

Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on **essd-2022-134**

Anonymous Referee #2

Referee comment on "HMRFS-TP: long-term daily gap-free snow cover products over the Tibetan Plateau from 2002 to 2021 based on hidden Markov random field model" by Yan Huang et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-134-RC2>, 2022

Snow cover plays an essential role in climate change and the hydrological cycle of the Tibetan Plateau. Currently optical sensors are severely affected by clouds, resulting in a gap in snow products. Using MODIS snow cover product and HMRF algorithm, this work produced daily cloud-free snow cover dataset from 2002 to 2021 over the Tibetan Plateau. In order to validate the accuracy of the dataset, the authors used snow depth data from ground meteorological stations and Landsat-8 images as reference data to systematically evaluate the accuracy of snow products produced from different altitudes and slopes. And this work improved the elevation representing environmental information of the original HMRF model with solar radiation based on the experience of actual field experiments, and the validation results showed its great effect on the accuracy improvement. However, there are still some issues needed to be justified clearly.

Major comments/suggestions:

- The threshold of NDSI used in this work is set as 0.4, while in the work of Zhang et al., (2020), they used the value of NDSI as 0.1 to determine snow or not in the Tibetan Plateau. So, I'd like suggest the authors have to compare these two threshold on the determination of snow cover in Tibetan Plateau.

Reference □ Zhang, H., Zhang, F., Che, T., & Wang, S. (2020). Comparative evaluation of VIIRS daily snow cover product with MODIS for snow detection in China based on ground observations. *Science of The Total Environment*, 724, 138156.

- The Tibetan Plateau has high altitude and complex terrain, and Landsat-8 data used for reference data is 30m, which will be affected by terrain and mountain shadow. Have you considered the terrain effect on Landsat-8 snow cover? And how's it affect validation results?
- Why use solar radiation not net radiation to represent environmental effect? Net radiation might be more related with snow surface than solar radiation here.
- The snow fraction estimated method used in **the equation (2)** was derived through other regions, and many studies have shown that the linear relationship has limited accuracy in the Tibetan Plateau region. If possible, I'd like suggest the authors re-fit that empirical relationship between snow fraction and NDSI in the Tibetan Plateau region. In addition, the fitting relations of Terra and Aqua satellites are different. If the same equation was used for Terra and Aqua, it might cause error on snow cover determination.
- Landsat-8 images was not enough to demonstrate the current results. If possible, please add more validation Landsat images, such as Landsat-5/7 images.
- Why the validation accuracy of HMRF_solar or HMRF_dem is higher than MODIS? In my opinion, HMRF just filled the data gap, why the accuracy is also improved a lot. Please justify it.
- I have concerned that the weight used in Equation (1), such as U_{xi} , U_{st} , U_{ev} are negative defined in Equation (3), (4) and (13).

Specific comments/suggestions:

- Please provide the definition and equation of accuracy evaluation index(OA,OE et al.)
- Figure 8. Please add the latitude and longitude information.
- The Figure 4,5,7,8 resolution is too low, please check whether the Figure format meets the requirements of the journal.
- #Line115-116, "the values of 211, 237, and 239 in the NDSI_Snow_Cover_Class band were reclassified as non-snow". From #Line111, "the values of 211, 237 and 239" indicate "night time", "inland water", "ocean". So it is not reasonable that the pixels with three values are determined as non-snow.