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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Identification of secondary aerosol precursors emitted by an aircraft turbofan" *by* Dogushan Kilic et al.

Anonymous Referee #2

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The manuscript presents data from an airport test cell, where emissions from an engine are aged in a chamber by exposure to OH and the predicted vs measured SOA are compared for several thrust conditions. These measurements are then used to assess the potential impact on LAQ with an airport as a point source.

The paper is well written and very timely with increased interest in PM from aircraft and the upcoming nvPM regulation. There are a few questions/queries listed below. My only main suggestion is that the abstract/conclusion should reflect the fact only one of the three modelling cases matches the measured SOA. In the low thrust case, the model over predicted the SOA mass by a factor of $\sim$1.6 and (as stated) at cruise it under predicts by a factor $\sim$0.25. Lines 21-22, to say that the SOA mass can be explained by the oxidation of gaseous aromatic species is only true for 1 case. The

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Discussion paper

body of the text does however consider the contributions of low Cn products or yields not being correct.

1) In most chamber studies, it is usual to consider the wall losses and the calculated mass is derived from the difference between the measured mass and some empirical loss model. Is this something that has been considered here?

2) Did the authors check the sulphate fragmentation? Either by Hi Res analysis or the 48:64 etc ratios? Are they sure it is not an organic fragment interfering with a sulphate peak? Same for the nitrate.

3) Are the authors sure that the measured particles are within the AMS 100% transmission window ($\sim$60-600nm Dva) for all thrust setting and the CE $\sim$ 1? Line 147 implies the AMS mass was converted to a volume and compared with the SMPS volume. Is that correct? Are the authors assuming that under organic rich conditions, the contribution to the total volume from the eBC is negligible or that the OA is externally mixed from the eBC? Is this the case across all thrust settings? Furthermore, what shape factor did the authors use to convert the Dva to Dm or vice versa to compare the total volumes? Or did the authors use the PToF data and an effective density, in which case is one value across all powers sensible?

4) Section 3.3 – Can the authors expand on why there is a significant difference between the predicted and measured SOA at 3-5% thrust, compared with almost complete agreement at 6-7% thrust? They allude to a reduced NMOG contribution at 6-7% thrust, could it be that not all the NMOG is contributing to the mass? Could the difference in NOx explain this? Other chamber studies show different chemical pathways based on the NOx concentrations. Elsewhere in the manuscript, the authors discount the possibility of oxidation of the semi-volatiles because they are already bound in the particle phase. With the dilutors, is it possible that has been a re-partitioning due to the dilution of high purity N2 which will change the equilibrium between particle and the gas?

5) Given the work of Yu (and others referenced in the manuscript), can the contribution from the oil to the SOA be determined? Are the authors looking at primarily combustion processed OA or oil processed OA?

6) I am assuming the AMS used was a HR-ToF-AMS as they authors refer to V-mode? Has no Hi-Res (PIKA) analysis been done on the data? This may give insight into some of the oxidation products (although may be beyond the scope of the paper).

7) The work on the estimated yearly production of SOA from Zurich is based on the reported NMOG EIs and the work of the authors, but the PAM is under photochemical oxidation conditions i.e. OH production during daylight hours. Do the authors estimation take into account daytime vs nightime activity on the emissions of NMOG and the potential impact on SOA formation?

Minor typos/suggestions:

Lines 192 & 195. NRPM1 or NR-PM1. Check document is consistent. Same with eBC or BC. Both are used in the document.

Figure 2: Labelled a) and b) but then not referenced in the caption as a) and b). Either have a & b in the caption or remove from figure.

In other figures where there are 2 graphs, authors do not label them a) or b). Have a consistent format for the figures.

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