



EGUsphere, referee comment RC3  
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## **Comment on egusphere-2022-565**

Anonymous Referee #3

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Referee comment on "Development of an automated pump-efficiency measuring system for ozonesondes utilizing an airbag-type flowmeter" by Tatsumi Nakano and Takashi Morofuji, EGU sphere, <https://doi.org/10.5194/egusphere-2022-565-RC3>, 2022

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### Review of **Development of an automated pump efficiency measuring system for ozonesonde utilizing the airbag type flowmeter**

By Tatsumi Nakano and Takashi Morofuji

This is an important paper, and certainly appropriate for publication in ACP. I have just a few points that the authors should address before publication, primarily to do with clarity of explanation – there are a few areas where I was not entirely sure of the authors' meaning.

Line 31: "...about 80% of stations of WMO..." In fact, all except Hohenpeisenberg and several stations in India use the ECC sonde.

Lines 60-61: I think it is important to make the point here that measuring the efficiency of each pump is NOT normal practice in ozonesonde launches, as it is considered difficult and time-consuming. As a result, almost all ozonesonde profiles are produced using average pump efficiency curves as described in the paragraph beginning in line 62. This is a source of uncertainty that the system described in this paper eliminates. It is a major advance and should be introduced here properly, as the scientific question that this paper addresses.

Line 65: Actually, it is the pump corrections that are underestimated, not the efficiencies.

Lines 139-140: Why does the airbag get wrinkles?

Line 157: I think you mean that the volume of the airbag when inflated is assumed to be the same regardless of ambient pressure, as long as the pressure inside is equal to that outside.

Lines 170-177: I find this description quite confusing. I see that there is some hysteresis, but it appears that the whole point of folding the inflation and deflation curves back on each other is to show that the inflation and deflation times are equal. Could this not be simply stated?

Lines 183-185: This is confusing, and the first sentence seems like it belongs somewhere else in the paper. I suggest writing simply: "The pump correction factor (the reciprocal of the pump efficiency) is obtained only from the time required for airbag inflation and deflation, and in the case of differential pressure  $\Delta P$  is expressed from equation (2) as follows".

Line 212: "the thin line". Do you mean "the narrow tubing"?

Lines 220-223: I'm not sure that these remarks, or Figure 8c, add anything to the paper. Figure 8c is not mentioned further. The remarks are also confusing, coming in the middle of a discussion about "real-world" back pressures. I suggest dropping these lines, and Figure 8c.

Lines 255-256: Why is there a differential pressure? Is that because it is the method to determine when the bag is full/empty? It might be helpful to say this.

Lines 294-299: "...we found about half of the airbag temperature change rate affected the pump correction factor...". So what happened to the other half? This paragraph appears to state that "our observations only followed Charles' Law about halfway, so we used 0.5 as a fudge factor". This is not acceptable.

Line 305: This contradicts the previous equation. Which one is correct? Is the pump change adiabatic or not? By the way, all equations should be numbered.

Line 306: Please explain what approximations were used to arrive at Equation 8. The reader should be able to reproduce your analysis without guessing.

Line 313:  $\delta_{\text{O}_3}(\text{‰})$  should be 1.

Line 330: Why use the measurements after #24000, rather than before #24000? You've just said that stability was not good after #24000.

Lines 351-352: I think you mean "for this experiment only"?

Figure 15 (upper) appears to be wrongly labelled on the x-axis.

Lines 403-406 (and Figure 17 caption): I am confused by this description. Should you not simply calculate the difference, for each sounding, in the total ozone found using your measured pump corrections to that using the average pump correction curve (either CMDL or your average before serial #24000 – or after serial #24000)?

Line 432-433: Can such an automated system be built and operated by other stations at a reasonable cost? Can it be commercialized? If so, this recommendation would carry much more weight.