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Interactive comment on "Application of relaxed eddy accumulation (REA) on managed grassland" *by* M. Riederer et al.

Anonymous Referee #2

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The paper has two main topics: the first one is the applicabiliy of the REA technique to measure fluxes according to the management periods of the field, and the second is the analysis of isotopic CO_2 fluxes on two summer days, with an attempt to discriminate between photosynthesis and respiration of the grassland.

From a general point of view, the work is well conducted and offers interesting results. It is relevant for, and deserves publication in AMT, once some clarifications would have been brought by the authors.

1. Title: it is too vague and does not reflect the substance of the paper. Though I could give some suggestions, I leave the choice to the authors.

2. Abstract: It should involve the results of the second part of the paper (isoflux and

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assimilation/respiration partitioning).

3. There is a need for clarifications in definitions, equations, units, etc.. The authors discuss about 12CO2 and 13CO2 fluxes, which are not in the same unit. So, their ratio as presented in Fig. 6 cannot be easily interpreted. It is said in the conclusion that "isoflux represents 2.5% of the entire CO2 flux", this should be consistent with the plots in the figures. CO2 flux is expressed as a mass flux (e.g. in μmol/(s*m**2)), 13CO2 flux should be expressed in the same unit. If not, this is not a mass flux, and a non-ambiguous label should be used (e.g. Delta_F instead of F) and the precise definition and unit should be clearly given. Equation (7) should be demonstrated, starting from the definition of the flux and the isotopic ratios. Equation (1): given that air density is present in the equation, the scalar should be expressed in mixing ratio unit. This should be clearly indicated (avoid the use of "concentration" which is ambiguous).

4. Introduction: This section is a nice review of the scientific context of the study. I would suggest to add a short paragraph explaining what the authors are going to present in their paper.

5. p. 4989, lines 9-10: I think it is the opposite: The biomass is 13C depleted with respect to the atmosphere (mainly for C3 vegetation), and therefore the 13C isotopic ratio increases in the air during the assimilation period. Note that such an increase in the air (less 12C with respect to 13C) does not necessarily result in an increase of the 13C mixing ratio in the air . . .

6. p. 4991-4992: there is a long list of works relative to the REA technique and related parameters variability. It is certainly impossible to be exhaustive in this presentation, however I would suggest to add the references to Andreas et al. (1998) and Fotiadi et al. (2005) regarding the variability of the "b" coefficient.

7. Equation (3) and p. 4992, line 21: If the deadband is chosen symmetrical with respect to zero, then the condition for downdraft selection should read "w < -w0" (assuming w0>0). Also note that different thresholds for up- and down-drafts can be chosen. I

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suggest to remove "linear" (or replace it with "constant").

8. Equation (4): The correct formulation is : ABS(w'c'/(Sigma_w*Sigma_c)) >= H. This need more discussion, because HREA requires the real-time knowledge of the w and c variance. How is it achieved?

9. Equations (5) and (6): it is unclear. (5) should be removed. Given that the correlation cannot be calculated between the REA variable and its proxy, but only between two possible proxies, I suggest modify (6) into: r_c_proxy1,c_proxy2 = ... Over which period of time are computed the correlation coefficients?

10. p. 4997: Aren't the same things as said in lines 7-8 and lines 14-15?

11. Equations (10) and (11): There is a problem of sign. Fluxes should be algebraic (positive upwards). The equations should verify F_A+F_R=F_EC.

12. p. 5001, lines 20-22: the last sentence of the paragraph needs rephrasing.

13. p. 5002, line 2: "... neither T_s nor H2O are suitable ...".

14. p. 5002, line 28: remove "first".

15. p. 5003, lines 19-21: sample carry-over in REA systems could also be a source of reduction in concentration difference, resulting in an artificial increase of "b" coefficient.

16. p. 5004, line 18: what means "... F_ISO and F_EC balance ..."?

17. p. 5006, last sentence: what means that?

18. Fig.1: The whole REA system would need a sonic anemometer, and, for HREA, a fast gas analyser.

19. Fig. 3: "Absolute value" should be indicated in the caption.

20. Fig. 4: Some other parameters should be added on this figure, like the CO2 flux, 13C and CO2 mixing ratios in up- and down-drafts.

21. Fig. 5, caption: -24.9.

References:

Andreas et al., BoundaryLayerMeteorology 86: 409–420, 1998.

Fotiadi et al., Boundary-Layer Meteorology 114: 615–640, 2005.

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