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Interactive comment on "Environmental controls on seasonal ecosystem evapotranspiration/potential evapotranspiration ratio as determined by the global eddy flux measurements" *by* C. Liu et al.

Anonymous Referee #1

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The manuscript "Environmental controls on seasonal ecosystem evapotranspiration/potential evapotranspiration ratio as determined by the global eddy flux measurements" by Liu et al. explores the possibility to extend the use of 'crop coefficients' from crops (as proposed by FAO) to natural vegetation. The manuscript also attempts to estimate such coefficients based on eddy covariance data from several locations in the world.

The idea is interesting, as potentially one could estimate the actual evapotranspiration from easy-to-obtain basic meteorological data, geographical location and vegetation

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type. Nevertheless, I think the manuscript does not deliver what it promises. The bulk of results focuses on the correlation between crop coefficient and climatological data or basic ecosystem properties (e.g., LAI), presenting mostly expected relations. The impact of this work would be greatly enhanced should the authors really tested their approach, by, e.g., calculating the crop coefficients on the basis of their multivariate linear model and basic ecosystem and climatic data and comparing the results with the estimates from eddy covariance data.

Aside from the specific results, the manuscript and methodology suffer from several, mostly addressable, issues: - Time scales are important, as some processes may be relevant at specific scales. Yet, it remains unclear throughout the manuscript at what time scales the method is applied and to which scales the data refer. Specifically: is the method applied at the annual time scale or at the monthly time scale? Are the data shown monthly (or annual) averages for a specific year or across several years? To what time scales do the following statements refer? L 59 (subdaily to seasonal?), L 69 (decades to centuries?), L 88 (within a certain developmental stage?), L 138 (daily, monthly, annual or multi-annual means?) - Most of the eddy covariance sites are mid-to-high latitude sites, where most likely temperature and solar radiation are the limiting factors for evapotranspiration during part of the year, potentially even leading to leaf shedding in deciduous ecosystems or absence of crops in some cropping systems. Hence, rather than working at the annual scale (as suggested by L 173), it would be probably more meaningful to restrict the analyses to months in which vegetation indeed drives actual evapotranspiration, e.g., on the basis of LAI dynamics or an indicator based on temperature/day length. This would also mean considering dry/wet seasons in the few tropical ecosystems. - More in general, this work would benefit from more attention to the main mechanisms defining actual and potential evapotranspiration. Accounting for seasonality is an example in this sense. Another example is the role of temperature, which appears not relevant in the introduction and method description, yet impacts both potential and actual evapotranspiration in a nonlinear way, directly and indirectly (e.g., via vegetation). Finally, it would be helpful to have some

more information on the crops – if annual summer crops, their winter Kc (L 164) represents other, non-vegetation related, mechanisms. - Finally, the dataset available to the authors is heavily dominated by temperate and boreal ecosystems, with very few tropical sites. I am well aware that only limited eddy covariance data are available from low-latitude sites. Nevertheless, I think that the authors should either limit their attention to temperate and boreal sites (underlining this limitation in their results) or obtain at least few more datasets from the currently under-represented ecosystems/regions. This second approach may require moving beyond FLUXNET data, but may greatly enhance the impact of the work.

Minor issues: - Please use the same symbols and terminology throughout the manuscript (e.g., potential evapotranspiration is later referred to as reference evapotranspiration). - L 63: maximum stomatal conductance may be considered an ecosystem property, but actual stomatal conductance depends not only on vegetation types, but also on soil moisture, VPD, wind speed. - L 149: LAI is not a biomass measure; it is linked to leaf biomass via the specific leaf area, but this parameter varies across ecosystems. - L 159: months are very not meaningful when combining data from northern and southern hemispheres; rather, refer to summer and winter. - L 194: as pointed out on P. 10, LAI and precipitation (and latitude) are not necessarily independent. A justification of the approach is thus necessary. - Whiskers in Figures 2-3 mix different sources of variability – across locations and, for each location, across years. I wonder if it would be more meaningful to distinguish these two aspects.

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