

Interactive comment on “Large scale snow water status monitoring: comparison of different snow water products in the upper Colorado basins” by G. A. Artan et al.

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Title: Large scale snow water status monitoring: comparison of different snow water products in the upper Colorado basins

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We thank the reviewer for the constructive comments, we will strengthened the manuscript based on reviewer's specific comments. Below are point-by-point responses to the referee comments.

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Point-by-Point Responses to the Reviewer's Comments

1. First of all, in order to better evaluate your corrections in the paper according to the reviews, I would prefer to see the revised manuscript coeval with the correspondent response uploaded as attached file.

Response: we will upload the revised manuscript within next few days.

2. In general I would suggest emphasizing more on the added value of your model to convince the science community. In this regard you could highlight the motivation in abstract and introduction as well as improve the writing style of your result part using more sophisticated and precise sentences, which will make the paper more interesting for the general readership. Especially the result part is sometimes difficult to follow.

Response: The motivation of the study is highlighted in the introduction. The objective of study was to explore if it is possible to monitoring the status of the snowpack at regional scales in near real-time with data that are available in even the most data-scarce regions of the world. We'll improve the abstract; we added sentences that highlight the value and need for snow accumulation/ablation models that uses as input meteorological data from satellites and weather forecast models.

3. Concerning your response to reviewer 1 (page C3292): “The underestimating bias of the GFS temperature is only important for the first week of the snow ablation seasons; consequently, the GFS temperature bias should not affect the total snow ablation or the monthly melt values that we have used for our comparison.” - Can you please discuss this more in detail? Did you check it?

Response: We have run the model when the input air temperature is increases by 20 Celsius, our statement was based on that analysis (see attached Figure). From that analysis comes our understanding that the underestimation bias of the GFS temperature is only important for the first week of the snow ablation seasons we included in the revised manuscript our findings from that analysis. The objective of paper was to

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investigate if a snowmelt energy balance model forced with coarse globally available meteorological data can be used to monitor snow water status. Consequently investigating how the uncertainty of the input meteorological propagates into the snow model outputs is beyond the scope of our current paper. In our future research plans discussed in the conclusion section, we will include the need to quantify the effects of the errors in the input meteorological variables on the output of snowmelt models.

4. I totally agree with reviewer 1 that a validation over some years is too short for statistical significant model validation. In this context, you answered that the short simulation period from 2006 to 2008 is based on limited time coverage of Microwave imagery. What about the other data sets and its temporal availability? I assume some data must be available before 2006? It would really make more sense to simulate the climatology of about 20 to 30 years. If the data for comparison are not available, please advise me or else give me some more explanations for using only these three years.

Response: We share the reviewers desire to see simulations longer than the three seasons we presented. The temporal limitation of the snow processes simulations that we have presented is due to the lack of data as was explained to reviewer 1 to some extent. The Multi-sensor Precipitation Estimator (MPE) data from the NOAA National Weather Service (NWS) are available only as far back as December 19, 2005; and the Microwave data from National Snow and Ice Center is not available after the April 2007. The only precipitation data available before December 2005 is the Tropical Rainfall Measuring Mission (TRMM) dataset. We included in the revised manuscript data for the first winter (January 2006-May 2006) of the simulation. The January 2006-May 2006 simulation data that was excluded from first draft that the reviewer is referring to for model spin up.

5. As you suggest in the abstract and throughout the paper that the underestimation bias of air temperature (and precipitation) is one (maybe the most) important factor contributing to the disagreement between modeled and observed SWE during the snowmelt period, I would also ask you (in agreement with reviewer 1) to discuss this

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problem more in detail. Unfortunately you didn't reply appropriately on this comment from reviewer 1. Hence, I highly recommend you to analyze the impact of temperature and precipitation bias on your model performance. If it is not possible within this paper, you should add the outcome for ongoing work in addition to your snow albedo parameterization problem, which can be another interesting task in improving the model.

Response: We will include in our ongoing research the need to investigate the effects of the errors of the meteorological variables on the simulated snow water. The underestimating bias of the NOAA's Global Forecast System (GFS) model temperature is only important for the first week of the snow ablation seasons; consequently, the GFS temperature bias should not affect the total snow ablation or the monthly melt values that we have used for our comparison. See new Figure 10 for the impact of bias of the input temperature data on the simulated monthly snow water content.

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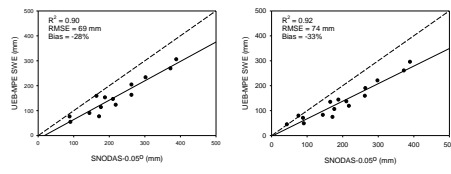


Fig. 11. Scatterplots of monthly SWE (at the 39 SNOTEL sites) from the SNODAS and the (A) SWE from the DisUEB with MPE precipitation and the original GFS's air temperature for January 2006–April 2008, and (B) SWE from the DisUEB with MPE precipitation and the original GFS's air temperature increased by 2 degree Celsius.

Fig. 1.

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