Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-749-RC1, 2018

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Now You See It Now You Don't: A Case Study of Ephemeral Snowpacks in the Great Basin U.S.A." *by* Rose Petersky and Adrian Harpold

Anonymous Referee #1

Received and published: 14 March 2018

General comments:

This study focuses on mapping ephemeral snow over the Great Basin in the US and diagnosing the mechanisms for ephemeral snow behavior, to better understand the impacts of ephemeral snow on soil moisture. To do so, the authors use station based SNOTEL and SCAN observations of snow and soil moisture, remotely sensed snow-cover from MODIS, and modeled snow data from the SNODAS product. A snow seasonality metric is developed using MODIS snowcover imagery and SNODAS data to map ephemeral and seasonal snowcover. Then a decision tree is developed using SNODAS modeled data to diagnose the mechanism of ephemeral snow. Finally, the

Printer-friendly version

Discussion paper

landscape characteristics of estimated snow duration are explored. The study's results are that topography and climate are strong controls on the distribution of ephemeral snowpack. This paper extends previous work on ephemeral snow by attempting to classify the processes driving snow loss (no snowfall, melt, sublimation/blowing snow).

This paper addresses a previous unaddressed question of identifying and mapping the dominate process causing ephemeral snow cover. Further, connecting snowmelt from ephemeral snow to soil moisture and this link's sensitivity to inter-annual variability (or climate change), is an interesting scientific issue fully within the scope of HESS. I believe this paper will provide a valuable contribution after some of the issues below are addressed.

Specific comments:

- Title: The title should be more descriptive of what the paper is about: diagnosing ephemeral snow mechanisms and impacts on soil moisture.

- The abstract provides some descriptive comments on the seasonality of the observed and modeled results, but only hints at "recommendations to bolster physics based modeling". These recommendations (and results supporting them) should be clearly articulated in the abstract.

- Lack of discussion of how uncertainty in the SNODAS model affect the results of this study, namely the classification of ephemeral snow. Over high-elevation terrain where we could expect blowing snow redistribution and sublimation losses to be greatest, SNODAS at 1km by 1km, likely does not capture these processes well. This may be supported by Figure 7, showing SNODAS diverging from MODIS at highest elevations (This is an interesting finding that could be discussed more as well).

- Because ephemeral snow occurs during short events, the driver of snow loss for a given 1km SNODAS cell could be variable with time. How does your ephemeral snow mechanism modeled results change if you look at smaller time slices than a year?

- Snowpillows modify the ground heat flux to snow and the calculated snow presence/absence. Please address how this observational uncertainty impacts your results.

- Using the peak of (I assume hourly?) soil moisture data for your calculations for Figure 6, may bias this metric toward high intensity rainfall events (i.e. Feb 2015 in Figure 5e), that may be slightly higher than later snowmelt driven soil moisture increases. Try using a longer averaging time or at least address the sensitivity of your results to this metric choice.

- Making your final mapped snow regions publicly available will greatly improve the usefulness of this study.

Technical corrections:

- Page 2, 5 – Missing citation of Kormos et al., 2014

- Page 2, 14 – Inputs “to soil”

- Page 2, 16 – Comparable to? To previous studies using the 60 day threshold?

- Page 2, 34 – Currently sentinel-2 provides 5-10 day repeat times. Coupled with Landsat, this can provide far more cloud free images of ephemeral snow.

- Page 6, Citation for earth engine

- Noel Gorelick, Matt Hancher, Mike Dixon, Simon Ilyushchenko, David Thau, Rebecca Moore, Google Earth Engine: Planetary-scale geospatial analysis for everyone, Remote Sensing of Environment, Volume 202,

- Figure 1b is not needed, it can be stated in the text.

- Figure 7 - Date ranges for MODIS and SNODAS should be consistent for comparison.

- Figure 8 – Need consistent color bar ranges to aid comparison (or note in caption if you make them different). - Figure 11. 2012 and 2013 “No Snow” look green instead

of black.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-749, 2018.

Printer-friendly version

Discussion paper