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Reply on RC1

Zhaofei Liu

Author comment on "The accuracy of temporal upscaling of instantaneous evapotranspiration to daily values with seven upscaling methods" by Zhaofei Liu, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-73-AC1>, 2021

Response

Ms. Ref. No.: hess-2021-73

Revised title: Accuracy of temporal upscaling instantaneous evapotranspiration in simulating daily values in remote sensing applications

Author(s): Zhaofei Liu

It would be greatly appreciated for your kind reviewing to this paper. Thanks very much for your valuable comments and suggestion. For your convenience to re-review the paper, the response corresponding to your comments are described in detail as follows:

This manuscript evaluates the performance of seven upscaling methods for predicting daily ET from instantaneous ET measurements and provides an analysis of the pros and cons of these methods. In general, the manuscript is well organized and well written. I only have minor suggestions as below:

- *The title seems not precise or a bit awkward, perhaps you can reformulate it a bit to something like below:*

"The accuracy of temporal upscaling instantaneous evapotranspiration to daily values with seven upscaling methods"

Reply: Yes. In the remote sensing ET retrievals, a critical temporal upscaling step is upscaling from instantaneous to daily ET values. Therefore, this study is focus on evaluating the performance of seven upscaling methods for predicting daily ET from instantaneous ET measurements. The author would like to modify the title to "The accuracy of temporal upscaling instantaneous evapotranspiration to daily values with seven upscaling methods".

- *In this study, the author claim this is one of the first study to do such evaluation*

(seven methods) at a global scale, and based on such evaluation, some advantages and disadvantages of different methods were explained/discussed. On the other hand, it is not clear how all these methods will help us to understand better the physics/processes/mechanisms behind daily ET predication at a global scale across all different climate zones;

Reply: The physical process mechanisms behind daily ET predication at a global scale across all different climate zones are very complex. The data used in this study cannot guarantee the representativeness of each climatic region. Spatial distribution of the accuracy of upscaling methods is shown in section "3.3 Spatial distribution of the accuracy of the sine function and EF(Re) methods". It shows that the performance is poor in tropical rainforests (e.g., BR-Sa3, GH-Ank, ID-Pag) and tropical monsoon (PH-RiF) sites. As described in this section, "this may be due to irregular changes in the LE in these regions. For example, there is little seasonal variation in LE in tropical rainforest climate regions, and the fluctuation of daily LE data series is relatively small. This results in poor agreement between simulated daily LE and measured values (Fig. 5). However, the SD-Dem site, also located near the equator, was characterized by seasonal variation in LE due to the tropical grassland climate in this region. As such, the simulated daily LE at this site demonstrated greater consistency with measured values. Although the performance of upscaling methods was poor in agreement with the daily LE data, there was an apparent correlation between simulated daily LE and the measured data. For example, the R² was higher than 0.30 and 0.40 at the GH-Ank and ID-Pag sites, respectively, while it was greater than 0.50 at the PH-RiF site." This is only one result that we found.

We believe the physical process mechanisms behind daily ET predication at a global scale across all different climate zones are very important, and need more further research at regional scales when more data are available.

- *The author suggested that the result of this study can help improve the accuracy of remote sensing ET products. However, there is no example/demonstration with the application of what the author claimed (e.g. Sine, EF(Re)), for producing remote sensing (RS)-based ET products. And there is also no intercomparison between such 'temporal upscaled' ET product with existing RS-based ET data.*

Reply: As mentioned above, upscaling from instantaneous to daily ET values is a critical step in the remote sensing ET retrievals. This study is focus on evaluating the performance of seven upscaling methods for predicting daily ET from instantaneous ET measurements. The accuracy of remote sensing ET products might be improved by using the upscaling method with better performance. However, remote sensing ET data production is a huge project. That is not included in this study. But the results of this study can provide reference value for data producers.

- *Perhaps, the data script (e.g., download script / a readme file or so for how you access/download FLUXNET data [stations etc.]), and the processing script can be opened and invite the community to engage better with this analysis, and see if further methodologies can be developed based upon your studies.*

Reply: Yes. The FLUXNET data was downloaded from its website. The website is provided in the section "Data availability". However, it is the homepage of the website. The author would like to modify this website to the data download link. The link is <https://fluxnet.org/data/download-data/>. Details of readme file, station information, and other documents could be found in this link. All of the processing script is based on Visual

Basic for Applications, which is embedded in Microsoft Excel. The author would like to share the processing script.

Some further minor suggestions as attached

"The intra-day distribution" from which method showed greater consistency with Gaussian function than the sine function?

Is this not expected?

Reply: In Figure 2-(b), the intra-day distribution of normalized LE is directly compared with the sine and Gaussian functions. It shows that the intra-day distribution of LE is more consistent with Gaussian function than the sine function.

As described in the section 3.1 Intra-day distribution of observed LE and its influencing variables, "The Gaussian function matched LE perfectly at any time during the day. The sine function slightly underestimated LE during the afternoon, and tended to overestimate LE from 6:00–10:00 and 15:00–17:00." Yes, this is not expected. This result is also presented in the Abstract as "The intra-day distribution of the LE showed greater consistency with the Gaussian function than the sine function."