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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assessing snow water equivalent of an Alpine catchment using snow dynamic model calibrated with satellite images" *by* C. Corbari et al.

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The paper deals with the application of NOAA satellite snow cover images for hydrological modeling in 261-km2 Alpine catchment. An elevation based correction procedure is developed by the authors to improve snow cover images before application. Then the corrected images are used for calibration of distributed snow model based on the degree-day conception. Two model parameters which control partitioning of precipitation into liquid and solid phase are adjusted through calibration procedure. The snow model is validated against both satellite snow data and at-site snow measurements.

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Interactive Discussion

Discussion Paper

The tested snow model is incorporated as a component into the FEST-WB hydrological model by which snowmelt hydrographs are simulated and compared with the observed ones.

General Comments

1. Consideration of satellite information on snow coverage can, in principle, lead to real refinement of the snow model parameters and improvement of the simulation results. However, the method of such a consideration presented in the paper looks questionable for me. First of all, it is unclear why the parameters of partitioning of precipitation into liquid and solid phase are selected by the authors for refinement on the basis of the satellite snow cover images. In my opinion, spatial distribution of snow covered area should not be too sensitive to these parameters affecting mainly the process of snow accumulation. According to my experience, the degree-day factor Cm which directly affects the melt rate is more important for this distribution. I suggest analyzing sensitivity of simulated snow coverage to the model parameters (including the parameters of snow melt) and then using the snow cover images for refinement of the most affecting parameters.

2. The criterion of the model performance, which is used for comparison of simulations with the snow cover images, looks not appropriate for the distributed snow model. This criterion reflects an ability of the model to reproduce total fraction of the catchment area covered by snow. It doesn’t matter for this criterion where snow covers the area, say, if the upper half of the area is really covered by snow but the simulated snow exists only in the lower half of the area then the model performance is assessed as perfect according to this criterion. Such criterion could be used for a lumped snow model but it looks too “weak” for the distributed model. I suggest applying criterion reflecting snow coverage in the different parts of the area. However, even with the used “weak” criterion, the demonstrated results of the model validation are improper; the efficiency is 0.21. (Note that this value is not a typo as the Reviewer #1 suggested; Fig 6b confirms poor validation result). I believe that valida-

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tion test could be more successful if the parameters of snow melt would be adjusted against the satellite data on snow cover.

3. An approach allowing the authors to assess the model performance by comparison of simulated snow water equivalent (SWE) with the measured snow depth is not presented in details and, probably, that is why it looks questionable. Normalization of SWE and snow depth can not, in my opinion, result in “avoiding the problem of comparison” of the different characteristics of snow. Snow depth divided by its maximum (seasonal? multiyear?) value can not be compared with SWE normalized by the same way.

Since incorporation of the above-mentioned suggestions as well as suggestions of the Reviewers needs additional work, I suggest accepting the paper with major revision.

Specific Comments

1. I agree with the Reviewer #1, the title should be changed.

2. P. 3134, l. 10-13: What are the “corrected images” here? Before this point, the authors do not describe any correction procedure. In addition, how are the pixels which are “falsely classified as not covered by snow” determined? Probably the authors mean the elevation based correction procedure described in the following sentences. If this is the case, these sentences should be moved in the beginning of the paragraph.

3. Table 1 looks as unnecessary because it simply shows that the applied correction procedure results in increasing of estimated fraction of snow cover. This result evidently follows from the description of the correction procedure.

4. P. 3136, l. 18-19: What are the “other parameters of the distributed model”? Please clarify. 5. P. 3137, l. 16: This is not a “good result”.

6. Figures should be numbered in accordance with their references in the text. For

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instance, Fig. 4 is referred in the text after Fig. 1; Fig. 2 after Fig. 8, etc.

7. I suggest adding brief description of the FEST-WB model.

8. References in the text should be put into one-to-one correspondence with the list of references.

Concluding Remarks

1. Does the paper address relevant scientific questions within the scope of HESS? YES 2. Does the paper present novel concepts, ideas, tools or data? NO 3. Are substantial conclusions reached? NOT COMPLETELY 4. Are the scientific methods and assumptions valid and clearly outlined? NOT COMPLETELY 5. Are the results sufficient to support the interpretations and conclusions? NOT COMPLETELY 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientific (traceability of results)? NOT COMPLETELY 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? NOT COMPLETELY 8. Does the title clearly reflect the contents of the paper? NO 9. Does the abstract provide a concise and complete summary? YES 10. Is the overall presentation well structured and clear? NOT COMPLETELY 11. Is the language fluent and precise? NOT COMPLETELY 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? YES 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? YES 14. Are the number and quality of references appropriate? NOT COMPLETELY 15. Is the amount and quality of supplementary material appropriate? NOT COMPLETELY

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 3129, 2008.