Comments reviewer 2

This manuscript reports a novel comparison of multiple micrometeorological sites classified as Class 1 and 2 within the Integrated Carbon Observation System (ICOS). The study focuses on assessing the correction of high-frequency attenuation for CO_2 and H_2O flux data, and their effects under different atmospheric conditions, using two well-known approaches (one analytical and one theoretical). Based on this analysis, the authors reach the important conclusion that the correction factors for CO_2 are significantly lower compared to H_2O under humid and very stable conditions, particularly for low-height sites experiencing strong attenuation.

The manuscript is relatively well written, but I believe the analysis could benefit from a stronger discussion of the mechanisms behind high-frequency attenuation corrections. Additionally, the deployment of the open-source tool is a highly valuable contribution that can be tested by the micrometeorological community and potentially implemented in future versions of eddy covariance processing software like EddyPro. Overall, this work is a great contribution to Atmospheric Measurement Techniques and the micrometeorology community.

⇨ Since we do not propose any new fundamental developments regarding high-frequency loss corrections in this paper, we initially chose to provide only a brief overview of the different mechanisms responsible for these losses and to refer readers to seminal publications for a more detailed discussion. Nevertheless, following the reviewer's suggestion, we have expanded the discussion of the mechanisms underlying high-frequency attenuation in Lines 55–60 and in the new Section 4.5.

I recommend minor revisions and request that the authors address my questions and specific points below.

General Comments

• To complement Section 2.1, I recommend including a summary table (perhaps in the supplementary materials) detailing the specific sites used in the study. Even though the sites are listed in Figure 1, providing their respective EC heights, sampling rates, ecosystem types and characteristics, and location countries would be highly beneficial for context.

⇨ We followed your suggestion. Table F was added in the annexes, listing station ID, coordinates, plant functional type (PFT), height of the eddy covariance system (EC h, m), mean canopy height (can h, m) and flow rate of the gas sampling system (L min^{-1}).

• While the paper focuses on enclosed-path gas analyzers as they are the standard in ICOS, do you intend to analyze other types of IRGAs (e.g., open-path or closed-path)? Since the type of gas analyzer directly impacts the necessary high-frequency attenuation corrections, and given that the enclosed-path setup is specifically designed to combine the benefits of open- and closed-path systems, discussing this would strengthen the text. I suggest mentioning the pros and cons of applying co-spectral corrections to these other types of IRGAs in the paragraph starting on Line 41.

⇨ Our priority after the publication of this paper will be to explain the differences between our results and the ICOS processing pipeline, hoping to improve the latter one, either by solving factual site-specific mistakes possibly linked to metadata or by re-questioning some methodological choices so we have no short-term project to expand this analyser to other set-ups but we fully recognize the added value of such a work. The open-source FREQCOR tool would ease such kind of work.

⇨ We added a short discussion on open and closed-path analysers, as suggested. It is positioned as the last section of the discussion rather than in the introduction in order to maintain the focus on the setup primarily considered in this paper, namely the enclosed-path configuration". It reads: " This study was limited to enclosed-path gas analysers, and therefore its conclusions are limited to this configuration. Other set-ups do exist, involving open-path or closed-path gas analysers, the latter being often used for other gases than CO_2, in particular CH_4 and N_2O where also H_2O is measured. For EC systems based on open-path analysers, high-frequency attenuation are intrinsically small, limiting the importance of the specific correction method. For closed-path systems, however, especially when long sampling tubes and limited flow rates are involved, the potential differences between spectral and co-spectral approaches to correcting high-frequency losses could be important and have not been addressed here. Differences related to sensor separation are expected to be more limited, even for non H_2O, because the increasing importance of tube effects may overwhelm the sensor-separation effect, as observed for H_2O in the present study. On the other hand, noise removal, which is already potentially problematic with enclosed-path analysers and is specific to the spectral approach, could become more critical as stronger tube-related attenuation increases the likelihood of noise at the high-frequency end of the spectra. A similar multi-site study, facilitated by the availability of a standardised dataset based on such analyser configurations, would therefore be valuable.".

Specific Comments and Technical Corrections

• Line 45: The word "Observation" is misspelled as "Obervation" within the network name.

⇨ The spelling has been corrected.

• Line 55: There is a missing closing parenthesis.

⇨ This sentence has been modified following a suggestion of the reviewer 1.

• Line 121: The notation could be clarified here. Since this is the first formal introduction of the stability parameter, I suggest using a distinct symbol (e.g., $\zeta = z/L$) rather than zL, or explicitly stating that this notation will be used for this parameter throughout the manuscript. Please explicitly define the parameter as a dimensionless quantity, use unambiguous notation for it, and make sure the same notation is used everywhere.

⇨ We followed you suggestion of simply using "z/L" everywhere and added the dimensionless aspect.

• Line 127: A reference is missing and appears as a "?".

⇨ Now showing Eugster and Senn, 1995

• Line 144: As "cof" is used repeatedly, I recommend using "cut-off frequency (cof)" rather than "cut-off frequency – cof –" for clarity. The same applies to the abbreviation "CF".

⇨ We followed your suggestion and adapted slightly the sentence to avoid using brackets within brackets : "…, wind speed classes were used for both gases and computation steps, namely cut-off frequency (cof) and correction factor (CF) estimation".

• Line 211: A period is missing between "exchange" and "This".

⇨ Period added.

• Line 221: Please ensure consistent formatting of CO_2 throughout the manuscript (e.g., it alternates between italics and standard text in Lines 206, 221, and 233).

⇨ Converted to standard text in all places where it was not the case.

• Line 368: I suggest replacing "data with WSs of 2 to 3 m s^{1}" with "data with wind^{-} speeds (WSs) between 2 and 3 m s^{1}".$^{-}$

⇨ Done.

• Line 468: Replace "compare" with "compared".

⇨ Done.

• Lines 491–492: I suggest replacing "lower CFs, again due to the shift of the shift of the reference co-spectrum towards higher frequencies" with "lower CFs, which is again attributed to the shift of the reference co-spectrum towards higher frequencies."

⇨ Done.

• Line 627: Please add the term "kinematic" when referring to the fluxes and use overbars and primes to distinguish averages and fluctuations, respectively. For example, the fluxes should be written as $\overline{w'T'}$, $\overline{w'c'}$, and $\overline{w'h'}$, as appropriate.

⇨ You are of course right. Done.

• Figures 5 and 6: Please increase the font size of the labels and axes to improve readability.

⇨ Done.

• Figures B1–B4: Please increase the font size of the WS class labels to improve readability.

⇨ Done.