

Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on **essd-2021-181**

Anonymous Referee #2

Referee comment on "A flux tower dataset tailored for land model evaluation" by Anna M. Ukkola et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-181-RC2>, 2021

This manuscript synthesizes a global network of site level meteorological and flux variables that draws from the existing flux tower networks of FLUXNET2015, OzFlux and LaThuile. For meteorological data the FLUXNET2015 data product is gap-filled using ERAinterim downscaled estimates, whereas OzFlux and LaThuile provided statistical gap filling techniques. For flux variables all data sets used statistical gap-filling approaches. If gap filling exceeds 10% of the data set, then the entire year is thrown out. A single format gap-filled data site level data product is helpful for a regional or global network of land model simulations, as well as for model-data fusion (data assimilation) purposes where a network of data could be ingested into a model to provide a regional analysis. Synthesized data sets like these are certainly welcome to the modeling and data assimilation community. This reviewer would like to encourage the authors to think about more quantitative inclusion of uncertainty with the gap-filling routines. Robust uncertainty estimates are an often overlooked but important piece included within data products both for model validation and model-data fusion exercises. See next section for more detailed feedback.

More detailed comments:

- Sections 2.2.1: Would prefer a little more detail on the flux variable gap filling approach, where statistics on the skill of the filling methodology (linear regression against shortwave, temp and humidity) could be included from Ukkola et al., 2017?
- Table 1: Isn't NEE uncertainty reported in FLUXNET2015, in addition to GPP and ER partitioning uncertainty? Why not provide here?
- Figure 2: It appears for the site BE-Bra that SW_down and T_air are labeled as gap-

filled (red-line), because in the text it is mentioned that year 2003 is removed for that site. This should also be stated in the figure caption and this time period should not be listed as gap-filled (red line). US-Tw2 is same thing, state in caption this was discarded.

- *"The majority of sites are located in grassland (40), forested (89) and cropland (17) ecosystems. 22 sites are located in savanna and shrubland ecosystems and 10 sites in wetlands."* It would be preferable to see a more specific breakdown of these sites into plant species, or perhaps into more specific classifications (e.g C3 or C4 grasses, boreal/temperate evergreen, deciduous, crop types etc). Figure 3c has some of this information, but it would be helpful to spell it out here a bit more in the text, or at least refer to Figure 3c at this point.
- Figure 3: It is helpful to show the coverage of the sites in terms of MAT and MAP, and spatially. Might it also be useful to present site level location in terms of regions with the most productivity/biomass? Presenting a climate envelope is not as necessarily important as perhaps locating regions which have the most influence upon carbon cycle, for example. t.
- "Model evaluation, particularly at shorter time scales, should thus be avoided against long periods of gap-filled data." This statement could be made more quantitative by providing uncertainty bounds with the linear regression model so that the user, can make a quantitative evaluation of the model run. Simply, providing a recommendation that long gap-filled time periods should be avoided seems a bit qualitative and not as helpful as providing an uncertainty estimate.
- *" it should be noted that the remotely sensed LAI estimates are highly uncertain at the site scales, with large differences between Copernicus and MODIS LAI at many sites."* Could you discuss/quantify what is meant as 'highly uncertain' at site scales, and where does this uncertainty derive from? Is it a case of algorithm uncertainty directly from the MODIS or Copernicus raw data – or is it a case of representation mismatch between the coarse product spatial resolution and the footprint of the site (1 km²)?

Supplement:

Table S1: The manuscript states the flux data covers the period 1992-2018, but the vast majority of sites are (FLUXNET2015) and thus only available through 2014. I guess that is to be expected given you are drawing from FLUXNET2015, but a bit misleading.