

## ***Interactive comment on “Sources of uncertainty in eddy covariance ozone flux measurements made by dry chemiluminescence fast response analysers” by J. B. A. Muller et al.***

### **Anonymous Referee #1**

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#### Notes on ‘Abstract’

There’s material not really belonging to an Abstract. Leaving the unnecessary parts away would also make the Abstract more concise.

It is recommended to leave lines 2-7 out of the Abstract. In line 13 the word ‘calibration’ should be left out, because in its present form the sentence implies that the fluxes were calibrated while in fact only the concentration fluctuations were calibrated. The content of the sentence in lines 14-16 (“It is shown . . .”) is in contradiction with the sentence in chapter 3.2 (p. 2255, lines 25-27) – it should be checked what the result actually was. In line 25 the words ‘behaviour of disc’ should be left out, because a potential reader

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unfamiliar with the instruments might not understand that ‘disc’ is essentially equal to ‘analyser’.

#### Notes on ‘Introduction’

There’s enough material in the Introduction covering the subject matter of the MS, explaining the working principles and presenting earlier results on the operation and performance of the instruments in question and giving good motivation to the work. However, the MS would gain if the Introduction was shortened.

It is asked to pay special attention to paragraph 1 (p. 2243, lines 2-20), paragraph 2 (p.2243 lines 21-28 – p. 2244 lines 1-16) and paragraph 3 (p. 2244, lines 17-29 – p. 2245, lines 1-6) and consider whether these could be condensed. On page 2245 in line 11 the words ‘and highly sensitive’ should be left out, because it is not a typical requirement – the degree of sensitivity required depends on the measured component. In the last paragraph the first two sentences are an unnecessary repetition of what has been written earlier in the Introduction, so it is recommended to leave these sentences (in lines 21-25, p. 2247) out.

#### Notes on ‘Experimental’

The content of Experimental is thorough describing well enough the measurements, data processing and analysis. A few unclear sentences and probably typing errors should be corrected. Also parts of the analysis methods are not covered till in ‘Results and Discussion’ and ‘Conclusions and Recommendations’ sections while they should be given already in ‘Experimental’.

In chapter 2.2.1 in line 15 (p. 2249) the description of the co-ordinate rotation is unclear – what is meant by “best plane of fit correction” ? Also a reference to the rotation method should be given. It is also recommended that explanations of the calculation of spectral and co-spectral estimates be given in here with the appropriate references. In chapter 2.2.2 in line 2 (on page 2250) the term ‘flux covariance’ is unclear. It is

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suggested that the whole sentence be re-written. Maybe it would be appropriate to first define flux as the covariance between the vertical wind and concentration and also explain what is basically meant by the symbols  $w'$  and  $X'$ . In line 7 it is suggested to write 'the mean absolute ozone concentration' instead of just 'ozone concentration'. In chapter 2.2.3 the equation 4 is believed to be incorrectly written in its present form – the fault is made evident by the different units of the terms in the addition. The evaluation of the ROM method compared to RM (sentences in lines 8-10, p. 2251) actually would belong to 'Results'. And in fact it is recommended leave the discussion on the offset voltages (and subsequently Figure 1) totally out of the MS. In line 11 (p. 2251) the term 'error bars' should be replaced by term 'error estimates', because 'error bar' is what one plots in a figure. In chapter 2.2.4 the equations 6 and 8 are believed to contain the same typing errors – the  $X$  should be squared in the denominators. In line 11 (p. 2252) the term 'error bars' should (again) be replaced by term 'error estimates', because 'error bar' is what one plots in a figure. In chapter 2.3 the symbol  $V$  should be replaced by symbol  $X$  in line 5 on page 2253.

#### Notes on 'Results'

The results of the study have been analysed thoroughly. At a few points the line of thought was not clear, and it is of course recommended to check them. However, one major revision would probably help make the MS more compact.

In chapter 3.2 in line 21 (p. 2255) it should probably read 'measured ozone fluxes' instead of 'absolute ozone fluxes'. In line 27 it is suggested to replace 'error' by 'error estimate', because an "error" can generally not be known exactly. Also it is pointed out that the error bars in Figure 3 are really not discernible. Likewise the sentence in lines 16-18 (p. 2257) should be re-written so that the reference to the error is left out. In line 28 it is suggested to leave out the words 'of methods' and 'calibration or', because this would help to make the sentence more compact. In chapter 3.3 selecting date 17th Aug as representing a day when the flux data did not agree doesn't seem to be correct, because at least in Fig.4 (and Fig. 3) the two data appear quite similar

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– the date should be checked. The term ‘high frequency lag’ in line 1 (p. 2260) is not clear. In fact the purpose of the analysis of the cross-correlation between the ozone signals is unclear – there was a difference of 0.25 s between the lag-times of the analysers and the cross-correlation between analyser signals simply seems to corroborate this. It is recommended to leave the sentence starting ‘However, the cross-correlation ...’ in line 27 (p. 2259) out. Linked to this also the figure 7 should be re-plotted without the ROFI-GFAS cross-correlation. As mentioned in chapter 2.2.2 no corrections for high-frequency losses were performed in the study. It is recommended, however, to calculate the losses and to correct the flux values accordingly. This might narrow the day time gap observed between the flux results of the two analysers. The whole chapter 3.4 could be removed, because it is considered to go beyond the scope of the MS. The MS will be extensive enough without the discussion on deposition and canopy resistance.

#### Notes on ‘Conclusions and recommendations’

A major revision should be performed on the ‘Conclusions and recommendations’. The chapter is too long and many of the items would actually be more appropriate in the ‘Experimental’ and ‘Results’ chapters.

The sentence in lines 4 – 6 (p. 2263) belongs more to chapter 2.2.1 and it is recommended to move it there. The content of the lines 14 (p. 2263) – 22 (p. 2264) should largely be moved under the ‘Results’ chapter. The sentence starting in line 14 lets one to expect something general about analysers to follow, when in fact the items 1,2 and 3 treat only the analysers used in the study. In the sentence starting ‘The comparison ...’ in lines 26-28 it is said that the two analysers compare well, but the data in Fig. 8 does not corroborate this – maybe this statement should be left out. The end of the chapter, i.e. the lines 25 (p. 2265) – 10 (p. 2266) should be left out together with the removal of the chapter 3.4.

#### Notes on ‘References’

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The references gone through for this MS are valid, well chosen and cover an impressive time span extending also up to the current year. One reference, Derwent et al. (2008), is however missing from the text itself although it's given in the reference list. This should be checked out.

### Notes on 'Tables and Figures'

Tables are justified and clearly written. Regarding Table 1 it is recommended that the two missing values (symbol '-' ) be replaced by symbol 'n/a'.

Figures need somewhat more editing. A general note on figures is that in the present form the captions and the legends contain the same information. This is unnecessary, and should be corrected. Figure 1 should be left out, because the data in them is not essential for this MS. In figure 3 the error bars are really not discernible. In Figure 6 the axis labels are not clear – it would be good to define all the variables and symbols, preferably by adding their introduction in chapter 2.2.1. In the present form of the MS they just “pop out” from seemingly nowhere – to begin with what is 'z', 'U' etc. The legend (already) gives the symbols for the 'ROFI' and 'GFAS' data and so the corresponding sentence could be removed from the figure caption as unnecessary. What is meant with the '(-ve values)' in the legend ? Figure 7 should be re-plotted without the ROFI-GFAS cross-correlation. The legend (already) gives the symbols for the 'ROFI' and 'GFAS' data and so the corresponding sentence could be removed from the figure caption as unnecessary. In Figure 8 the explanations for the line symbols in the figure caption are unnecessary, because they are given in the legend. Figure 9 is recommended to be left out.

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