Hydrol. Earth Syst. Sci. Discuss., 7, C4270–C4272, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C4270/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Simulation of high mountainous discharge: how much information do we need?" *by* B. Schaefli and M. Huss

Anonymous Referee #1

Received and published: 18 December 2010

This manuscript presents an interesting study on the issue of the value of different kinds of information in hydrological models. As the authors rightly state, this issue is of especially importance in catchments with glaciers as here the water balance constrain does not apply. The manuscript addresses two issues, one is the model development based on different types of data, the other is the question how much data is needed for parameterization. The title is a bit misleading, as it emphasizes the latter question, whereas the manuscript rather focuses on the first issue. The authors did not fully address the question how much data is needed by using, for instance, different lengths of runoff/balance data).

The general finding, that catchment models in glacial catchments can be quite wrong

despite producing reasonable runoff is not really new and has been stated several times before (including previous work by the authors). The model developments are reasonable and the use of the data to guide the development is a valuable approach. However, the model remains a bit (too?) simple even in the end, most importantly snow is not being transferred into firn/ice.

The lack of more detailed analyses on the value of different amounts of data is a bit disappointing (especially with the title in mind). I would strongly recommend strengthening the manuscript by a more systematic investigation of the effect of using different amounts of data. This would allow to come to more interesting conclusions (most of the current conclusions are no really surprising, are they?).

The manuscript would also benefit from a number of improvements as suggested below.

Model description (2.2) Eq 1 of course only applies to the glacier portion of the catchment, please clarify. Please also describe the rest of the model, the parameters of the groundwater routine later 'pop up' without being mentioned before here Why is the transformation of snow to firn and ice not simulated? I would argue that this is crucial for both the mass balance and the correct simulation of snow respective ice melt

Section 2.3 In the last sentence you state that annual discharge has been used to validate estimates for precip, but how can you do this in a catchment with a glacier where

Equations:

Equation 4: In the Nash-Sutcliffe value Q bar refers to the observed mean annual discharge. This value should not be a function of the parameter set Equation 5: it seems a bit unnecessary to first define the NS-value as 1-SSE/var and then f as 1-NS=1-1+SSE/var=SSE/var. I would suggest to omit Eq 5 and to define f directly in Eq 4 as SSE/var (you still can mention that this is directly related to NS) (minor comment: the

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explanation in parantheses, p8674, line 3-4, is not needed and actually more confusing than helping) Equation 6: here some form of normalization seems to be missing. At least I would expect to divide by the number of years. Looking on the values in the figures I assume the sum of mass balance errors must have been divided by some average mass balance. Please clarify. Equation 7: this seems not to b correct, V(z) and W(z) can not be the same in the middle repective right part of the equation

Presentation:

The structure should be improved. Currently there are several method-parts in the result section. The language could generally be improved. One general comment is the use of tenses. Please be consequent and use past tense for what you have done. Example: p8663, line 8ff, This sentence reads a bit confusing .... '... lumped equations accounting only for ...', the equations of course for many other processes and the equations are not lumped bu trepresent the processes in a lumped way.

Figures:

Figure 1 is not needed Fig 2 would be clearer if boxplots were used Fig 3, present the inset in figure b as own figure c Fig 5 present the correlation plots in a own figure (as they are not directly related to the distribution functions) Fig 6 is too small and generally a bit confusing

Please list/number the figures in order of their occurrence in the text, seems a bit mixed-up in the current version.

Minor comments: P8683: the coefficient of variation can't be negative, can it? P 8686, line 10: what is meant by negative degree-day factors?!?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 8661, 2010.