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Interactive comment on "Sun-induced Fluorescence and Near Infrared Reflectance of vegetation track the seasonal dynamics of gross primary production over Africa" *by* Anteneh Getachew Mengistu et al.

Anonymous Referee #1

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The authors compare SIF and NIRv, along with a handful of vegetation indices, against six flux towers located across the African continent. They use these data to build a linear model of SIF and NIRv to estimate GPP across the continent.

I have concerns about the spatial mismatch between eddy covariance measurements and the satellite products used for upscaling. The authors use 0.5 degree satellite imagery and take the further step of aggregating up to 4 degrees (filtering 0.5 degree pixels by dominant land cover type). These average observations are then compared against EC-derived estimates of GPP. Figure 3 suggests that this spatial aggregation

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significantly influences the temporal correlation between the satellite measurements and GPP estimates. In the case of GH-Ank, the 0.5 degree measurements of NIRv are dramatically different from the 0.05 data (e.g., the 0.05 degree data show much more temporal variability). For ZM-Mon, the shape of the NIRv curve is quite different during the middle of the growing season when comparing 0.5 to 0.05 degree imagery.

This is a fairly challenging problem to get around. On the one hand, the authors offer a nice proof of concept that SIF and NIRv can be scaled to GPP using continental-scale observations. On the other, higher resolution measurements of SIF are rapidly becoming available (e.g., TROPOMI, as the authors mention) and are already available for NIRv. In fact, a more extensive, global scale analysis of the NIRv-GPP relationship, using tower-scale satellite measurements, has been presented elsewhere (Badgley, Anderegg, Berry, & Field 2019).

At a minimum, the authors might consider quantifying how the scaling issue affects their modeled estimates of GPP. They could do this by comparing the coefficients of a model derived from 0.05 NIRv data against the 0.5 degree data.

The authors could also be more descriptive about how they construct their model. How is missing-ness handled? How are clouds screened for? When aggregating to 4 degrees, these details are going to be quite important for understanding how the final satellite signal is constructed.

I appreciated the authors attempt to use their study to draw inferences about the controls on productivity at the continental scale. I think this is the type of framing and analysis that has the potential to make the paper a nice contribution to the literature, as opposed to simply demonstrating that the SIF/NIRv-GPP relationship holds regional. Much of the analysis centered on a discussion on the controls of seasonality in photosynthesis. On P15 L2-8 the authors write: “Our analysis showed seasonality of soil moisture strongly controls plant productivity with a weak intervention of available shortwave radiation. . .During saturation, when the soil is very moist, the amount

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of shortwave radiation significantly impacts productivity, whereas during the growing or end period of growing seasons vegetation production has a strong proportion to soil moisture."

While possibly true, I think this analysis is a little too broad sweeping. Figure 4 shows that broadleaf evergreen forests have a decline in SWR that coincides with declines in precipitation. Personally, I think it would be quite interesting to see if per-pixel anomalies in SIF and/or NIRv track anomalies in SM. I also think that such an analysis would be more informative about mechanism. Aggregating all the data together across biomes, like in Figure 5, has the potential to hide as much as it reveals, given that averages only reflect the most common SIF-precip/SIF-SWR relationship, as opposed to potentially more complex per-biome or per-pixel relationships.

Minor Comments

P2 L19: "so-called" can have a quite negative connotation. Consider removing.

P5 L1-2: "Uncertainties in NIRv are largely due to in accuracy in measurements of canopy architecture, including the leaf projection function and the clumping index, both strongly vary in time and space (Zeng et al., 2019)." I believe that Zeng agues that NIRv carries information about the leaf projection function, as opposed to the leaf projection function causing uncertainty in NIRv measurements.

P7 LUE framework âĂŤ How appropriate is the LUE framework when you normalize by cosine of solar zenith angle. Doesn't that mean the APAR signal goes away? How should we interpret what is left?

P13 L3 The manuscript does not address uncertainties in the eddy covariance measurements, so seems unnecessary to spend so much time discussing how the approach is uncertain in tropical context.

P15 L19: Again, the paper does not use COS, making this discussion feel a little out of place.

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Works cited

Badgley, G., Anderegg, L.D., Berry, J.A. and Field, C.B., 2019. Terrestrial gross primary production: Using NIRV to scale from site to globe. Global change biology, 25(11), pp.3731-3740.

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