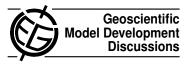
Geosci. Model Dev. Discuss., 3, C231–C235, 2010 www.geosci-model-dev-discuss.net/3/C231/2010/ © Author(s) 2010. This work is distributed under the Creative Commons Attribute 3.0 License.



## 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

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Comment: We actually do consider Fig. 2 worth being in the paper, since the spread-

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sheet itself is a significant part of the paper (it is available for free from the authors) and we have improved the figure quality. The column explanations are not meant to be identified in the figure, but to help to navigate in the spreadsheet file. We have attached the latter to be loaded up on the GMD server.

Comment: Please see changes in publication text, we have modified the manuscript accordingly.

Comment: Here seems to be a misunderstanding. The validation on a (nearly) weekly time basis results from the frequency of snow water equivalent (swe) pit samples taken in the field and does not correspond to model accuracy.

Comment: The presented model is designed as a performant, easy to use tool that substitutes computational expensive iterations and detailed descriptions of physical processes e.g. by common bulk formulations. A comparison of results achieved using these simplified approaches to more complex process descriptions has been carried out by Strasser (2008, p. 61). The results of this comparison indicate a comparably good model performance even under the given restrictions of limited detail in the process description. Including iterative approaches in the spreadsheet version would strongly limit the usability with different spreadsheet programs as the functional imple-

mentation of iterative algorithms is different and incompatible.

Comment: Details on the description of climate change parameter modifications have been added to the publication. The effect of potential changes in temperature and precipitation on the snow conditions are shown by the example of two scenario simulations for the Kuehroint site in the Nationalpark Berchtesgaden in the paper. As the effect of climate change depends on the defined parameter values as well as on the meteorological recordings setting the data basis for climate change modifications, future users of the model are highly encouraged to conduct own studies in order to analyze climate change effects on the snow conditions under different scenario conditions and at other sites. Of course we agree that the climate change modifications in ESCIMO.spread strongly simplify the complex meteorological processes and interactions involved. Still, this pragmatic approach allows to deal with climate change related questions e.g. in how far the effect of rising air temperatures on the snow conditions might be compensated by an increase in winter precipitation - if it falls as snow. Alternatives to our approach can be found in the utilization of climate model simulations including a subsequent downscaling of the data, both are connected to immense computational effort and suffer limited regional transferability. From our point of view, there is no question

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that the model can and should be used in education as it is the responsibility of the teacher to guarantee a reasonable interpretation of the methods and results.

Comment: This is a very valuable suggestion. In fact, the model has been applied and validated in it's FORTRAN version at middle elevation temperate, high elevation temperate, eastern US and arctic sites in the framework of the Snow Models Intercomparison Project (SnowMIP) (http://gaim.unh.edu/Structure/Future/MIPs/SnowMIP.html). The results of the project indicate that the model is capable of simulating local snow conditions under a variety of of climatological and environmental boundary conditions. This information has been added to the publication text (please see changes in the manuscript).

Comment: The melting point of water has been formulated as 273.16 K to assure consistency with the FORTRAN version of the ESCIMO model. Note that this parameter can easily be adjusted in the spreadsheet.

Comment: Thank you very much, we have forgotten to add citations here. This has been corrected in the text (please see changes in the manuscript).

Comment: You are right, this has to be 2009. We have corrected this issue in the text (please see changes in the manuscript).

Comment: You are right here again, there are two publications that are now clearly distinguished (please see changes in the manuscript).

Comment: DANUBIA-Light is the FORTRAN version of DANUBIA. As ESCIMO is implemented in DANUBIA and DANUBIA-Light, we avoid the confusion by only using one term "DANUBIA" (please see changes in the manuscript).

Comment: Details on the description of climate change parameter modifications have been added to the publication (please see changes in the manuscript).

much for all your valuable comments and suggestions for further improving our manuscript! Your endeavours are highly appreciated!

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

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