

Title: *Drivers and **vertical** CO₂ flux **balances** in a Sahelian *Faidherbia albida* agro-silvo-pastoral parkland: Insights from continuous high-frequency soil chamber measurements and Eddy Covariance.*

Author (s): Seydina Mohamad Ba et al.

MS type: Original research article

Manuscript No.: egusphere-2025-2660, submitted to Soil

Dear Editor and Riccardo Picone,

We would like to thank you once again for taking the time to carefully examine the authors' responses to the various questions and comments you had previously raised. We then received a series of minor revisions from you, which we have fully taken into account and incorporated into the revised version of the manuscript. We greatly appreciate this feedback, as it has significantly improved the quality of our article.

Please find below the additional revisions requested by the editor and an updated version of the authors' responses to the reviewer RC1. For clarity:

- Editor comments are shown in *red italics*;
- Additional revisions are presented in **green bold text**;
- The comments of reviewer are presented in *black italics*;
- Updated responses, with final line numbers, appear in plain black text, and changes made to the manuscript are indicated in **blue bold**.

With best regards,

On behalf of all the co-authors,

Seydina Mohamad BA,
PhD candidate in the EU-funded CASSECS project
IESOL, Centre IRD-ISRA, 18524, Dakar; Senegal
Email: seydina.ba@ird.fr

and

Olivier Roupsard

Researcher

CIRAD, UMR Eco&Sols, Dakar; Sénégal

Eco&Sols, Univ Montpellier, CIRAD, INRAE, Institut Agro, IRD, Montpellier; France

IESOL, Centre IRD-ISRA de Bel Air, 18524, Dakar; Senegal

Email: olivier.roupsard@cirad.fr

Additional revisions requested by the editor

Authors' responses to the editor

Editor's report:

Comment #7

The response #7 on comment #7 by reviewer 1 (Riccardo Picone) is not yet entirely clear. A more detailed explanation of a measurement sequence, including the measurement frequency, chamber closure time and purging time, could contribute to the clarity of the manuscript.

Response #7

The main automated steps of the CO₂ flux measurement cycle (purging, chamber closure, measurement delay, CO₂ accumulation measurements, and chamber reopening) have been provided in Supplementary Material S1, in Table S1.2.

Updated authors' responses to the reviewer RC1

Reviewer's report:

This work reports a comparison of carbon fluxes between different zones of an agroforestry system during one whole year assessed with two different methodologies. A comparison of the two methodologies was also done. The topic is therefore highly relevant for the journal. The abstract does a good work in framing the context of the study and the relevance of the findings. The introduction effectively presents the topic and its importance, by highlighting key knowledge gaps that will be addressed by the study. Anyway, I would suggest including a brief description of the Eddy Covariance method in this section. In my opinion, the main problem of the paper is that clear starting hypotheses that have driven the work were not stated. This should be addressed. Methodologies appear to be consistent and appropriately described, and all the reported methods have the appropriate bibliographic reference. I would only suggest some minor integrations to the experimental design description. Results are correctly reported in all the necessary detail. The discussion does a very good job in comparing the results to other studies, hypothesizing mechanisms driving the findings, and highlighting limitations of the study. Conclusions realistically summarize the key discoveries. All supplementary materials are relevant and correctly reported. The authors are requested to carefully proofread the "references" section because some journal names are not correctly abbreviated. Based on these considerations, I would recommend minor revisions to be applied to the manuscript before it can be accepted for publication.

Hereafter follow the specific comments I made on the text. Text between quotation marks indicates citations from the manuscript. When multiple lines are indicated, the comments refer either to a full sentence or to a meaningful part of it

Comment #1

L. 43 Please report the full name of the species when it is first mentioned in the abstract.

Response #1

The full name of the species was mentioned

Line 43: "*Faidherbia albida*" (Revised version)

Comment #2

L. 57 I would suggest deleting the phrase “of trees”.

Response #2

The correction was done.

[Line 57: “fertile island effect” \(Revised version\)](#)

Comment #3

L. 64 I would suggest briefly describing the methodology used for this technique.

Response #3

The methodology used for EC technique is described as follows:

[“The EC technique quantifies CO₂ exchanges between ecosystems and the atmosphere by correlating fluctuations in vertical wind velocity with simultaneous variations in CO₂ concentrations, providing a direct and non-invasive estimate of CO₂ fluxes \(Baldocchi, 2003\).”](#)

[Line 66 to 69 \(Revised version\)](#)

Comment #4

L. 95 “upscaling” Undertsanding/comprehension?

Response #4

Thank you for pointing this out.

The main idea, here, is to partition the ecosystem fluxes by compartments (soil and trees).

The corrected sentence becomes:

[“When combined with EC, this dual-method approach strengthens source attribution and improves the partitioning of fluxes across complex agroforestry landscapes”.](#)

[Line 97 to 99 \(Revised version\)](#)

Comment #5

L. 99 The hypotheses that have driven the study are not stated.

Response #5

Thank you very much for this comment, which further improves the quality of the paper.

We have therefore added the following assumptions:

(1) Rch and GPPch are higher under the canopy of *F. albida* than in full sun, (2) soil moisture is the main environmental factor directly controlling both Rch and GPPch, (3) when extrapolated to the field scale, the chamber-based method provides seasonal dynamics of respiration and photosynthesis fluxes comparable to those derived from EC technique.

[Line 108 to 112 \(Revised version\)](#)

Comment #6

L. 139 At which distance from the trees were the chambers installed?

Response #6

This was already mentioned in non-revised version line 139 (...at least 20 m from trees).

[Now in line 148 \(Revised version\)](#)

Comment #7

L. 147 "half-hour flux measurements" Does this mean that the measurement was repeated every 30 mins in each chamber? If so, I suggest being more clear on this.

Response #7

This question is now fully addressed by providing and supplement table in [Supplementary Materials S1, in Table S1.2.](#)

Comment #8

L. 160 "indicated" Indicating?

Response #8

The correction has been made.

[Line 169: "indicating" \(Revised version\)](#)

Comment #9

L. 166, 168 "NDVI", "LAI" Please report the full name.

Response #9

The full name for NDVI ([normalised difference vegetation index](#)) and LAI ([leaf area index](#)) was reported.

[Lines 175 and 178 \(Revised version\)](#)

Comment #10

L. 172-174 How often were VWC and Tsoil measurements repeated?

Response #10

“[All at 5-min intervals](#)”, this measurement frequency for VWC and Tsoil was already indicated in non-revised version line 174.

[Line 184 \(Revised version\)](#).

Comment #11

L.223-227 These two sentences are a repetition.

Response #11

The repetition has been removed.

[Line 230 to 232 \(Revised version\)](#)

Comment #12

L. 344 Inside “the” chambers.

Response #12

The missing article “the” has been added.

[Line 354 \(Revised version\)](#)

Comment #13

L.351 “references” Reference

Response #13

The correction has been made.

[Line 362 \(revised version\)](#)

Comment #14

L.s 387-388 How do you account for a standard error of the same entity of the measurement itself?

Response #14

Here, it refers to the mean \pm standard deviation, not the standard error. I have added this clarification in the text.

The sentence now reads: “FS showing (mean ± standard deviation) $0.9 \pm 0.9 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ (modeled) and $1.3 \pm 1.2 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ (measured)”.

[Line 398 – 399 \(Revised version\)](#).

Comment #15

L. 483 “GPPshowed” A space is needed here.

Response #15

Corrected.

[Line 476 \(Revised version\)](#)

Comment #16

L. 553 “F. albida” Italics is needed here.

Response #16

Corrected

[Line 590 \(Revised version\)](#)

Comment #17

L. 617 “roots” Root

Response #17

Corrected

[Line 654 \(Revised version\)](#)

Comment #18

L. 634 I suggest deleting these two abbreviations (AF and FS).

Response #18

The deletion was made

[Line 669 to 678 \(Revised version\)](#)

Comment #19

L. 683 “have been also” Have also been.

Response #19

Corrected

[Line 721 \(Revised version\)](#)

Comment #20

L. 692 "and cowpeas" I do not understand why this is reported here since this crop was not grown during the experimental period.

Response #20

The field where the EC flux tower is installed features peanut cultivation intercropped with cowpea. Therefore, the ecosystem respiration fluxes (Reco.EC) measured by the tower include the contribution of cowpea to respiration.

[Lines 273 to 276 \(Revised version\)](#)

Comment #21

L. 696 "field's" Field.

Response #21

Corrected

[Line 734 \(Revised version\)](#)

Comment #22

L. 710 "footprint's" Footprint.

Response #22

Corrected

[Line 748 \(Revised version\)](#)

Comment #23

L. 727 "compartment's" Compartment.

Response #23

Corrected

[Line 766 \(Revised version\)](#)

Comment #24

L. 734 "advancing understanding" Advancing the understanding.

Response #24

Corrected

[Line 773 \(Revised version\)](#)

Comment #25

L. 740, 767, 772 "system's" System.

Response #25

Corrected

[Lines 777, 806 and 812 \(Revised version\)](#)

Comment #26

L. 770, 794, References "F. albida" Italics is needed here.

Response #26

Corrected

[Lines 810 and 843 \(Revised version\)](#)
