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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new method to correct the ECC ozone sonde time response and its implications for "background current" and pump efficiency" *by* Holger Vömel et al.

Anonymous Referee #1

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The issue of the 'background current' which is conventionally subtracted from the measured current in an ozonesonde ascent has been the source of controversy for a long time, with evidence from many sources that it is not, in fact a constant. In this paper the authors argue that the signal measured by an ozonesonde is the sum of a 'fast' component, which is its response to the ambient ozone concentration, and a 'slow' component which arises from other reactions in the cell. A method is described to remove the slow component, and to correct the 'fast' component for lags in the response. Evidence is presented from laboratory and chamber measurements that the new method works very well and improves the accuracy of the ozonesonde measurements. The paper than applies the method to old ozonesonde profiles to evaluate the difference it makes

in practice.

The paper is carefully argued, generally well written, and should be published in AMT with some minor corrections. Before listing these, I would like to invite the authors to consider the following point

The background current problem arises in large part from the practice of exposing the ECC cell to ozone during the preparation. Despite the elegance of the method presented here, there is still some uncertainty in the measurement arising from uncertainty in I'(t0) (eqn 6). Would it not be better to keep this value as small as possible by not exposing the cell to ozone during the preparation?

Points to address:

1. L.170. Equation 4 is not, as stated, a generalisation of equation 3 and the terminology is confusing. I0 and I0' in equation 3 are both constants but in equation 4 they are functions of time. Furthermore the terms Iss and Iss' are introduced without explanation. More care is needed in introducing equation 4.

2. I find the discussion on pp 6-7 of the method to determine the slow reaction term I0'(t) confusing. To get from equation 4 to equation 5 (and hence 6), Iss' is taken as constant. Yet in equation 6, it is replaced by a scaled version of the measured current, which necessarily varies with time. This invalidates the derivation of the equation! Furthermore, the whole point of the slow term is that it is a response to exposure to ozone in the past, so I do not understand how it can be represented by a term proportional only to the measurement at time t. The use of the word 'integration' on line 203 suggests that there may be more to the calculation of the slow pathway than simply plugging numbers into equation 6, but this is how I understand this paragraph. To take an extreme case, an ozonesonde in the tropics encountering a filament of high-ozone air in the lower troposphere then entering a layer of very low ozone concentration just below the tropopause would 'remember' being exposed to ozone in the preparation but not to its much more recent exposure during the profile. In that case equation 6

as written would give too small a slow reaction term IÂň0' and overestimate the ozone concentration.

3. In figure 2, what is the cause of the enormous error in the orange line in the top panel? Was the background current excessively large for this sonde?

4. L.285 concentration (not concentrations)

5. Fig 4 caption, purple

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