

Referee report for amt-2024-6 (Teng et al., Field assessments on impact of CO₂ concentration fluctuations along with complex terrain flows on the estimation of the net ecosystem exchange of temperate forests)

General Comments:

I think this is a very important and good study. It addresses the role of short-term fluctuations of CO₂ on the estimation of storage term (Fs) in forest over complex terrain, using an innovative method (decision-level fusion model), which proves quite useful. By analyzing specific time series of three towers and classifying them using different drivers. They also estimated and compared the storage flux using a 10Hz eddy-covariance system and an atmospheric profiling system, additionally multiple statistical methods to analyse the uncertainty of Fs were employed.

This work shows a great effort to establish a methodology to reduce inaccuracies when estimating NEE, focusing on the storage term using different experimental sites and seasons. I think the title of the work is very striking, but it seems to me that the discussion about the complexity of the terrain went to the background, the discussion about this issue should be broader. I think that the Appendix about the TCI needs at least a couple of references and more context (images), since it is a complex topic to understand and it is not clear if the authors propose the descriptor or it was previously established. A couple of figures in the paper (Figs. 10 and 11) need some quality touches, since it is not possible to clearly see the legend to distinguish the lines.

I have some suggestions. Although they are a bit numerous, I classify them as ``minor'', because I think the study is very good and relevant and, as such, it deserves publication. Therefore, this is what they are, suggestions. The authors should feel free to address them or not.

Mostly minor/editorial-type comments:

L. 97: Personally, I think you should use numbers when referring to time averages along all the text. So replace two-min by 2-min

L. 158: The exact name of integrated system from Campbell Scientific you are using is the CPEC310. So for me it would be better read something like: "The CPEC310 integrated system from Campbell Scientific comprising an ..."

L. 159: Remove "ray" word. IRGA = InfraRed Gas Analyzer

L. 175: replace "Dolton's" by "Dalton's"

L. 185: the CO₂ molar mass is 44.01 grams per mole.

L. 218: Mention explicitly the average time windows you employed.

L. 225: In Equation (9) explain what the "i" index refers to

L. 242-244: Why did you use 15d window? What does "i was located" mean?

L. 254: As mentioned previously: It seems not to be very comprehensible. More detail and references need to be added to the Appendix A.2.

L. 303-305: I am not sure if "amplitude" is the appropriate word, because you are referring to the "variation or magnitude" in the diurnal cycle. It might be confused with the amplitudes you got using EMD and spectral analysis.

L. 314: Caption in Fig. 5 replace "donate" by "indicate", or "represent"

L. 355-357: I think it is very important to why the reduction in random error approaches to behavior of white noise.

L. 408: It is necessary to explain what is shown in Figure 10. Explain clearly each one of the predictors (independent variables) you employed in the multiple linear regression. Why does mean $\ln(A_{\max})$ and $\ln(P_{\max})$? You can explain this better in the caption of the figure.

L. 419-422: Figures 10 and 11. Use the tags ((a), (b), (c), ...) from the plot to better describe the caption of the figure.

L. 428-442: This discussion is not easy to follow.

Appendix:

A.1

L. 689: Equation A.1. In the denominator is missing the "j" index

A.2

L. A figure would be illustrative to understand what are $P_{\{d\}}$, $S_{\{v\}}$, etc.