

Interactive comment on “ESCIMO.spread – a spreadsheet-based point snow surface energy balance model to calculate hourly snow water equivalent and melt rates for historical and changing climate conditions” by U. Strasser and T. Marke

Anonymous Referee #1

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The paper presents a spreadsheet version of the ESCIMO snow surface model, whose formulas were explained in several publications before as cited by the authors. The new idea is a version which is easily portable and runs particularly fast for applications in education and in the field. Good measures of accuracy are obtained for a temporal resolution of one week. Additionally, the easy handling enables the estimation of the impact of potential future climate changes on snow cover.

C162

The clear structure and language of the paper supports the understanding. All formulas are explained in detail; concise symbols with values and units are correctly defined and used. The figures are clear with the exception of figure 2 (see specific comments below).

The model performance, as shown by several cited publications, supports the application in education as proposed by the authors. The possibility to see changes in parameters in a kind of white-box model is especially relevant for student courses. On contrary, the advantages for field work are not described clearly. What is the main advantage of the model application in the field? During a field trip, measurements can be carried out; at weather stations often snow height or water equivalent is observed, too. Consequently, these data provide sufficient information, particularly when considering the mentioned model accuracy of one week. Additionally, parameter optimizations in the model, where needed, or more detailed simulations should be carried out with a model version containing more details as for example the iterative routine for calculating surface temperature for air temperatures below 273.15 K, as described in Strasser (2008).

The option of simulating climate change impacts on the snow cover in changing air temperature and precipitation is an interesting tool. Nevertheless, the description of the modifications requires more details (p. 634). Is the temperature increase simulated uniformly over the year? Is there a way to differentiate between the seasons? What exactly happens in shifting precipitation from summer to winter? Furthermore, the question raises, if such a simple climate change simulation tool should be applied in education. Is there a risk to give a wrong impression of climate change impacts in uniformly (if this is the case) modifying the temperature? Despite a temperature increase, winters with a large amount of snowfall still can happen in the future, although they might be rare. The tool offers a lot of options, but it should be applied carefully in education.

Finally, the model validation is done at the Kühroint station. This seems to be too few.

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Although it is referred to a variety of studies, a validation of the spreadsheet model at another place with different climatic conditions would improve the validation chapter. What is the model performance at places with frequent changes of snow coverage and melt out in river valleys, for example?

Specific comments: p. 630, ln.8: Melting point of water at 273.15 K -> please check manuscript

p. 631, ln. 15 et sqq.: Missing citations for parameterization of sensible and latent heat fluxes (eq. 4 and 5) after Kuchment, L. S. and Gelfan A. N. (1996): The determination of the snowmelt rate and the meltwater outflow from a snowpack for modeling river runoff generation Journal of Hydrology, Vol. 179, pp. 23-36.

p. 632, ln. 23: Mauser and Bach 2008 can not be found in the references -> 2009?

p. 633: for Prasch et al. (2008) two references -> which is referred to?

p. 634, ln. 1: DANUBIA is explained in cited publications, but not DANUBIA-Light -> please give an explanation

p. 634, ln. 24 et sqq.: please give more details for the description of the modifications to simulate climate change impacts on the snow cover

pp. 634 and 646: Fig. 2 hardly readable -> please revise; column explanations are detailed but not relevant for the paper since the mentioned columns are not shown in the figures; maybe this would be better as additional material together with the spreadsheet model

Interactive comment on Geosci. Model Dev. Discuss., 3, 627, 2010.