "The slope effect is largest under direct illumination, which occurs most in the near-infrared domain under clear-sky conditions."

Corrected, as proposed.

P13L7: superficial -> near-surface (also P16L9)

Done.

P14L1: slopes -> slope

Done.

P14L19: at last -> lastly

Done.

P14L33: perhaps this is a good place to insert the possibility of

We have added: “UAV and laser scanners are possible tools to acquire accurate snow digital surface model in a non-invasive way.”

P16L13: variable -> mixed

Done.

P18L20: systematically -> systematical

We have completely removed the word.

Figure 3: suggest to discriminate more between blue and gray

We have added crosses for the small slope calculation.