Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1351-RC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Identification of jet lubrication oil as major component of air craft exhaust nanoparticles" *by* Akihiro Fushimi et al.

Anonymous Referee #1

Received and published: 25 February 2019

Fushimi et al. present a study on the chemical analysis of nanoparticles in aircraft engine exhaust. They identify jet lubrication oil as a major component of particles < 30 nm. The size resolved sampling using a multi-stage cascade impactor took place near the Narita International airport. Chemical analysis of the samples used a thermal desorption unit coupled to gas chromatography /mass spectrometry. The authors designed the study with necessary caution, in terms of duplicate sampling, dilution of the sampling flow for measurements of particle number concentration, analyzing nighttime (airport non-flight hours) vs daytime samples and analyzing reference jet fuel and lubrication oils. The usually challenging task of chemical analysis of nanoparticles (limited mass) is overcome in this case by high particle number concentrations.

The measured particle number concentration brings me to my main point of concern

regarding this paper: although, one might expect high particle number concentration near an airport, so far I have not seen ambient number concentrations of 2.5e7 cm-3 (Figure S3). The authors should comment on the reason of these high numbers, and should point out the differences to other studies: e.g. Hudda et al. observed max. 1.5e5 cm-3 within 3 km of LAX airport. Also, it would be helpful to show a longer time series of particle number measurements additionally to Figure S3 (which is only one hour). This might shed light into certain conditions that favor the buildup of such extremely high nanoparticle number concentrations. For such a time series graph a log y-axis might be helpful in order to evaluate the urban background particle number concentrations – if these numbers are reasonable, the measured numbers at Narita Intl. airport during operation hours would appear more plausible.

Apart from this point, the study appears well designed and the chemical analysis using GC/MS is solid. The main conclusion – identification of lubrication oil - is robust, since comparison by retention time, m/Z and EI-fragmentation spectra agree well with pure jet lubrication oil products.

Minor/technical comments:

p.1 l.28: Please comment on the formation of soot under idling vs. low- and high-thrust.

p.3 l.7-10: Did you calculate/estimate the inlet line losses of the small particles?

p.3. l.25: Did the manufacturer recommend the backup filters used (two different ones)? Can the differences of the back-up filters alter flow rates and thus cut-off sizes?

p. 3 l. 28: A nitrocellulose filter installed underneath the PC filter? Does this have an effect on the distance between nozzle and impaction plate?

p.4 l.1: These numbers are slightly different from the specs of the manufacturer. Did you measure cut-off sizes? If yes, how?

p.4 l.19 The experimental section should describe the procedure of the gravimetric analysis in the main text, since this is extremely challenging for small size fractions.

p.5 l.19: OC is roughly 2/3, and only during day. There is also 15-20% sulfur in one sample, and another nighttime sample is 100% “other elements”. Hence, the statement that nanoparticles comprise “mainly organic carbon” is not correct.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1351, 2019.