

## ***Interactive comment on “Using MODIS estimates of fractional snow cover extent to improve streamflow forecasts in Interior Alaska” by Katrina E. Bennett et al.***

### **Anonymous Referee #2**

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In their study “Using MODIS estimates of fractional snow cover extent to improve streamflow forecasts in Interior Alaska” Bennett et al. investigate the value of two MODIS-derived snow cover area products (MOD10A1 and MODSCAG) to improve streamflow simulations in the interior of Alaska as compared to simulations where model-generated areal depletion curves are used. The authors conclude that there is only marginal improvement when evaluating the model performance with metrics such as NSE, RMSE etc., but argue that the MODIS derived snow covered area products might be valuable particularly in regions with sparse or poor quality observations. The methods and findings are sound and the article is generally written in a clear, concise and very structured way.

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Nevertheless, I have some minor comments, which I would like to see addressed prior to publication:

### General comments

- The basins with the sparsest streamflow observation had the greatest improvement in streamflow simulations. (P1L13,P14L 25-26) → could indeed the sparse data be the main reason for the improvement rather than the product? This could be tested with a little model experiment adding some data gaps and see how the performance measure is sensitive to that maybe for the basin with the longest observations
- Why do the authors include the Chatanika catchment, when it shows very poor performance both using the model generated and the MODIS product derived snow cover extend? Please clarify.
- Move more detailed description of the derivation and differences between the MODIs products (interpolation, filtering, and smoothing) from the supplements in the main study.

### Minor/technical comments

- There are passages in the article where fill words like utmost, great, very are used abundantly. In my opinion, it would help to go through the article and check where these are really needed and where they could be dropped.
- There is a mixed use of watershed and basin. Do the authors use it with equivalent meaning? If so, then use only one term throughout the paper, if not please clarify why the two terms are used.
- Often model runs could be replaced for better clarity with SWE simulations (e.g. P10L30) or streamflow simulations, respectively.

- Please make the units consistent (sometimes there is sec, sometimes there is s, etc.)

P1L29/30 did both extent and duration decrease by the same percentage?

P1L35 Delete this sentence

P2L3 Extremes → Extreme

P3L14 in which P3L22/23 what does it mean that they perform better, better than in other regions or these models are better in these regions than the other models. Please clarify.

P3L33 Date missing in reference

P4L33 delete above the Steese Highway ( I do not see the relevance of this information)

P5L23 delete at the Steese Highway site

P5L35 add eq. 1 in brackets

P6L1 does still really need to be expressed in feet?

P6L17 how sensitive are streamflow simulations to this lapse rate? What motivates the assumption that the fixed lapse rate of  $0.6^{\circ}\text{C}/100\text{m}$  holds?

P6L30 delete “and is set to . . . “already mentioned above

P6L33 mm/mb/6hr is that the unit for rain on snow, then move to melt from rain of snow earlier in the sentence

P7L12-15 It might be helpful to see a sketch of how the ADC works

P7L16 add a reference to this look up table

P7L29 change “produces streamflow simulates” to “simulates streamflow”

P8L12 delete study

P8L30 to P910 all of these statistics are well known, I think it would be sufficient to just add some reference for each, else, I would summarize them in a separate table. In case the authors want to keep the equations, check the equations carefully: MAE has to additionally be divided by the number of observations, Spearman correlation coefficient could simply be written in a simpler form.

P9L10 make units consistent

P10L1 delete “for reasons that are discussed in the following section”

P10L5 why it is the maximum recommended value and who recommended it? Maybe refer again to the table with parameter ranges

P10L14 What does a more rigorous calibration mean here?

P11L10 Why for May 15th 2001?

P12L6 1-R

## Figures

- Most figures are difficult to read when printed in black and white. This could be improved easily by adapting the color palette.
- Figure1: not all elevation classes are used in the map. Units are missing for the elevation zones. Drop last sentence in caption.
- Figure2: what happens to MODIS SASC North between May 10 and 17?
- Figure3: It seems there is a difference in the fractional snow cover extend seasonal development for the years that are used for calibration and the years that are used for validation. Is this also the case for each individual catchment, or is one catchment causing this difference? Is it ok to shift the year in validation, calibration period in the Chatanika catchment compared to the other catchments?
- Figure9: could the time be extended spanning April to September as also used in Table 1? Would it be possible to add quantiles of the streamflow to get an idea about the range per season? Unit should be  $m^3/s$ , I do not understand what the average of all basins can tell me.

## Tables

- Table1: units: elevation m a.s.l.; Q  $m^3/s$ ?

- Table2: maybe replace current with the last year included
- Table3: SCF Max values seem messed up
- Table4: mention that period of record is not the same for each catchment!

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