

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

Anonymous Referee #1

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General comments:

This study applies the multi-resolution (MR) grid discretization approach developed by Baldo and Margulis (2017) to a data assimilation test case. Fractional snow covered area (fSCA) is assimilated in a snow reanalysis system using a particle batch smoother for a portion of the Yampa River in Colorado, USA. The MR approach uses concepts of hydrologic similarity as justification to aggregate portions of the landscape into coarser resolution units, thus saving computational time with little loss of information. Baldo and Margulis (2017) show good results in the initial testing and thus apply

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the MR approach to an assimilation case. The MR approach is able to recreate the high-resolution simulation with minimal differences. The authors do a reasonable job explaining the deviations between the two simulations.

Overall, the paper is very straightforward to understand, is generally well written, and reasonably organized. This is an incremental study of the MR approach and similarity concepts more generally. However, it is sufficient for publication in that it does demonstrate clearly that the MR approach can be used successfully with fSCA assimilation at a reduced computational load, which is a clean result for future data assimilation studies.

Specific comments:

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.

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.

3) Same comment as 2) for Figures 8 and 9.

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