

Interactive comment on “Hourly mass and snow energy balance measurements from Mammoth Mountain, CA USA, 2011–2017” by Edward H. Bair

Anonymous Referee #2

Received and published: 21 November 2017

Review of ‘Hourly mass and snow energy balance measurements from Mammoth Mountain, CA USA, 2011-2017’ by E. Bair, R. Davis, and J. Dozier

The authors present a dataset of snowfall mass and energy balance compiled from two neighboring stations located in a snow-dominated mountainous environment in the eastern Sierra Nevada, California. The study site is described as one of only five energy balance monitoring stations in the Western U.S. The authors describe the dataset as useful to run a variety of snow models.

The dataset includes: 1) hourly air temperature, relative humidity, wind speed and direction, and air pressure, 2) hourly incoming shortwave and longwave radiation including shortwave direct and diffuse components, 3) hourly snow depth, 4) daily surface albedo, and 5) daily wintertime snowfall (hand measured snow water equivalent).

The quality of the seven-year (2011-2017) dataset is high. The paper is fairly well written and the methods and data are well-described. In my opinion, the strength of the dataset is in the availability of hourly shortwave radiation (the availability of both direct and diffuse components is rare), which provides substantial information on cloud cover, longwave radiation (required by energy balance snowmelt models), and albedo (useful to either force a snowmelt model or verify empirical algorithms within such models). These observations could benefit an array of Earth system sciences, including snow hydrology, remote sensing and land-atmosphere interactions. For that reason, I support the ultimate publication of the paper and dataset.

I have a few concerns that prevent me from recommending publication in the present form. The product lacks hourly precipitation necessary to run most snow energy balance models, and lacks snow water equivalent data necessary to validate a snow model. The title does not appropriately describe the dataset. Finally, the paper would benefit from 1) an expanded description of how these variables are used in Earth Sciences, 2) evidence of data quality (figures), and enhanced examples of its application. Such additions would greatly improve the paper and extend its utility across a range of Earth sciences. Please see my associated comments, below.

(i) Hourly precipitation data have become a standard requirement of snow energy balance models. The title 'hourly mass . . . balance' is misleading – only daily snowfall is provided and accurate snow mass balance typically requires all-phase precipitation including rainfall. Could regional (hourly) precipitation measurements (e.g., SNOTEL) be used to inform a temporal interpolation of daily hand-measured SWE to an hourly product? Providing an hourly precipitation product may support more diverse application and user interest.

Addressing the second point (mass balance) may be more difficult. Because hand-weighed SWE measurements are rare, and in the absence of local total precipitation measurements, the authors must better and more carefully explain what information these data contain and what information they may lack. What are the potential pitfalls

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of using such measurements to constrain the snow mass balance in general and at this location (blowing snow, melting, rainfall)? Further, how does a plot of cumulative hand-measured snowfall compare to a time-series of seasonal SWE measured on the ground? The authors do not offer enough data to promote an understanding of hand-measured snowfall.

(ii) A more detailed description of common (potential) uses of this dataset would be helpful. It may be worth mentioning the utility of the dataset for validating distributed products such as NLDAS-2 or remote sensing products.

(ii) Even if the snow pillow SWE data are limited, they could still be a substantial resource for users looking to verify a snowmelt model. I strongly suggest that these data be included. The SWE is more directly relevant to the mass and energy balance theme strummed in the title than snow depth.

(iii) “A variety of snow models” on Line 15 is vague . . . I expected more discussion and examples in the paper. Along the lines of a paper by Landry et al. (2014) that highlight similar measurements from a site in Colorado, it would be helpful to include an example of snow model results forced and verified by the data. This would also serve as evidence of data quality and utility.

Landry, C. C., Buck, K. A., Raleigh, M. S., & Clark, M. P. (2014). Mountain system monitoring at Senator Beck Basin, San Juan Mountains, Colorado: A new integrative data source to develop and evaluate models of snow and hydrologic processes. *Water Resources Research*, 50(2), 1773-1788.

(iv) Please provide some discussion about the possibility of snow on the radiometer sensors, how these times might be flagged, and some words of caution.

Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2017-114>, 2017.

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