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Atmospheric Measurement Techniques Discussions

Interactive comment on "An aircraft gas chromatograph-mass spectrometer System for Organic Fast Identification Analysis (SOFIA): design, performance and a case study of Asian monsoon pollution outflow" *by* Efstratios Bourtsoukidis et al.

Anonymous Referee #2

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Review of amt-2017-201 manuscript: "An aircraft gas chromatograph-mass spectrometer System for Organic Fast Identification Analysis (SOFIA): design, performance and a case study of Asian monsoon pollution outflow", by Efstratios Bourtsoukidis, Frank Helleis, Laura Tomsche, Horst Fischer, Rolf Hofmann, Jos Lelieveld, and Jonathan Williams

This manuscript is well written and describes an aircraft based pre-concentration GC-

MS for identification of volatile organics in-situ. The manuscript references the TOGA instrument and shows similarities with this instrument but includes some very interesting innovations such as the LN2 implementation and the oven design. Unfortunately, it is the detailed description of these two elements that seems most obviously lacking from the text. Firstly, there seems to be a problem with the overall order of the manuscript. The sampling unit is described with reference to the liquid nitrogen container and is particularly difficult to understand without reading later sections and then coming back to re-read the descriptions and try to build a picture of how the instrument works. The figures include CAD drawings and a photograph but the picture quality is much too small to make out any useful detail. I'm still a little unsure as to how the cooling system actually operates.

I have read the comments from the other reviewer before writing this review and I do agree with many of their observations. However, I do feel that it is vitally important to publish these types of manuscript, which describe in detail the operation of an instrument that will undoubtedly be used in many future research campaigns. Fitment of this type of instrument in any aircraft is a large undertaking and cannot be held in the same regard as say, a laboratory instrument. To this respect, even if the instrument as a whole is not novel (although I would argue that this indeed is), there are many novel design aspects and operational challenges that should be reported in this type of manuscript and are extremely useful information for the scientific community.

I do agree that the manuscript should focus more on performance testing of the instrument and feel that the campaign data section adds very little to the overall text. I would like to see more detail, text and graphic, describing the instrument. It is currently very difficult to understand the system in its entirety. If a manuscript is to describe an instrument then the relevant detail should be present to allow the reader to fully understand the system.

Observations from the text:

All units should have a space after the value- e.g. 2 mL not 2mL

P1,L24 – ExR should maybe be ExMR with the reference to mixing ratio matching the acronym NEMR

P2,L27 – I believe the UK aircraft operated by FAAM has a GCMS on-board. I think the first reference to this is from the Co-ordinated Airborne Studies in the Tropics (CAST) campaign.

L32 – include quotation - “System for Organic Fast Identification Analysis”

P3, L30 - In my experience, heated teflon line can be quite permeable, how do you test for contamination? e.g. TOGA has zero air introduced right at the start of the inlet as it enters the cabin.

Section 2.1.1 – I’m not sure that I fully understand the inlet system with regard to the pumps. Maybe clarify on the schematic. Which pumps are where? inlet pump or sample pump? also, not clear how the calibrated volume is used. Is it pressurised using the pump and then the pressure supplies the trap? Need to make this more clear.

P3, L30 - brings the air into the inlet MuPo

L36 - so the KNF pumps used were all-PFA? maybe change the sentence around to say 3 identical PFA pumps were used....the Pmax of single stage wasn’t enough, dual stage too heavy, so backed with 4th pump...

P4, L1 - what are chronometer o-rings? watch o-rings? reference part number, material type? how were they fitted? did you have to machine a groove? Also, did you test the pumps for inertness?

P4, L11 - 5mL/min?? volumetric or mass flow? SCCM better?

P4, L15- strange use of the word concert in a scientific context. Maybe ’concurrently’ or ’in unison’ would be better?

P5, L3 – aerogel product number, ref? L4 -3D printed material

P5 L12- stainless tubing but what grade? Any coating? Is this the trap material in contact with the sample? Text quite ambiguous

P5, L17 - how are the traps electrically isolated from the fittings and thermocouple? fitting and ferrule material?

P6, L11 - is the CPOR the name for the system built using the camping gas regs or is this a separate commercial item? Unclear

P6, L32 - this makes it sound like the system is able to run at sub-ambient? is this possible as it seems that the oven is cooled by a fan

P7, L11 – to which regulator are you referring? temperature controllers? are you saying that PID values are variable dependent upon temp or do you refer to the combination of fan speed and heater control. paragraph needs clarification

P7, L25 – ‘The dwell time for the individual ions selected was 10ms and a complete chromatogram run for 2.4min’ Bad sentence structure, maybe: . . . and the chromatographic runtime was 2.4 min P7, L30 - Apel Riemer standard gas referenced to any scales? date of cylinder production?

P7, L36 - creates the need for robust peak

P7, L38 - separation of peaks that elute at similar retention times

L40 - peaks. MPIC-Chrom, a new peak integration software written in IGOR, was used. . .

P8, L11 – too many words, maybe simplify: 50 degC initial temp, hold for 20 sec, ramp to 80 degC at 2 degC/sec, ramp to 150 at 1. . ..

P8, L15 - if you are going to mention this then need to detail the improvements

P10, L39 – ‘were’ should maybe be ‘where’

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