

## ***Interactive comment on “Response of carbon fluxes to water relations in a savanna ecosystem in South Africa” by W. L. Kutsch et al.***

### **Anonymous Referee #4**

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#### General comments

The authors present a study of the influence of soil water status on carbon fluxes in savanna ecosystem using eddy covariance data from a 9-month experiment.

The study represents an interesting study of different weather and soil status conditions in order to explain carbon fluxes in savannas. However, the authors do not explain enough the implication of using EC method to explain the processes they study. They intend to partition  $F_c$  measured from EC to partition between canopy assimilation and respiration but they did not use it to argue their discussion.

It is also well known that carbon and water fluxes are strongly coupled. The authors should either take advantage of many papers dealing with EC measurements or place

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their study in a way that clearly makes it different.

Finally, the paper is difficult to follow because in one hand the authors are not thorough enough and in the other hand, many parts need additional explanations.

### Specific comments

Introduction is too long. Some paragraphs can be moved to 'material and method' section. There are too many figures.

p. 2199, line 13: delete coma before Hutley et al 2000.

p. 2199, lines 8-14: Too many references for this subject. Keep only these that are used later on.

p. 2199, line 27 - p2200, line 3: move at least these lines to 'material and method' section.

p. 2200, lines 19-21: the authors state that influence of temperature on respiration described by exponential equation provides a good fit to the temperature-respiration relationship at short timescales, despite it has been criticized by recent papers (e.g. Davidson et al 2006).

p. 2201, lines 10-11: the same as above. Select some references or explain what each of them brings.

p. 2201, lines 18-19: Any references?

p. 2201, line 29: it is not clear if 'this study' means the present study or the paper cited before?

p. 2202, line 1: delete space between 'sto' and 'matal'

p. 2202, lines 4-8: move to 'material and method' section

Change 'Methods' by 'Material and methods' section.

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The authors mention the 'Kruger National Park' in the introduction but not in the description of the site. Was it a different place where the EC measurements took place?

p. 2202, lines 18-20: give coordinates of the tower.

p. 2202, lines 21-24: what is the impact of the undulating form of the landscape on EC measurements? Here you explain that combretum savannas are on the crests and acacia savanna on the lower parts. This is inconsistent with the sectoral analysis of EC measurements (p. 2199, line 27 - p2200) which seems then not adapted. Please explain.

p. 2203, lines 6-7: explain why 0-10 cm and 0-30 cm?

p. 2203, eq. 1: explain what is 'WCakt'.

p. 2203, lines 12-18: many of the graphs are already explained in the figure caption. Text can be reduced. Esp. delete 'Precipitation is shown as cumulative curve' and 'In the lower part...long-term mean'.

p. 2203, line 26: clarify 'i.e. within canopy LAI ~ 3.0' even though the sentence before is 'increasing to an average of approx 1.0.'

p. 2203, line 26-p 2204, line 3: the meaning of this sentence is not clear to me. Please re-phrase.

p. 2204, line 6: the EC system was mounted at 16 m above the ground, but how high above the trees was the system? You never mention at least the mean trees height.

p. 2205, line 3: why did you use 'small towers' to measure temperature and soil moisture of the soil? Please clarify.

p. 2205, lines 8-11: which software did you use for calculating 30 min fluxes? Which quality control and filtering did you perform?

p. 2205, eq. 2: any reference?

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p 2205, line 18: explain what is  $t_0$  and  $t-1$

p. 2206, eq. 3: what is FR. You explain that it is detailed in the section result but I can't find it. Is it the same as 'Reco' in eq 7.

p. 2206, eq. 4: what is  $FP_{sat}$ ?

p. 2206, line 21 : what is the link here with eq. 4?

p. 2206, line 25: explain this multiplication factor. Where does it take from?

p. 2207, line 4: please unit of VPD in Pascal! Same remark for Figure 6.

p. 2207, line 7: explain the value of  $2000 \text{ mmol m}^{-2} \text{ s}^{-1}$

p. 2207, line 15: explain shortly what is this  $D_0$  coefficient.

p. 2207, lines 19-23: the title is not in accordance with the text. You should develop the analysis of figure 2 and Table 1? Why do you use another splitting (wet/medium/dry) in Figure 4? This part needs significant improvement, at least add something about phenology.

p. 2208, lines 6-8: delete this sentence. It is redundant with figure caption. Is  $F_c$  the same as  $F_{CO_2}$  or  $F'_{CO_2}$ ?

Figure 3: why don't you perform non-linear adjustment in order to give accurate conclusions? Why don't you use PAR in spite of global radiation? Is the conclusion that there is no difference between the two types of vegetation is available for all periods described in Table 1? Why do you illustrate only period 3?

p. 2208, line 25: from where do you deduce the  $Q_{10}$  value? Explain.

p. 2208, line 25 - p. 2209, line 7: This part should take place in the discussion section. This could avoid using Fig 8 before Fig. 5! I guess Reco,ref is what you call  $R_{15}$  in Fig. 9. I also guess you mean Fig. 9 instead of Fig 8?

p. 2209, eq. 7-9 : many terms need to be defined:  $T_{ref}$ ,  $T_{soil}$ ,  $T_0$ ,  $RSWC_{1/2}$ ,  $RSWC_0$ ,

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etc.

p. 2209, line 19: rates of what? which model do you mean? Is 'measured' means measured by EC method? The correlation is not so strong ( $r^2 = 0.65$ ). Justify your conclusion.

p. 2210, lines 10-14: delete this sentence as it is already explain in the Figure.

p. 2210, line 23: delete 'the' before 'during the dry season'

p. 2210, line 25: I guess you mean 'eq 6'? Again you use Fig. 9 before Fig. 7. You write 'The annual courses of the coeff c in eq 6 describing the sensitivity of canopy conductance of VPD is summarized in Fig 9' and what? Develop or delete this sentence which bring any information.

p. 2210, line 25- p. 2211, line 6: what about Fig. 7a-c-e-g? Again Fig 9 comes before Fig. 8.

p. 2211, line 7: explain how you estimate WUE and add it to the material and methods section. Why don't you give the hyperbolic functions?

p. 2211, lines 8-13: develop.

p. 2211, line 15: replace eq 5 by Eq 6.

p. 2211, line 15: what are these optimum water conditions?

p. 2212; line 1: replace 'C' by 'c'. Develop or delete this graph.

p. 2212, line 3-7: avoid the repetition of what you explain in the Figure caption and the text and try to bring new information!

p. 2212, first paragraph of the discussion: all this part needs to be better argued. The conclusion looks like more speculation than discussion.

p. 2213, line 2-3: Why don't you use  $F_p$ , sat instead of  $F_p$ ,max? Explain how do you get these values?

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The following publications have been forgotten in the reference list: Boone et al 98, Hummelshøj (1995), White (1980).

Figure 1. Add (a) for the top graph and (b) for the bottom one. Delete 'In order ... August to July'.

Figure 3. Delete the last sentence. It is useless as the symbols are in the graphs.

Figure 5. Delete '(regression values ... top)'

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