Author Response to RC2

Journal: ESSD

Title: A 1-km daily surface soil moisture dataset of enhanced coverage under all-weather conditions over China in 2003-2019

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General Comments:

"The authors present a downscaled soil moisture product, which combines the advantages of a 36-km resolution passive microwave remote sensing product with a 1-km resolution MODIS LST product. Such high-resolution soil moisture is very important for agriculture and water resource management. The manuscript is generally well-organized, I suggest accepting it with considering the following revisions."

Response:

All authors greatly appreciate you for your final decision with "accepting it with considering the following revisions". We have paid great attentions on each bullet pointed out by you and have modified our paper carefully based on your comments. Please see the following responses to your specific comments.

Response to specific comments

1. The quality of the figures should be improved. Currently, some legends are too small to identify.

Response:

We have tried to improve the quality of some figures (Fig.3, Fig.5, Fig. 7). However, if there are still unclear legends in the figures, please let us know the specific points after this revision. Thank you.

2. Fig. 7. was not used in the main text.

Response:

We accept your comment and have mentioned Fig.7 as "another manner of illustrating Fig.6" in the revised version, above Fig.6 and Fig.7. Please see Lines 544-547 ("*The above inter-seasonal differences on data coverage are also reflected in Fig. 7 in another manner based on presenting the spatial distributions of number percentages of available dates in each three-month period*").

3. Also in Fig.7., it shows that the original PM SSM almost does not have any data in the winter season on the Tibetan Plateau. It is reasonable since, in the winter season, the soil is frozen and generally covered by snow, and then it is difficult for microwave remote sensing to identify soil moisture. However, as shown in this figure, the new 1-km downscaling product has some soil moisture data. How did it come? What did the soil moisture value during this season on the Tibetan Plateau mean? How about the accuracy of these downscaled SSM?

Response:

Thank you for reminding us on this problem. Our downscaling framework is actually consistent with your opinion on leaving out the invalid "winter pixels" (See our description in Lines 538-542). Unfortunately, we made a tiny technical mistake when calculating the statistics for Fig. 6 and Fig.7 last time. Now the bug has been fixed for both Fig. 6 and Fig. 7. Also, relevant texts have been revised (please see Line 535). In this revised version, null values have been assigned for all 1-km sub-pixels within the frozen or snow-covered passive microwave pixels (e.g. the microwave pixels characterized by null values on the Tibetan Plateau in winter and early spring).

4. It is recommended to draw some time series of the soil moisture products, the new one, the original one, and SMAP high resolution one, on several stations, to demonstrate the advantages of this daily 1-km product.

Response:

Thanks for your advice. We had actually investigated the time series at some of the stations when we designed this study. After careful investigation, however, we found it is rather difficult to use time series data at only a few stations to highlight our conclusions that have been drawn based on nation-wide research. We do not wish to have an impression of cherry picking. Therefore, we finally decided not to present any of them in the paper:

(1) In our study we have more than 2000 validation sites across the country in total. The time series patterns for the downscaled SSM and the station benchmarks are rather different from site to site. It's very difficult to find one or two sites where the relative performances

among soil moisture time series of different data sources are typical and representative of their background climate regions at the provincial or large-basin levels. Moreover, we believe the complicated influential factors behind soil moisture seasonal time series of different eco-regions have to be investigated specifically in our subsequent studies. For our current study case, the overall validation performance (see Fig.4) is more important than time series demonstration.

(2)   The SMAP-sentinel high resolution data has a much poorer temporal frequency (for some locations even lower than 12 days), as a consequence of which, the true shape of its time series might be arbitrarily interpreted. Therefore, it is difficult to fairly compare its time series with that of other daily-scale datasets through visual inspection.