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Interactive comment on "Improved estimate of global gross primary production for reproducing its long-term variation, 1982–2017" *by* Yi Zheng et al.

Anonymous Referee #1

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LUE model is an important empirical model for estimating GPP. The authors added the impacts of CO2 concentration, diffuse/direct PAR, and VPD to the traditional LUE model, which showed improvement.

Line 18-35 In the abstract section, it is necessary to present some quantitative results that can directly prove the improvement of the revised EC-LUE model over other currently popular models.

Line 31-32 "The global GPP derived from different datasets exist substantial uncertainty in magnitude and interannual variations." Which datasets and which models were used here? Do the authors mean different datasets used to drive the revised

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Discussion paper

EC-LUE model? Or other models?

Line 448 Do the authors mean process based ecosystem models by biophysical models? And empirical or data-driven models by satellite-based models?

Line 50 The starting and ending years could be given while reporting a trend.

Line 70-90 (Major concern) The ratio of diffuse PAR is of course an important regulator of LUE for dense canopy. However, the amount of total PAR should not be ignored. LUE could rapidly decrease with the amount of total PAR because in clear sky the incident PAR could easily exceed light saturation point.

Section 2.1 At which temporal and spatial resolutions were the model run? And some the variables in the equations were not explained, e.g. epsilon in eq 4. Line 113 intercellular [CO2]? Line 111 add concentration after the second CO2. How was 356.51 in eq 5 determined?

Line 145-155 The fluxnet GPP contains many datasets of GPP according to the reference CO2 profile between sensor and canopy. Which dataset was used? And what is the temporal resolution of GPP, 30-min, daily, or 8-day?

Line 164 Daily mean air temperature?

Line 203-207 Those lines should go to method section.

Figure 4 (Major concern) Fig 4 could be expanded to better compare the performance of the revised EC-LUE model with other models in capturing the inter-annual and intra-annual GPP variations, to show the improvement of the revised EC-LUE model. This is important because there are a number of the existing models (process-based and the empirical LUE models as well the machine learning method). While the results about spatial and temporal variations of the GPP (from the new model and other models) should be compressed or even dropped.

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