

Interactive comment on “Glacial debris cover and melt water production for glaciers in the Altay, Russia” by C. Mayer et al.

Anonymous Referee #1

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This is an easily readable paper to which I have only a few comments.

The effect of a thin debris layer to increase melting as indicated by Figure 5 is rather small in my opinion. The maximum effect is $\sim 10\%$ increase for ~ 1 cm thick debris compared with clear ice. I don't have a good reference but I would have expected (much) higher values for thin debris that is as an average only a mm or even less in thickness (this is based on my experience and the experience of colleagues with variation of calibrated degree-day factors in ablation areas with and without volcanic debris in the ice). Maybe the authors could comment on this in the final version of the paper.

On page 412 near the top it is described that the melt model underestimates snow melt in year 2003 and it is stated that a higher degree-day factor is need to model the melting

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during this year. The reason for this is not clear. This year is then excluded from the analysis. This is not a good reason to exclude an apparently good data point. Why not just keep this data point and accept the higher errors? If no reason for the higher error in year 2003 is found, it seems that the error is higher than obtain only from the years 2000 to 2002 when the model fits the observation better.

The reference "Knap and Reijmer, 1998" on p. 412 is missing in the list of references.

I don't understand the argument presented near the top of page 413: "because the temperature of melting ice is limited to 0°C and higher radiation amounts cannot be fully exploited". Radiation absorbed by a melting ice surface is used for melting and I do not see how the temperature of 0°C limits the amount of absorbed radiation energy. Following this it is stated that: "In the case of sub-debris melt, the debris surface temperatures can reach rather high values; thus we estimate the effect of the enhanced radiation on ice melt to be about 90% in this case." It is true that higher surface temperature increases conduction of heat into the lower debris layers and underlying ice and thereby increases melt. However, the higher surface temperatures also lead to a greater loss of heat to the surroundings by greater longwave radiation from the surface and greater heat conduction to the surrounding air so it is not obvious why a greater radiation should be more effectively used for melting for debris-covered ice compared with clear ice from these arguments. A greater albedo of the ice is, however, a valid argument for a less effective use of additional radiation energy for melting.

In table 1, the interval 1996-2008 in the heading of the 6th column should be 1966-2008.

The English language could be improved in many places.

Interactive comment on The Cryosphere Discuss., 5, 401, 2011.

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