

Interactive comment on “ μ Dirac: an autonomous instrument for halocarbon measurements” by B. Gostlow et al.

Anonymous Referee #1

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This is an instrumental paper describing a new GC system for measurements of halocarbons in air. Generally, this is an important paper and appropriate to the journal. The paper is well written and describes in detail the technical development of the instrument. The described instrument is extremely light weight and thus presents a novel approach, which merits publication after some revisions as explained below. My main comment to this paper is that much more detail is given on the technical specification than on the chromatographic set-up and the discussion of the ambient air measurements. In particular, I would suggest to include more information on breakthrough volume of the trap, the efficiency of the trapping system, blanc levels, instrument linearity, cross-interferences (overlapping peaks) and comparisons between laboratory and field performance of the instrument. I have not found any information how individual peaks were identified as belonging to specific compounds. I also wonder if the authors

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have coupled their system to a mass spectrometer in order to search for interfering peaks, as this is an intrinsic problem of an ECD detection system. Such a test should at least be performed in the laboratory, using the calibration gases. I suggest that the authors include more detail on these and related comments/questions regarding the chromatography, which will be detailed below.

Specific questions/suggestions

p. 2127. section Sample adsorption/desorption: This section describes the technical set-up of the trapping system. I think that more information on trapping performance is needed. How quantitative is the trapping/desorption? How does this depend on temperature, flow rate and species. I am sure that this has been studied and this would be very valuable information.

p. 2130, l. 16: Most ECD detectors work at significantly higher temperatures, and usually the sensitivity increases with temperature. Why is the ECD operated at this rather low temperature?

p. 2133., l. 14: Teflon has generally not been used much in analysis of halocarbons, as it is suspected to show solubility and/or blancs for CFC and related compounds. Has this been investigated?

p. 2133/344 : It would be interesting to know how strong the standard drift is with time during such a profile. As far as I understand, no MIR flight could actually be performed. I would suggest to include the number of chromatograms expected between calibrations.

p. 2136, l. 18: As the detector is extremely sensitive to temperature variations, I wonder if the authors have noted an influence of the ventilation on ECD performance.

p. 2138., l. 3: Does the membrane drier show and blancs or lead to decreases in the reproducibility? To which level does it dry the sample?

p. 2140., l. 6: What is the basis of the estimate of accuracy? Or is it merely an

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“educated guess”?

p. 2140, l. 2.: The way that the deviation from linearity is shown in Figure 5 is somewhat misleading. I suggest to plot the calibration gas volume against the deviation of the peak height from the peak height expected for linear behaviour. This way the deviations are highlighted much more closely. Also, I suggest to include information on non-linearity for other compounds and how the non-linearity has been corrected for in determining atmospheric mixing ratios. The fit-curve used for the correction should be included in the plot.

p. 2140, table 1.: Why is the laboratory calibration precision so much better than the field precision, especially for CFC11?

p. 2140., section 3.3.: Have the authors investigated the effect of varying ECD temperature on the sensitivity?

p. 2140. l. 13: It is nice to see calibration chromatograms. However, I would suggest to include larger figures in this instrument paper, so the expert reader can see more details (e.g. blow-ups showing smaller peaks, so that the noise level can be seen). Also, I think that for an instrument for ambient air measurements, typical outside air chromatograms should be included. Furthermore, I have not seen any discussion of blanc levels or blanc chromatograms. As this is crucial in evaluating the performance of the instrument for outside air measurement, I suggest putting more emphasis on this part of the discussion. Considering the dimensions of the trap (I calculate its volume to be 0.05 ccm), the fast heating time and the narrow bore column used for microDirac, I was surprised to see that the peaks are quite broad (especially in the early part of the chromatogram). Is the reason for this understood? Would a refocusing of the analyte be able to improve this? As explained above, I think that more information on the trapping/desorption (breakthrough volumes, temperature dependency etc.) would be valuable for the characterisation of the instrument.

p. 2141: I do not understand why an increase in the adsorption volume would lead

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to decreased chromatographic resolution? If the species are truly immobilised on the adsorbent, then this should not affect the resolution.

p. 2145, l. 1: If the CH₂Br₂ data are overestimated, it is surprising that UEA data (which should be on the same scale) are even higher.

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