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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assimilation of satellite information in a snowpack model to improve characterization of snow cover for runoff simulation and forecasting" *by* L. S. Kuchment et al.

Anonymous Referee #2

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anonymous review of MS No.: hess-2009-185

"Assimilation of satellite information in a snowpack model to improve characterization of snow cover for runoff simulation and forecasting" by L. S. Kuchment, P. Romanov, A. N. Gelfan, and V. N. Demidov

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Synopsis

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Interactive Discussion
Discussion Paper

The authors use a spatially-distributed, physically-based snowpack model and remotely sensed snow products from AMSR-E and MODIS to simulate runoff from a basin of 124 000km2. The snowpack model is calibrated against 19 stations in the study area, then the model was run uses a combination of NASA satellite data & regional station data. The runoff model is calibrated against extensive measurements over many years. The remote sensing data & snowpack model drive the catchment runoff model. Results using both the satellite products and runoff model do better than without the runoff model in simulating the hydrograph of the catchment output river.

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general comments

excellent English with only minor corrections needed

very nice study, both in terms of rigor of the underlying physical approach, and the connection of both a snowpack model & a catchment runoff model.

p5506/L12-16 this description is very similar to the 'ANSA' snow product suite described in Foster et al, 2009, International Journal of Remote Sensing (accepted). This paper should be referenced. title is "A blended global snow product using visible, passive microwave and scatterometer satellite data" authors are "JAMES L. FOSTER, DOROTHY K. HALL, JOHN B. EYLANDER, GEORGE A. RIGGS,SON V. NGHIEM, MARCO TEDESCO, EDWARD KIM, PAUL M. MONTESANO,"

Fig 7 shows a nice example of the effect of forest cover masking the signal of snow on the ground.

calibration of the catchment model appears to be extensive, taking advantage of many years of measurements. no doubt this has a great deal to do with the relatively good performance of the model.

The detailed descriptions of the snowpack & runoff models is too detailed for this paper since the focus of this paper is on the performance of the models when used together.

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Interactive Comment

Since the details are previously published, just cite the appropriate papers. This is a major revision simply due to the percentage of the current manuscript that must be changed.

More quantitative results on p5522 would greatly improve the value of this paper to interested readers. Right now, the paper has lots of detail on the input data used in the study, the models used, but too little detail on the results & the interpretation of the results.

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specific comments

p5509/L8 '3rd decade of March' is confusing. 'decade' usually refers to a 10-year period.

p5516/L3 where did the canopy emissivity value of 0.96 come from?

p5531/fig5 the model appears to overestimate depth in the beginning of the snow season. what is the reason for this?

p5518/L21 "Assuming that the spatial variability of snow density is much less than variability of SWE". Since SWE is a function of depth & density, then for this statement to be accurate, variability in the depth must be more responsible for the variability of SWE. Doesn't this depend on whether it is near the beginning or the end of the snow season? In the early season, density may indeed be more uniform since not much metamorphism has occurred. But later in the season, a lot of metamorphism has occurred and it varies spatially quite a bit. As a result, we would expect density to vary quite a bit. And if melting has been limited (e.g. by March 1), then SWE could be fairly uniform even if denisty varies a lot.

fig 10 it is interesting that both SWE-based approaches produce a better match to the observed hydrographs for the right column (2005) vs. the left column (2003). Is there a simple explanation?

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