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Atmospheric Measurement Techniques Discussions

Interactive comment on "Development and validation of inexpensive, automated, dynamic flux chambers" *by* B. B. Almand-Hunter et al.

Anonymous Referee #1

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This manuscript describes the deployment of a dynamic flux chamber capable of simultaneously measuring deposition of O3, CO2 and NOx to vegetation and the soil surface. The authors validate the performance of the chamber to capture the flux dynamic of the specific vegetation type by successful comparison with concurrent flux eddy covariance measurements of O3 exchange. This is not done for CO2 and NOx. The authors conclude that their chamber design is suited for measuring O3 fluxes as well as CO2 and NOx and deposition estimates can be precise if LAI of the vegetation is taken into account. The manuscript argues well for the need to develop cheap, easy-to-handle chambers that are capable of measuring multiple gas species. On the O3 part I think you manage to convince the reader that their chamber design works according to your objectives, partly because of the well-founded theory, but most of all

because of the solid field measurements. I understand why you initially included CO2 and NOx, but the results for these gases are far from as convincing as for O3. Excluding CO2 and NOx from the manuscript will, in my opinion, make it stand out sharper and more focused. I know that this suggestion goes against one of the objectives of the paper, but because you are not able to validate chamber performance with eddy measurements in the field, as you state in the introduction is needed and want to do, I think merely presenting chamber performance is too little to warrant inclusion at this stage. Specific comments 2.2 Page 6883, line 7-25 & 6884, line 1-4: Is this theory necessary here? To me it would be enough to refer to Baldocchi et al. 1998, skip the equations and associated text and thereby shorten the text. You should ask yourself if this very brief introduction serves to convince the reader that your approach to test the chambers against eddy flux is valid. Readers unfamiliar with eddy will skip this section as it is not important to understand your main results and readers familiar with eddy will likewise skip it because it is rather superficial. For example, there is no notion how you model footprint. Therefore, I think you should delete it. 2.4 Your flux-chamber description is spot on and a great "manual" for other researcher to be inspired from. Likewise your figure 2 is very good Page 6887, line 14 change "minimuze" to "minimize" 2.6 In my opinion you could cut out this entire section of the paper or shorten considerably. In your own words you write that you do not use it, so what is the point in having it here. The concept is quite cool and maybe refer to Pape et al. 2009 and then use the text in lines 27-29 on page 6890: "We present. . ." 3.1 Page 6891, line 7: What exactly do you mean by "evaluated"? What criteria do you use for this evaluation when you use eq. 7? This is a rather vague formulation that leaves a lot to the imagination of the reader. Please provide a clearer description of your evaluation procedure and if it entails any statistic or numeric procedures. 3.2 Again I think you have too much theory here and strictly speaking it is not results. Have the equations R1, R2 and (11)-(16) been published before? If yes, you should consider allocating it to supplementary materials instead of having them here. If this is textbook stuff then it should go. Also, if you follow my advice regarding excluding CO2 and NOx this entire section will automati-

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cally go as well. 3.3 Page 6895, line 5-8: Overall, I agree with your conclusion here, but bear in that this is based on very few chambers. Of course I understand that you cannot operate as many chambers as you need to cover the spatial variability within the footprint of the eddy tower, which you by the way have not written anywhere. As I read this your conclusion here is based on the assumption that the footprint represents the site, but what you should really do is eliminate the site and instead write “the footprint of the ddy tower” in line 8. It is a matter of wording, but it is important that you mention this basic assumption. Also, you write in the introduction and conclusion that contrary to eddy, chambers are able to capture spatial variability, but here you want to eliminate that in order to obtain the best agreement in mean values, between the two techniques. I understand this as a way for you to validate the performance of the chamber. But have you thought that this is merely a coincidence, since you only have 5 chambers to base this comparison on? The less dominating sites does also have an influence on the net flux and hence should be accounted for in some kind of stratified sampling design. Maybe mention this as a note for applications of these chambers down the road. Also, how strong is it if you test it with a formal statistical test? There are some deviations between eddy and chamber in figure 5, even after chamber A was moved. Although, your results are quite convincing here, I would like to see some standard deviations on the fluxes in the text as well as stats test, just to show the reader you have tested it thoroughly so as to eliminate doubt re your results.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 6877, 2014.