

Interactive comment on “UV albedo of arctic snow in spring” by O. Meinander et al.

Anonymous Referee #2

Received and published: 9 April 2008

General comments

The article ‘UV albedo of Arctic snow in spring’ shows new and important results of measurements of Arctic UV albedo in various snow conditions. The snow cover is changing constantly during one season. During the accumulation period the UV albedo was determined to be slightly higher (0.6–0.8) than during melting (0.5–0.7). Further a diurnal feature in the snow albedo was detected, which was attributed to changing snow conditions after midday.

The measurements described here were performed very carefully. The radiation detectors used for the study have been thoroughly calibrated and were maintained carefully during the experiment. Besides the radiation data ancillary parameters such the snow grain size and liquid water content have been included to explain the obtained results. This combination of parameters is seen very rarely in studies on experimentally de-

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terminated UV albedo, and it is certainly necessary to underline and understand the complexity of the results.

Experimental studies like this one are fundamental and should be encouraged because they provide the essential data for various applications such as validation exercises for satellite based data and radiative transfer models and enable interdisciplinary work for example with biologists and geographers who need such data.

The description of the experiment and the analysis is very clear. There is one comment concerning the structure: Please insert a separate section on the conclusions. The discussion section is quite long. It could be more concise. The conclusions drawn need to be emphasised in an own and separate section. Most of the figures need to be revised, which is described in detail in the following section.

Specific comments

In Section 3.2 you mention that the springthaw occurs on julian day 56 and you refer to Figure 7. In my opinion the springthaw occurs on day 66. On this day the maximum air temperatures change from negative to positive values.

Section 3.3, page 4164, line 22: You write: temperature, snow depth and time. What do you mean by time? The time during the day or the time during the season or experiment?

Equations 3 and 4: Have you also measured the UV albedo in the spring of 2008? How does this empirical formular hold for other years?

Last paragraph of Section 3.3: You say that there were occasionally days with maximum air temperature above 0°C before the springthaw and name the 26 and 29 March. Are these days are after the springthaw?

It would be very informative to mention the exact time of solar noon at your measurement site! Maybe in Section 4 or in Table 1?

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Page 4169, line 6: diurnal decrease in snow depth or in albedo after midday?

The first point in your discussion is to explain that the weighted UVB albedo is important for biological studies. This is one of the motivations for measuring the UV albedo and you already mention the biological applications (i.e. snow blindness) in the introduction. In my opinion it is not necessary to repeat this motivation in the discussion. I would suggest deleting the first sentence of Section 5.

On page 4173 around line 20 you argue the diurnal decline in albedo was observed later in the afternoon in the Antarctic in other studies. You try to explain this with a bigger irradiance amount and a higher temperature in the Arctic. Do you really think the amount of irradiance is higher in the Arctic? In both polar regions the midday SZA is rather large, but in the Antarctic the snow is cleaner, the air contains less aerosols and the (snow) albedo is larger because now other objects such as trees or rocks decrease the overall snow albedo. Thus the downwelling irradiance is enhanced more in the Antarctic. All these arguments would lead to the conclusion that the amount of irradiance is higher in the Antarctic than in the Arctic. Additionally, maximum temperatures above 0°C can also occur in coastal Antarctic regions. Could you comment on this?

On page 4175 you mention different snow classes. Could you give a reference where the different snow classes are defined and explained?

Table 4: It would be good to add a column with the Julian day, because in the Figures you use the Julian day often as time line, so it will be easier to find the right day in the table. And in the column on cloudiness, please use 'overcast' instead of 'full cloudy'.

Figure 5: There are two grids underneath the snow flakes. Which one is the 1 mm-grid?

Figure 6: Around day 10, there is now data, or the snow depth is zero. I would suggest you omit the connecting lines between each data point. This Figure might not be necessary because the snow depth for the relevant time period is shown in Figure 8 as well. Could you omit this Figure completely?

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Figure 7: The x- and y-axis labels are missing. Please add.

Figure 8: The y-axis label is missing. Please add. By just looking at the graph it is not clear, which line/symbol represents the snow depth and which one the grain size. Please add a legend.

Figures 9 and 10: Please add a legend so it becomes clear which symbol refer to which parameter.

Figure 11: It is possible put the time in UTC in the x-axis? And please add a legend.

Figure 12: Is the albedo as calculated by Equation 4 or the measured albedo shown? And could you please add a legend?

Figure 13: If you want to show this figure, you need to explain it more in the text. Why is the albedo larger than 1 with values up to 1.5? x- and y-axis labels are missing. The headings are not uniform, e.g. in the lower left panel: What is 'snow UV Sodankylä'? Please revise them.

Technical corrections

Page 4158, line 18: insert a space between UV and Biometer

Page 4159, line 7: delete radiometer

Page 4161, line 11: subsequent

Page 4162, line 14: insert a space between A and for

Page 4162, line 19; page 4166, line 1; page 4170, line 16: insert ° or degree

Page 4163, line 13: regularly

Page 4165, lines 4 and 6: °C instead of Celsius and degrees

Page 4165, line 15: delete conditions

Page 4166, line 11; page 4167, line 4 and line 10: put and instead of -

Page 4166, line 12: insert the (-cases of the melt-)

Page 4166, line 16: put to instead of -

Page 4167, line 7/8 and line 14: metamorphosis

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Page 4168, lines 12/13: word order: -two days on which the maximum snow-in the surface layer was measured.

Page 4168, line 20: insert in the before cases

Page 4170, line 16: SZA

Page 4172, line 5: experience

Page 4173, line 10: anticorrelate

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