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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effective UV surface albedo of seasonally snow-covered lands" *by* A. Tanskanen and T. Manninen

A. Tanskanen and T. Manninen

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We thank the reviewers for their valuable comments and suggestions.

The main reason for us to write the paper was to report that the saturation level of the surface UV albedo of the snow covered terrain depends strongly on the land cover type. Although this finding can be considered self evident, previous publications on surface UV albedo and snow have mainly emphasized the importance of the snow depth and snow age on surface albedo. Our results are not alone sufficient for construction of a realistic surface albedo model, but we wish that they give other research groups some insight on what is required from such a model. We believe that many applications would benefit from a more accurate surface UV albedo data. Hopefully, future satellite instruments and their combined use will complete the picture.

Referee #1: "the description of the method is very brief".

We consider the description of methods adequate. The description of the moving time-window method is very brief, but we refer to an earlier publication that includes a detailed method description.

Referee #1: "the number of the test sites is rather small".

We agree that, because of the coarse resolution of the TOMS data, for some land cover types, the number of test sites is insufficient for representative results. New satellite data with improved spatial resolution as well as new databases of land cover use will likely offer possibilities for refined studies.

Referee #1: "Croplands have a different behaviour than other surfaces (figure 3). If one looks at the map (figure 1) it appears that these croplands are mostly located at lower latitudes(warmer countries) than the other lands, and in somewhat populated areas. Could it be possible to relate this behaviour to the type of snow: smaller depth, small scale variations of snow cover, variable pollution of the snow ?"

There are several possible explanations for the unexpected behaviour of the surface albedo of snow covered croplands. Firstly, it should be noted that croplands land cover class includes a wide range of subclasses, which are all subject to anthropogenic manipulation. Secondly, because most of the croplands are found at lower latitudes, the number of the homogeneous test sites was small and the selected sites may represent only a subset of the land cover type. Thirdly, the algorithms used for determination of the snow cover as well as surface albedo produce occasionally faulty data mainly due to cloud cover, which prevents from drawing strong conclusions. In addition, the pollution of snow surface is an extremely difficult topic, since also remote pollution is common. For example, sand of Sahara has been found on snow surface in latitudes of 65 degrees.

Referee #2: "...in addition to land cover type, other factors such as snow depth, soil

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moisture and quality affect the surface albedo, and that vegetation covers of the same type are not homogeneous in practice."

We consider these all important remarks, and agree that they should be taken into account in further research. The paper includes a reference to a study on the effect of snow depth on surface UV albedo by Arola et al., [2003]. The International Geosphere-Biosphere Programme has defined a new land cover scheme that includes more land cover classes than the data that we used in our study. Additionally, the density of the vegetation could possibly be taken into account by using for example Leaf-Area-Index or some other satellite data to divide the land cover types in further subclasses.

Referee #2: "One possible improvement would be to demonstrate the effectiveness of the algorithm by comparing the results with ground-based measurements of UV in various snow covered locations with and without the proposed correction. Perhaps that will be the subject of a follow-up study, but even some broad statement here about its importance for retrieved UV would be useful."

We agree that satellite-based estimation of the surface UV benefits from improved surface albedo data. However, as discussed earlier, this paper does not present a complete surface albedo model.

All the specific typing and wording related comments are being adopted.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 2873, 2007.