

Interactive comment on “Long term soil moisture mapping over the Tibetan Plateau using Special Sensor Microwave/Imager” by R. van der Velde et al.

Anonymous Referee #3

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The authors adapted existing retrieval algorithms to estimate topsoil moisture over Tibetan Plateau using harmonized 1987–2008 L1 SSM/I data set. The retrieved soil moisture was then compared with in situ measurements from 5 stations in $\sim 10 \times 10$ km² area, and with model soil moisture from GLDAS-Noah to show good agreements. The data were further analysed to provide evidence for positive monthly and annual trends during the 21.5 years and positive dependency on elevation.

The paper is generally well-written with sufficient details and documents publishable results. However the following points warrant clarifications,

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1. While an alternative retrieval algorithm for SSM/I is welcomed, its introduction is not properly motivated when there is an existing (and previously tested) implementation by Jackson et al. (2002). How does the proposed method be better, or is the choice made largely for practical reasons?

2. The shallow sampling depth at this higher frequency is susceptible to rapid changes to rainfall forcing and surface heating. Despite the fast dynamics, it is agreeable that longer trend is likely to be long-lived. However the threshold of 5 valid retrievals for estimating monthly means appears to be very low, leading to large sampling uncertainty for the sample means – please justify. What are the typical sample sizes for the estimation?

3. The discussion of VOD climatology is unclear. Figure 4 does not provide a clear picture of time evolution of VOD across the months and hard for readers to associate a similar seasonal dependence for soil moisture explained in the text. Perhaps the authors can present differencing maps, namely $VOD_{june} - VOD_{may}$, $VOD_{july} - VOD_{may}$, etc, or time series plots at selected locations.

4. Please clarify the time scales (daily or monthly) at which comparisons with in-situ were made (Figures 5 and 6).

5. Are all in-situ stations co-located within the same SSM/I satellite footprint?

6. The treatment of DEM data with nearest-neighbour resampling does not make sense – DEM is understood to be in $1 \times 1 \text{ km}^2$ resolution, while the footprint size is many times larger at $69 \times 43 \text{ km}^2$. Spatial averaging or Hamming window sampling would seem more appropriate.

7. It is difficult to reconcile the labelling of the average of 6-month (May-October) data as the “annual value”. Perhaps a better term should be used to avoid misunderstanding.

8. Please clarify and justify the time window used to define the monthly or annual

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means and standard deviation in Eq. 6. Is the time window 21.5 years? If yes, then it is unclear to me the nature of the anomaly studied here because N has the same frequency information as Θ -bar. If no, what is the sensitivity of the results to different choices of window sizes?

9. Is equal-weighted linear regression used in the analysis of trend-elevation dependency in Figure 10? If yes, since the spread is variable at different elevation height, should weighted regression be used here? What is the sensitivity of the slope to the elevation binsize? What are the standard errors of the estimated slope?

10. Table 1. What time zone is the satellite overpass times quoted?

11. Figure 1. Include lat/lon labels to both the figure and its inset, so that the spatial relation between the figure and the inset is clear.

In summary, evaluating against the HESS manuscript evaluation criteria,

- Scientific Significance – The paper reported extension of existing algorithms to adapt higher-frequency retrieval of soil moisture; and demonstrated the potential utility of the data in studying changes in hydrological properties of a relevant geographic region.
- Scientific Quality – Some of the choices made in the treatment of the data and analyses require clarifications. The above queries may also warrant further analyses and may alter the outcome.
- Presentation Quality – The use of figures is good, but typesetting is needed for readability and aesthetics.

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