

## ***Interactive comment on “Solving Richards Equation for snow improves snowpack meltwater runoff estimations” by N. Wever et al.***

**Anonymous Referee #2**

Received and published: 21 October 2013

The manuscript does provide a research result on a relevant topic for the field of cold climate hydrology. There is obviously a lot of work that went into the data acquisition, data analysis, and modeling. However, the authors do not do that well at providing a sound basis for many of their arguments about the comparisons of the models to the acquired field data. Too often they 'brush off' the differences between measured and modelled results as being due to measurement error without even documenting clearly that measurement errors were occurring. Is the reader to assume that when the comparison between measured and modelled results are good that the measurement errors are insignificant, while when the differences are large then the measurement errors are also large? That seems to be the case in their presentation.

The characteristics of the models are not that well presented. It would be better if some

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comparisons between model results were made using some synthetic conditions rather than trying to model field conditions. That way one could try to explain the differences between model results based on well-founded physical principles (and approximations) rather than based on shortcomings of measurements. This might make the manuscript longer, but either that or the authors need to publish a separate manuscript where such a comparison is made.

The authors focus on the water flow and phase change part of the models, but they do not explain anything about the energy balance part. How is the heat transport handled, and how is the radiation balance handled?

The authors seem to not account for the model, SHAW, which is a fairly complete model that accounts for soil freezing, snow water balance, etc.

The title of the paper gives the reader the idea that using Richards equation in the modeling does lead to improvements in the comparisons between the model and the measurements. However, the reasons for this apparent improvement are not articulated in any convincing way. As mentioned above, a separate analysis comparing model features on synthetic conditions would help to clarify why there are differences in model response.

Detailed comments are also given in a marked up manuscript sent along with this review.

Please also note the supplement to this comment:

<http://www.the-cryosphere-discuss.net/7/C2122/2013/tcd-7-C2122-2013-supplement.pdf>

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Interactive comment on The Cryosphere Discuss., 7, 2373, 2013.

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