

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-314

Housen Chu (Referee)

Referee comment on "Technical note: A view from space on global flux towers by MODIS and Landsat: the FluxnetEO data set" by Sophia Walther et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-314-RC1>, 2022

The manuscript by Walther et al. presents the technical details of a new customized and gap-filled remote-sensing product generated from MODIS and Landsat instruments across Fluxnet sites. They proposed a procedure to extract, quality-filter, correct, and gap-fill MODIS and Landsat data and develop standardized data products of surface reflectance, vegetation indices, and land surface temperature.

Overall, I think this is a great initiative, and I agree with the authors that "the data sets can widely facilitate the integration of activities in the fields of eddy-covariance, remote sensing, and modeling". I also appreciate the authors' efforts in presenting the details and being frank on the merits and limitations. Therefore, I would recommend the manuscript to be considered published in Biogeosciences after addressing a few general and specific comments.

[1] I agree with the general comment made by Michael Dietze on the need to differentiate this proposed data product from the one distributed under ORNL DAAC or any other ones. Consider highlighting the uniqueness of this product or main differences with others in the manuscript. It'll help the potential users to choose a suitable product for specific use.

[2] A standardized and operationally feasible procedure for quality control and gap-filling of MODIS and Landsat data is the main focus of this manuscript. I think the authors should consider adding more analyses to validate or at least demonstrate the uncertainties/limitations of the proposed data product. The examples presented in section 4.2 are great and illustrative, but I think it needs more generalized information on the performance across sites. For example, consider comparing the data product with other available gap-filled products (e.g., MCD43GF or others like Robison et al., 2017). Also, why isn't Landsat land surface temperature included, and why do Landsat data only cover till 2017?

[3] It's challenging and potentially problematic to gain generalized ideas of the spatial contexts based on those few examples (section 4.3). I understand it may not be feasible to calculate flux footprints for all sites included in this study. Still, please consider leveraging the findings from previous efforts (e.g., Göckede et al., 2008 on European sites, Chen et al., 2011, 2012 on Canadian sites, Ran et al., 2016 on Chinese sites, Chu et al., 2021 on AmeriFlux sites, and Griebel et al. 2020 on Fluxnet sites heterogeneity). Those studies analyzed many sites included in this study, providing information about the flux footprints (e.g., extents, areas) that can help justify the selection of cut-out extents and area-weighted methods.

A universally 2-km cut-out may be a bit small for specific tall tower sites. I'd suggest expanding the extents for at least the tall tower sites (e.g., forests, known tall tower (e.g., US-PFa). In our recent study (Chu et al. 2021), we found a few AmeriFlux sites (e.g., US-ChR, US-Wrc) have footprints (i.e., monthly climatology, 80% contour, based on Kljun et al., 2015 model) extending beyond 2 km from the tower. And, more sites are extending beyond 2 km if using half-hourly or daily footprints or using a different footprint model (e.g., Kormann & Meixner 2001). I think it's practically safer to start with a larger extent and then crop the images as needed.

[4] Last, I'd suggest the authors and the team consider adding other sites at this or future release, especially those with compatible processed flux datasets. For example, AmeriFlux begins rolling out processed flux data products compatible with FLUXNET2015 (see links below). Also, with other new Fluxnet initiatives (e.g., Fluxnet Co-op), it's optimistic to anticipate similar Fluxnet products will become available at more sites in the near future. As pointed out earlier, one of the major differences between this and DAAC subset products is the number of sites that are included. It will benefit many users if this data product could be generated at more Fluxnet sites.

<https://ameriflux.lbl.gov/data/download-data-oneflux-beta/>

<https://ameriflux.lbl.gov/data/data-availability/#/FLUXNET>

Specific comment

[5] Line 3: Please consider adding AmeriFlux to the list as other regional networks.

[6] Line 6-7: This sentence "...support the training and validation of ecosystem models" is vague. Consider rewriting it.

[7] Line 95: Is the sensor difference (e.g., among Landsat 4, 5, 7, 8) or sensor drifting

corrected? Also, Landsat 7 is known for Scan Line Corrector (SLC) failure and causes problematic data in certain themes. How does it be addressed?

[8] Line 135-137: This sentence is unclear. Could you explain it a bit more in detail?

[9] Line 139-161: Does the gap-filling procedure apply to the raw bands only (i.e., calculate vegetation indices based on filled bands), or separately for both the raw bands and vegetation indices? Any justification?

[10] Line 170-172: Consider adding more granular details of the flags. Does it indicate which method is being used, or is it simply a binary flag (filled/original)?

[11] 4.1 & Figure 1: Please add some discussions on the Landsat availabilities. Also, would it be more suitable to group sites by regions or biomes given geo-patterns of cloudiness? Looking at the low availability at some sites, I wonder whether it is more appropriate to leave out those sites entirely.

[12] 4.2, Figure 2-3: Please add some discussions on the Landsat time series.

[13] Table 2: Please add some details about the two cut-outs to the Method section in the main text. Consider briefly justifying the weighted approach.

[14] Line 274-290: I suggest moving this part of the literature review to an earlier section.

[15] Line 327-340 & Figure 6: The comparison is misleading. The net radiometer (for measuring long-wave radiation) has a fixed field of view depending on its mounting height and location. It is more appropriate to compare T_{surf} with LST at pixels corresponding to the radiometer's field of view or compare LST_{fpa} with sensible heat fluxes (or derived aerodynamic surface temperature (see Novick & Katul 2020)).

[16] Figure 7: Consider adopting the same color scale for all EVI maps.

[17] Figure D1: Consider using a similar layout (e.g., extents, x-/y-axes, color codes...) as in Figures 5-6.

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