

Interactive comment on “Effects of pan-Arctic snow cover and air temperature changes on soil heat content” by X. Shi et al.

Anonymous Referee #2

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In the model description, the authors describe that “The snow parameterization in VIC represents snow accumulation and ablation processes using a two-layer energy and mass balance approach (Andreadis et al. 2009) and a canopy snow interception algorithm (Storck et al. 2002) when an overstory is present.” Later, the author further stated that “When snow water equivalent is greater than a threshold, the model assumes that snow fully covers that elevation band.” In this case, I assume that when using VIC model simulates the soil thermal regime or soil heat content, the authors indeed use snow depth in the model. However, the authors try to use NOAA snow cover extent to explain the modeled soil thermal regime or modeled soil heat content, which includes the effect of snow depth. This is NOT consistent and is my major concern. To do so, the authors need to answer two questions: First, is the snow cover extent in the model the same as in the NOAA snow cover data set? The authors should provide validation

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and comparison results. Second, in terms of snow effect on soil thermal regime, the authors have to explain how can the SCE alone explain the influence by the simulated with snow depth (snow depth indirectly includes snow cover extent)?

Using soil heat content for soil column of 18 m depth is a good idea, it reaches to or below the depth of zero annual amplitude of soil temperature change. However, soil column heat content up to 18 m is an integration over the entire soil column and also over the past 6+ months in time. The current study simply does not consider the time lag issue, which is very critical. The authors need to consider how to include the effects of SCE and SAT on SHC over the past several months.

p.5, lines 108-110: please provide exact website address for snow data availability at NSIDC.

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