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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessment of a multi-resolution snow reanalysis framework: a multi-decadal reanalysis case over the Upper Yampa River Basin, Colorado" *by* Elisabeth Baldo and Steven A. Margulis

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1) Are there any other observations during the reanalysis period that can be used to look at the spatial distribution of SWE across the basin? Overflights from the Airborne Snow Observatory (ASO), or any measurements from the NASA CLPX perhaps? This is a curiosity comment as it isn't critical for the paper:

ASO data is unfortunately not yet available over the Upper Yampa basin. CLPX is, but was not included in the verification because the focus of this work was to compare

posterior MR SWE to the baseline. The verification performed using SNOTEL data was not meant to be exhaustive, but rather provide confidence that the baseline was reasonable. Other datasets can later be included for verification when the method is applied over larger domains.

2) It would be nice to recreate the density scatter plot in Figure 7a for all 31-years of peak SWE, and discuss any outliers that may be found. Mean analysis will mask any year-to-year performance differences, which may provide deeper insight into this use of the MR approach for assimilation. Also, outlier years and corresponding performance of model estimates in those years are key for water resource managers. This would complement or be added to the basin average yearly analysis in section 3.2.3. Same comment as 2) for Figures 8 and 9:

Based on the organization of the paper, Section 3.2.2 intentionally focused on the mean annual patterns. We therefore would argue that adding inter-annual variability in that section may hurt the flow of the paper. The interannual performance was presented in the next two sections, but focused on basin-averaged metrics, because extracting information from the scatterplots using all 31 years metrics presented was thought to be too noisy. An example of the scatter plots including all 31 years of data are shown below in Figure 1. These results are consistent with the mean annual plots presented in the paper (but noisier as expected). Given the lack of additional information brought by the scatter plots in Figure 1, as well as the existing thorough inter-annual analysis already presented, we feel that including these three new figures does not add significant insight and therefore would plan to exclude them from the result section of the revised manuscript.

3) For Figure 13 it would be nice to see the distribution of the differences as well:

We welcome the suggestion, and implemented the scatter plot and difference distribution of the ensemble uncertainty coefficient of variation (CV) in Figure 13 to mimic what is done for Figures 7-9. Since another reviewer suggested to shorten the result section, we are planning on focusing on CV only in the revised manuscript, instead of both CV and standard deviation as currently shown. As seen in Figure 2, the differences between the MR and baseline SWEpeak CVs remain within the same range as for the ensemble median (5-10%). Further, differences are mostly constrained over low complexity and SWEpeak areas, which supports the conclusion that the MR approach also preserves the accuracy of the ensemble uncertainty over areas of importance for montane snow processes.

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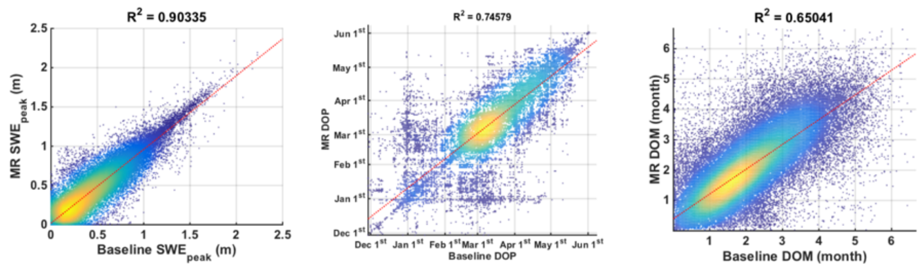

Fig. 1. Density scatter plots of baseline vs. MR (left) SWEpeak, (middle) DOP, and (right) DOM for all 31 years, as well as their respective linear regression plot. The linear regression coefficient is presen

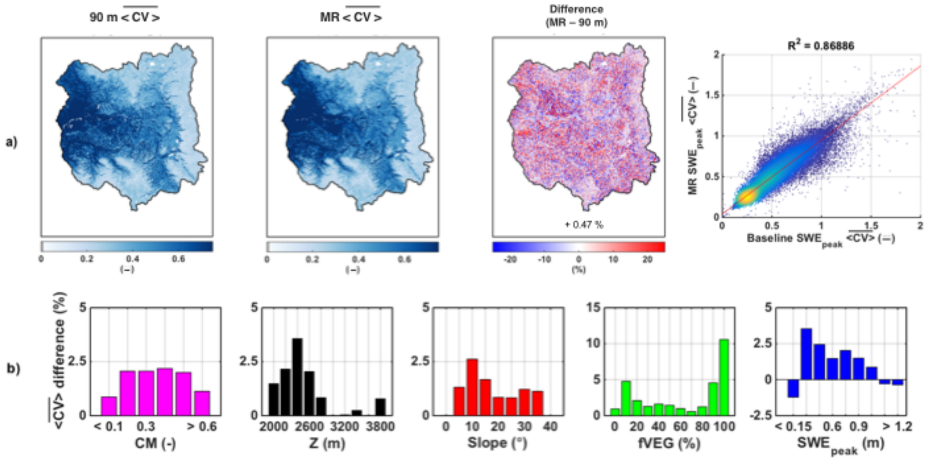

Fig. 2. (a) Maps and scatter plot of pixel-wise 31-year average posterior peak SWE (SWE-peak) coefficient of variations and (b) Distribution of SWEpeak coefficient of variation relative difference