Biogeosciences
Discussions

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Interactive comment on "Combining hyperspectral remote sensing and eddy covariance data streams for estimation of vegetation functional traits" *by* Javier Pacheco-Labrador et al.

Anonymous Referee #2

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The work by Pacheco-Labrador et al. attempt to combine measured and emulated hyperspectral images with Eddy covariance (EC) flux measurements, to retrieve the tree-grass ecosystem physiological traits. In the work, the authors use a running fertilization experiment to build a model to predicate the ecosystem physiological traits such as Vcmax and Ball-berry slope parameter (m). the authors do an inversion to the SCOPE model, and specifically the senSCOPE model that takes into consideration the senescence of leaves in the ecosystem. The measurements include three flux towers, one for each fertilization treatment. High spatial resolution airborne hyperspectral images have been taken during the experiment over the experiment. Also, isotopic samples were taken from the ecosystem as well. The emulated data used to

introduce the potential of future satellite missions for ecosystem physiological traits retrieval. It is highly noticeable that the works contain a large amount of data from many years of measurements. Moreover, the combination of the fertilization treatments, in the heterogeneous ecosystem, using a wide range of measurements should bring to a robust understanding of the ecosystem physiological behavior. The use in the SCOPE model also allows to combine spectral and physical parameters measurements to retrieve ecosystem physiological parameters. However, reading through the manuscript leads to the filling that the current work was mainly the building of the model and less to achieve an understanding of the ecosystem relation between the measured spectral data and the physiological traits. Moreover, it is a bit problematic to estimate the model performance in Infront of other estimated values (with their on uncertainties) and not with actual measured values. Estimation of Vcmax from leaves N content (which is also estimated part of the times, according to the authors) required a large number of assumptions and should be done carefully. To my opinion, this work has a high potential to bring to a better understanding of the ecosystem physiological response through hyperspectral and EC measurements, however, several changes are required:

- All the graphs (except to figures 2&3) do not mention the fertilization treatments, maybe this addition can explain part of the variance in the graphs.

- It looks like the summer measurements are not responding to the model, maybe the authors should consider excluding these results from the model, or at least to model them separately.

- In general, the discussion is mainly explaining the technical reasons for the model behavior against the other parameters. Maybe connecting the model to the actual physiology measured in the field will lead to a better understanding of the model strengths and weaknesses.

Short comments through the MS:

- Line 77: Reference is required. - Line 79-80: This is a very simplified assumption.

many works demonstrated that the atmospheric demand is highly relevant to the transpiration and stomatal response.

- Line 86-87: Reference is required.

- Line 112: Authors should consider referring to Fu et al. (2020), PCE "Estimating photosynthetic traits from reflectance spectra: A synthesis of spectral indices, numerical inversion, and partial least square regression".

- Line 215-216: WC is a tricky parameter; the leaf relative water content is a more reliable parameter in terms of plant water status.

- Line 226: it is not clear how N content was measured please explain or add a reference.

- Line 226: which model was used? Reference.

- Line 230: Please note, if it is possible, if the estimation of Cab was done from estimated Nmass or only from measured values.

- Fig. 4: Fig. 4 please fit the letters in the legend to the figure.

- Fig. 6: to see all the points on the graph and avoid overlap, the authors should make them a bit transparent.

- Fig. 7 please add parameters to the fitted curve and RMSE value.

- Line 565: replace "response".