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Atmospheric Measurement Techniques Discussions

Interactive comment on "Uncertainty of the hourly average concentration values derived from non-continuous measurements" *by* László Haszpra and Ernő Prácser

Anonymous Referee #2

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Review of the manuscript: "Uncertainty of the hourly average concentration values derived from non-continuous measurements" by László Haszpra and ErnÅŚ Prácser (AMT)

The manuscript presents a short analysis of CO2 measurements at Hegyhatsall tall tower in Hungary, focusing on the calculation of the hourly aggregation errors made from incomplete measurement series. Indeed CO2 measurement tall towers generally only use one analyzer to measure concentrations at several (3-5) levels. As a result, the measurement period must be distributed between these different levels, and the hourly averages provided to international databases are calculated with an uncertainty

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related to the representativeness of the measurement intervals, compared to the entire hour. The paper describes the methodology of this analysis very clearly, with very clear figures. I propose few minor corrections below, but I would like to see two important points developed before publication:

- the first point concerns the possibility of generalizing these results to other sites, by determining a relationship between the hourly aggregation uncertainty and the variability of the CO2 signal over the periods available.

- the second point concerns the discussion of the importance of hourly aggregation uncertainties for atmospheric inversions. It is essential to discuss more about random errors vs systematic errors, and to remember that atmospheric inversions currently only use measurements made when the atmosphere is well mixed, and therefore with minimal aggregation errors (according to your analysis).

Few comments:

Line 43: "which adds to the common instrument noise and scale uncertainty": I think there should be a clear distinction between random and systematic errors. Please specify that the latter are more critical in the context of atmospheric inversions, and those discussed in the paper are random errors.

Line 106-112: "we selected only those periods when the measurement elevation (82 m above the ground) was well within the planetary boundary layer" : I do not see the point of excluding those periods from the analysis. I would recommend to keep them and provide the results as a separate dataset

Figure 4: please clarify the period considered in this figure Line 180: "the shorter the sampling period the lower the uncertainty of the calculated hourly averages": I would rephrase this sentence to make it clear that the more injections of short duration, the lower the uncertainty.

Line 221-223: "It should be emphasized that the numerical results presented here may

be highly site-specific. . ." : The question that the paper does not answer is whether the uncertainty is site dependent or a function of signal variability. Would it be possible to establish a relationship between the estimated uncertainty and the variability of the observed signal? With such a relation would it be possible to generalize the estimation of uncertainties?

Line 235: "Our analysis has shown that the uncertainty derived from the non-continuous sampling at the tall tower sites may be significantly higher than the other terms of the measurement uncertainty": It seems to me that this conclusion deserves to be weighed. First of all, it is necessary to differentiate between random errors, such as the one discussed in this paper, from systematic errors such as those related to calibration scales. The latter is clearly more detrimental to the calculations of CO2 fluxes by the inverse methods. In addition, it should also be noted that most of atmospheric inversions only use data from tall towers during the afternoon, due to their difficulty in correctly reproducing the atmospheric dynamic the rest of the time. As a result, the data used in inversions correspond to those where the uncertainty of hourly aggregation is the lowest as shown by your analysis.

Line 242: "Metadata on sampling frequency and integration time, as well as more uncertainty studies, may help their work": Fully agree. One's could also considered to provide users with minute average concentrations rather than hourly average.

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