Atmos. Meas. Tech. Discuss., 3, C2384–C2388, 2011
www.atmos-meas-tech-discuss.net/3/C2384/2011/

Atmospheric Measurement Techniques Discussions

Interactive comment on "CO₂-gradient measurements using a parallel multi-analyzer setup" *by* L. Siebicke et al.

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Received and published: 4 January 2011

Final Author Comments to Anonymous Referee #1

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4 January 2011

On behalf of all co-authors I would like to thank the referee for the positive feedback about ideas presented in this publication and for suggestions provided for improvements. Below is our response to the referee's comments.

1 General comment (1)

The referee is concerned about the resources required ("large number of expensive instruments required"). While this is generally true, we would like to mention two things: first of all the budget for the multi-instrumental setup presented in this study (CO_2 sampling system including ten analyzers) was only 1000,- EUR, which we consider as very cost effective. This was possible by borrowing instruments for the duration of the experiment. This might well be an option for other experimental sites and groups, considering that one of the types of infrared gas analyzers used in this study (LI-6262, LI-COR) is very common within the research community and availability seems to increase as this model is increasingly often replaced with the newer analyzer model LI-7000. Secondly, we believe that the real potential of the presented method of simultaneous measurements of a concentration field and the proposed statistical corrections might even lie

in the application of a large number of inexpensive sensors which could not be used without the statistical calibration technique for reasons of accuracy but which can be used including the proposed corrections allowing for a spatial and temporal resolution far superior to what can be achieved with a conventional single analyzer setup. This should be explored in more detail in future studies.

2 General comment (2)

The referee comment addresses the complexity and accessibility of the presented method for less experienced people. The presented setup certainly involved complicated procedures and advanced micrometeorological experience is needed, which is typical for fundamental research. However, the processing of data and the statistical correction can be (almost) fully automated in software which can be made freely available to anyone to use. This would allow also people "without micrometeorological background (for example, in horticulture, biology, fishery)" to apply the proposed method. It should be noted that this is only the first publication of the method and further work will certainly improve the usability (e.g. after collecting recommendations about the mixing index threshold from other sites).

3 Specific comment (II.1)

Following the referee's suggestion we have re-phrased the relevant sentence for the revised version to become: "The applicability of the assumptions made was tested by Large Eddy Simulation (LES) using the model PALM and could be verified for a test case of well mixed conditions."

4 Specific comment (II.2)

We are pleased to hear that central ideas of the publication are "explained very well in a simple manner" ("first part", Sec. 2.4). Following the referee's comments on some of the following sections we have re-written the "second part" of the publication for the revised version (Sec. 2.5) and hope the structure is more clear now. We have also extended the "third part" (Sec. 2.8) to make its importance more obvious (see also next comment).

5 Specific comment (II.3)

While the published version of Sec. 2.8 was focused on horizontal advection, we have now extended the "third part" (Sec. 2.8), following the referee's suggestion, and included the full Net Ecosystem Exchange equation (all flux and advection terms) in the revised version. This aims at making the link between ideas presented in the current study and what is generally known in the micrometeorological community more clear, i.e. showing the importance of gradient measurements for horizontal advection and for Net Ecosystem Exchange estimates of CO_2.

6 Technical corrections (III)

"Figures 2,3,6,7 and 9 are very small and difficult to read.": we see the point of the referee here. The figures were optimized to have the proper size in a two column final layout with individual plots filling the full width of a single column. Due to the figure arrangement with two subfigures next to each other (Fig. 6, 7 and 9) rather than above each other, some of the figures became too small in the particular layout of the

discussion paper (we apologize for that). This is not an issue in the final layout (and could easily be fixed in the discussion paper layout by placing figures above each other, if necessary). Finally, the figures are provided as vector graphics which allows for the best graphical quality even when rescaling them.