Nonlinear Processes in Geophysics Discussions

Nonlin. Processes Geophys. Discuss., referee comment RC2
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Comment on npg-2021-27

Anonymous Referee #2

Referee comment on "Characteristics of intrinsic non-stationarity and its effect on eddy-covariance measurements of CO_2 fluxes" by Lei Liu et al., Nonlin. Processes Geophys. Discuss., https://doi.org/10.5194/npg-2021-27-RC2, 2021

GENERAL COMMENT

The manuscript analyses the issue of the intrinsic non-stationarity in observed data, due to turbulence randomness. The importance of accounting for it when using the eddy-covariance method to evaluate the CO_2 vertical transport is discussed. Data measured in an urban context, in the city of Beijing, are considered.

The rationale and goals of the work are clear, the text and discussion are well presented and streamlined. However, in general the discussion remains mostly on a technical level and not much interpretation of the physical processes related to the intrinsic non-stationarity is offered. Also, while data collected in an urban boundary layer are used, specific considerations of the effect of the urban complexity are missing in the analysis. This could be possibly done by proposing the analysis also for data collected in a homogeneous site, when available: the authors might consider performing this additional work.

There are some choices in the approach that would need more justification or support. Some additional deepening not only on the methodology, but also on the results achieved, would increase the scientific impact of this contribution. In my opinion there is room for improvement and the manuscript can be considered for publication after revision. Specific comments are following, indicating as Lxxx-xxx the lines to refer to in the manuscript.

SPECIFIC COMMENTS AND REMARKS

L11-16: the first part of the introduction is rather general and goes far beyond the specific topic and purpose of the work presented: a more focused introduction would be worth, with more specific references to the related literature.

L58-60: the improvement achieved using the DFA method and the reasons to choose it should be better introduced and explained, citing the original publication is not enough.

L72: is there any specific reason why n=1 was chosen for this study?

L84-90: besides the description of the instrumentation, given that the data cover a period of just one month in Summer time, some details on the typical meteorological conditions of the area and on how the urban geometries may interfere with and affect the incoming flow would be worth. Also, being Summer time, one can expect that the main pollutant emissions are due to traffic and possible industries: some information on this could be added.

L91-96: since the work of Vickers and Mahrt (1997) is used not only for their quality-control method, but also later on as a reference for discussing the results and the approaches to diagnose the non-stationarity, a brief summary of the their method and paper content would be worth.

L103-104: the averaging time for this type of analysis is generally chosen as 900, 300 and 60 seconds: the use of a 6-s averaging should be explained and supported; why didn't the authors consider a 60-s-order average? The transition from 900-300 s time averaging to 6 s is rather sharp, and it is not surprising that the fluctuation functions differ. It would be interesting to consider an intermediate averaging time.

L118: an introductory sentence explaining why the OU model is used here would be worth.

L130-131: why now a 5-minutes Reynolds average time is used?

L160-165: it is not fully clear to me how the RN-method of Vickers and Mahrt is applied, how the 'proportion of diagnosed stationarity' is computed: since this is an important part, what has been done should be better detailed and clarified.

L179-180: could the authors comment on how much the value of the crossover scale, here found as 27 seconds, can be related to the specific case considered in the study and what could be expected in different conditions? Beside recalling the results, some more discussion on how they contribute to the research field and on what is novel should be included.

TECHNICAL REMARKS

Figure 3a: comparing the curves in a single plot is hard, I suggest to include a graph for each curve so that the differences are more visible.

Figure captions: maybe better 'dashed line' than 'broken line'?

References: the way the references are cited in the manuscript should be in brackets when simply listed and not explicitly recalled in the sentence.