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Biogeosciences Discussions

# *Interactive comment on* "The importance of radiation for semi-empirical water-use efficiency models" *by* Sven Boese et al.

**Anonymous Referee #1**

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Boese et al. present empirical evidence of an intercept term in the formulation of the WUE model at ecosystem scale.

The WUE models at plant scale include a non-zero intercept term ment to represent the existence of conductance under very low VPD conditions or no photosynthesis. The canopy or ecosystem-level models however do not present such intercept. The first step was to demonstrate, based on EC measurements over X sites, that the introduction of an intercept would improve the ecosystem-level WUE model. The second step was to show the existence of a seasonality in the intercept, which proved to be related to the radiation.

The main results of the study are that radiation has an influential role on the WUE, and the formulation of a new ecosystem-level ET/WUE model. The manuscript is well



written and makes a clear and substantiated demonstration of the new dependencies evidenced, and their consequences.

Specific comments

The statistical method has been treated with great care. The use of cross-validated MEF to compare models with different forms and number of parameters was a good choice. But MEF does not provide a quantitative measure of the increase in the amount of variance explained by the successive modifications to the model. Table 2 could contain such an estimation, based i.e. on the (average) changes in the RMSE. The only problem in the model definition is that the intercept is left to be negative, which has no biological meaning and probably occurs because of a particular distribution of the observations in some sites. Following the idea that the intercept represents a low-VPD conductance, a negative but significant intercept should not be counted even if there is an overall model improvement. To circumvent this issue the hard way, the intercept parameter had to be represented as a squared term: Y = a.X + Z^2 + epsilon, where Z^2 = ETres. Changing this would suppose to redo many tables and figures. So for simplicity, the occurrences of negative intercepts can be subtracted from the tables 1, 2 and Fig 1 with a mention that models with negative intercepts were not used -as done for instance in Fig. 8.

It remains unclear why the effect of the radiation was modelled as a linear (P10 L7-10). A graph would help. Overall the manuscript has the tendency to not display the data and the relationships between them. Showing, for a couple of examples, the gain in having an intercept and incorporating radiation in the modelling would be great. This could be done in the form of time series. The number of figures included in the manuscript is already large and this figure could come in the supplementary material as a complement.

Minor comments

There are diverse typos and mistakes. Nothing major, the manuscript is well written

and easy to read.

P3L 15-20. How many times (or in percent) has the intercept ETres been found significant?

P3L13. Eddy-covariance is misspelled

P3L19 and hereafter. 'rain free' should be spelled uniformly throughout the manuscript, and I would use the hyphenation for ease of reading as in P4L2.

P4L6: unfinished sentence! " This procedure can thus ensure that. . ."

P6L9 The subsection's title "Partitioning of linear models" does not represent the content of the section which explains the methods used to estimate the contribution of each term in model. Thus Contribution partitioning or estimation of the contribution of models' components could be envisaged.

P6L 21 In the equation 9 it is not clear that the sum refers to the entire denominator, brackets should be used to avoid any misreading: $\sum ET + r.Rg$

would become $\sum(ET + r.Rg)$.

P7L 15. The variable STO has not been introduced!

P9L7. space needed between 0.34 and mm.

L8. Cut "is" in "a quarter of transpiration is was not. . .".

L11. Insert 'the' in ". . .was due to remaining contributions of. . .".

L19. cut 'representation' in "a missing process representation in the model. . .".

P10L7. replace 'parameter' by 'ETres' in "The seasonality of the parameter suggests. . .".

P10L9. Replace 'an' by the form of an in "It was therefore introduced in an additional. . ."

Table 2. Indicate the number of sites used to compute the mean MEF. Is the number



constant between variants?

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