

Interactive comment on “Adapted ECC ozone sonde for long-duration flights aboard boundary-layer pressurized balloons” by François Gheusi et al.

Anonymous Referee #1

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This paper presents the results of a modification to the normal working arrangement for an electrochemical concentration cell (ECC) ozone sonde. The modification is necessary to allow the ECC to be used on a long duration isopycnic balloon. This is accomplished by including electronics to control the instrument's operating cycles. Typically for each 15 minute period there are 13 minutes of dormancy, 1 minute of spin-up and 1 minute of sampling. The majority of the paper is focused on characterizing the measurements which can be achieved with an ECC sampling for one minute out of every 15 minutes. Overall the accuracy of this approach is shown to be within $\pm 10\%$ of measurements which would result from a continuously running ECC, or other ozone sensor.

C1

In addition to this analysis the authors spend too much time reviewing the working principles of the ECC sonde. All of this material is already available in the literature, and from more authoritative sources than this paper. Thus I see no reason that the appendices should be published here. Appendices that include the ECC working principles, data processing, background correction, pump flow rate corrections, . . . and the recipes for the cathode solutions, plus preconditioning, and day of flight preparations. There are standard WMO and other references for all of this material. It is completely out of place for these authors to be publishing this material. In particular, why are they including anything about pump flow corrections with pressure when the instruments, which are the subject of this paper, never rise above a pressure level of 700 hPa? The pump flow corrections begin at 500 hPa? So why do the readers need to have the information in Tables 3 and 4? These authors have added nothing new to these standard procedures.

While the body of the paper is mostly acceptable, the authors tend to present rather simple procedures in an unduly complex fashion, introducing symbols and nomenclature to describe straight forward procedures, easily understood without the symbols and formulas

I will recommend this paper for publication, after the appendices and superfluous Tables 2, 3 and Figure 3 are removed, and the authors take steps to reduce the complexity of the discussion of simple topics and procedures. Some of these places are highlighted below.

Aside from these complaints the paper presents some interesting data which may have captured the photochemical production of ozone within a Lagrangian air parcel. If the authors could stick to these results, and the background necessary to confirm the stability of measurements with a duty cycle of 1 minute out of every 15 minutes, then the community would be interested.

Even all the space devoted to establishing the accuracy of the measurements is some-

C2

what wasted. All that is really needed is establishing that the measurements are self-consistent for any one instrument. The interesting features of the data are not the absolute accuracy, but the relative variation of ozone measured by any one sonde. It could be argued that the work establishing the absolute accuracy of the measurements is not ultimately that important. A short paper conveying the really interesting and useful results, with a hard look to remove anything that is not really necessary, will always end up being used more in the community.

2.21 ... offer a means ...

6.10. Fig. 3 does not show an electronics card, rather the standard cells and pump for an ECC sonde. I don't see the point of showing an electronics card, or the current Fig. 3. These instruments are well known.

6.17-27. This is a rather long winded and much too quantitative way of saying that for every measurement cycle the instrument is warmed up for 60 s, measures for 60 s and then made dormant for a pre-determined interval, typically 1380 s (13 min). For continuous sampling the sleep interval is set to zero. Please take steps to simplify and shorten the paper.

Fig. 5. This Figure is not useful. All of the interesting features happen between 35 and 45 ppb, yet the figure extends to 60 ppb and the variations over this small range cannot be discerned. Please summarize this information into a three panel figure, with one panel for each rest period, 10, 5, 3 min. In each panel plot one off-on cycle with each of the three lines displaying the average and standard deviation of the 3-7(?) measurements available for each series. Then the reader can really tell how the three measurements compare.

7.22-28 and Fig. 6b). While the authors use 60 s as the spin up time, the LHS of Fig. 6 suggests that 300 s is more appropriate to avoid an overestimation of up to 10% in ozone. Do the authors have any comments on this?

C3

8.5-15. Again, this is too much text for the simple procedure of measuring the flow rate of an instrument with a bubble flow meter and a stop watch. There is no reason to define all these variables, t_o , t_i , ...

9.16. What does "resp." mean?

9.21-22. I don't understand this sentence, "An excess in ... is all the later to appear ..."
"?"

9.26. Why do the authors state that the deviation grows with time, when the graph shows the deviation trending towards zero with time? The spread in the measurements appears to decrease after 3 days, then increase again after 5 days.

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C4