Geosci. Model Dev. Discuss., 8, C2255–C2256, 2015
www.geosci-model-dev-discuss.net/8/C2255/2015/

Geoscientific Model Development Discussions

Interactive comment on "A Factorial Snowpack Model (FSM 1.0)" *by* R. Essery

Anonymous Referee #1

Received and published: 29 September 2015

1.General comments

This manuscript describes a model for the coupled mass and energy balance of snow. While such models exist in different levels of complexity in many applications (e.g. numerical weather prediction, climate modeling, hydrological models, ecological models, etc. . .) this manuscript presents the model development in detail using a robust conceptual construction. This is a novel approach and allows for a clear identification of the assumptions used. Furthermore, several levels of complexity for different processes were included in the model, and are all interchangeable. The model was tested over one winter at an alpine location and an example of the potential of the model construction is illustrated by comparing the influence of each particular process.

The model code is open source and can be accessed in github. I tried to use the code, and the installation and examples provided ran successfully without any particu-

lar configuration. The source code is well organized and documented. Resuming, this manuscript presents a clear conceptual construction and implementation of a snow model providing an excellent example of open-source model development that can be used and further developed for several applications. The manuscript is well organized and the model formulation is also clear and concise. Therefore I recommend the manuscript to be accepted.

2. Specific comments

Albedo (section 2.3.1): The albedo formulation accounts for the effects of patchy snow using snow cover fraction (eq. 13) to weight the snow and the snow-free surface albedo (eq. 12). This formulation introduces a positive feedback while trying to address subgrid-scale variability. While this is a common method used in many models, this approach does not seem to be in line with the conceptual model presented in section 2.1 that does not accounts for subgrid-scale variability (e.g. Fig. 1 & Fig. 2 diagrams). I suggest to add some explanation for taking this decision, and to highlight that this approach accounts for subgrid-scale variability.

Runoff results in fig. 4 & 5: I suggest to plot the runoff accumulated in time. This will filter the high temporal variability, and also provide an integrated view of the runoff timing which is very important in hydrological applications.

Interactive comment on Geosci. Model Dev. Discuss., 8, 6583, 2015.