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Atmospheric Chemistry and Physics Discussions

Interactive comment on "In-depth characterization of submicron particulate matter inter-annual variations at a street canyon site in Northern Europe" *by* Luis M. F. Barreira et al.

Anonymous Referee #1

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The paper by Barreira et al. summarizes measurements of aerosol composition and total mass concentration and meteorological parameters at an urban site in Helsinki during 2015-2019. Measurements include PM1 from an ACSM and MAAP, size distributions and absorption by an aethalometer, as well as PM2.5 mass concentration from TEOM. They conclude that long range transport and local pollution along with boundary layer height and dilution extent control aerosol mass concentrations at the site. During long-range transport pollution episodes, PM1 was dominated by inorganic species, mainly sulfate while during local pollution episodes (typically in winter), organics and BC were significant. Wood burning contribution to BC and optical absorption was observed during winter, and especially at night. Seasonally, organic concentra-

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tions increased during summer, suggesting contribution of SOA.Trend analysis indicate that during the measurement period, there was a decrease in organics, nitrate, and BC concentrations. The paper is overall well-written and interesting, but the scope of the paper fits better with a Measurement Report since there wasn't any new insight on general atmospheric sources of aerosols or aerosol formation and this is not the first study of aerosol measurements in Helsinki. With the following revisions, I recommend publishing it as a Measurement Report (but not research article).

L91. Clarify that the provided size range is in dva. L100. (NH4)2SO4 is ammonium sulfate. L116-117. These two sentences where confusing. If measurements were done at 1-min intervals, the DL should also be quoted for 1-min averaging times and not 10 min and vice versa. L150-155. It was confusing as to what density was used to convert dm to dva. One sentence indicates a constant 1.5 g/cc. This is followed by the composition-dependent equation for density. Also, why was such a low value for organics density used? Especially during long-range transport, OA density is higher than 1.2 because of dominance of oxygenated species. L158-159. Why wasn't a transmission efficiency applied to the volume distributions from SMPS to really count the particles in the ACSM range? Dm=549 nm is ∼dva=780 which is larger than 50% cut-size of the ACSM; therefore I don't think the comparisons between ACSM and SMPS are correct. More concerning is that the bounce correction was determined by this comparison. L180-185. This is also related to the point above. The mass concentration calculations for ACSM seem circular. If the first density estimate used to convert SMPS volume to mass is based on an equation which uses mass estimates of ACSM and if those mass estimates relative to BC are not correct, then the estimated density and SMPS mass concentration are not correct, so the ratio of (SMPS-BC) mass to ACSM mass is not correct. Please explain why you think this calculation is correct. L248. It's mentioned that the 4.5 yr dataset might not be long enough for trend analysis. How far back are similar data available? It seems some measurements are available since 2013. Can these two datasets be combined for just the trend analysis? L307. The seasonal explanation of VC doesn't match the monthly behavior as shown

in Fig. 5. It appears that VC is high during summer and low in winter. Why do authors say that ventilation was low in August? Add VC after 'ventilation coefficient' to define it since it's only discussed in SI. L308. So what's the source of high BC during holiday season/summer? Long range transport? L337. Cold start emissions during summer are still important although the duration of such conditions might be shorter. L348. Why can't the increased BCWB be from local sources? L385. Too qualitative of a statement. Please indicate a number (either exact or say larger by ##%). L400. Change exceed to exceeded L413. What was the concentration of BCff during this local pollution event? In the long-range transport case discussed in the following paragraph, it is indicated that during the local events relative contribution of BCff is not higher than during the long-range transport times and I find that surprising. Is that because its mass conc. is low relative to all the secondary species so the relative contribution stays more or less the same?

L 446. I think it makes more sense to look at the PM2.5 fraction of PM10 rather than the ratio of PM10/PM2.5. Why was the ratio used in the analysis?

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