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Discussions

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comment

Interactive comment on "Winter time hygroscopicity and volatility of ambient urban aerosol particles" *by* Joonas Enroth et al.

Anonymous Referee #1

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This manuscript by Enroth et al. presents some valuable measurement results regarding an important issue "hygroscopic and volatile properties of urban aerosol particles. This study reported the size-resolved hygroscopic and volatile growth factor of particles at Budapest, and discussed its diurnal variation and the difference between workday and weekend. This paper aims to provide important parameters (hygroscopic and volatile growth, mixing state) for understanding the atmospheric aging processes and anthropogenic activity. However, the paper does not bring much real novel findings (or understanding) to the urban aerosol hygroscopicity and volatility. While this paper is generally well written, substantial revisions are needed before it can be considered for publication in ACP, especially for the discussion section. Major comments: 1. My major concern with this work is that some speculative conclusions are drawn from the

measurements that are currently not supported (some instances are listed in the specific comments). The author should provide further evidences (or data) to support their conclusions or more extensive discussion, otherwise they should be removed. 2. The presentation of data should be improved. There were serval parameters used in the article to describe particles hygroscopicity and volatility. In order to avoid any confusion, I suggest that the authors use HGF and VGF to present particles hygroscopic and volatile growth factor in the body text and figures. The subscript like κLH is also suggested. 3. It would be advisable to discuss the impact of anthropogenic activities on aerosol hygroscopicity and volatility in detail. The comparison between workday and weekend is quite interesting. However, it still lacks some deep investigation. For example, it would be very interesting to know how the relationship between the number fraction and growth factor of NH and LV would change in workday and weekend. The comparison of the diurnal variation of particle number size distribution was also an interesting way in this section. 4. Although authors showed the data at Budapest, it was not very clear to me how the results of this study could be compared with previous studies at other urban areas. Specific comments: 1 P4 Line 12: Please add a citation about the earlier study here. 2 P4 Line 34: Please add the unity of each parameter. 3 P4 Line 36: It would be better to use Kelvin temperature instead of Celsius temperature here. 4 P4 Line 39: Is the depression of surface tension only controller by HULIS? 5 P5 Line 1-4: Is there other organics matter can reach the thermodynamic equilibrium fast enough to depress the surface tension in the humidifier tube. 6 P5 Line 8: Please explain why the influence of surface tension is smaller under subsaturated condition. 7 P5 Line 17: Why the parameter "volume fraction remaining" was used here to describe the particle volatility? The parameter "volatile growth factor" is quite enough in discussing particle volatility. 8 P5 Line 16: Please specify the actual value of RH when measuring the GF. 9 P5 Line 28: What is the meaning of "N" here? Do you mean total particles? It was a little bit confused. Please change the expression. 10 P5 Line 37: It may be not necessary to mention the reason of missing data. 11 P6 Line 3-4: According to Fig. 1, these two modes did not seem such distinct on January 16th, and

the particle number concentration decreased on the same time. It would be interesting to analyze the data during this period. 12 P6 Line 30: According to former section, the RH in the humidifier was set to 85% at the beginning of measurement and then set to 90%. Please specific the GF-PDF was measured under which RH value. Please use HGF-PDF and VGF-PDF in this article. 13 P6 Line 34: In sentence "... the median ambient concentration of these particles ..." Please add the actual value of the number concentration in this sentences. 14 P7 Line 30: The author should note the equation used in calculating mean growth factor and number fraction. 15 P7 Line 31: In order to avoid any confusion, please use "number fraction" instead of "relative concentration" in the discussion. 16 P7 Line 37: "The slight change in the hygroscopic growth behaviour cannot be reliably interpreted without measurements at high (>95%) RHs". Please give a more specific discussion on this sentence. Why the higher RH measurement was needed here? 17 P8 Line 17-19: I don't think that the GF for pure NH4NO3 and (NH4)2SO4 higher than the measured value indicates the LH species become coated with inorganics species. It is not strong evidence. Please modify this sentence. 18 P8 Line 21: Please use the full name instead of "TED/EDS". 19 P8 Line 34: "Our data are slightly below the average GFs". Please list the value of average GFs. 20 P9 Line 7: Please use standard deviation instead of "SD". 21 P9 Line 21-23: The correlation coefficients less than zero suggests that the number fraction of NH and LV modes were negative correlated with the total particle number concentration. Please explain the relationship between these negative correlations with the traffic emissions. 22 Figure 4: Please use κmean, κNH and κLH in the label of y-axis. 23 P9 Line 41-42: The κLH was larger during daytime could result from the development of boundary layer at noon, which would be able to bring aged aerosol from upper atmosphere layer to the ground. 24 P10 L1-2: Because 50 nm particles were more originated from primary emission. It would be better to be mentioned in the discussion. 25 P10 L4-5: The changes in chemical composition including mass distribution for a certain particle size would lead to the change of number fraction in each mode and mean κ. The sentence should be modified. 26 Figure 5: Please use VGF in the label of y-axis. 27 P11 Line

36-37:". . . and since the atmospheric residence time of the particles with the selected diameters is estimated to be several hours." What is relationship between the particles residence time and separating the data? This sentence was not necessary. Please delete it or try to explain more. 28 P12 Line10-11: ". . . but without substantial variation during the daylight period". It might be wrong. According to fig. 6 (c), the κ values increased during daytime and became much higher than in nighttime. Please explain that. 29 Section 4.5: There is not essentially difference between VGF and VFR. Please delete the part of VFR and focus on the relationship between VGF and HGF. 30 Section 4.5: It would be interesting to discuss the relationship between VGF and HGF for each mode. 31 P13 Line 34-35: "The smallest particles (with dry diameters of 50 and 75 m) appeared to be dominated by vehicle emissions since their size range, diurnal variability and timing matched the traffic intensity and 35 emissions." It doesn't consist with the former discussion in page 11 line 2-3 "Particles with diameters of 50 and 70 nm seemed more volatile during the daylight time period than the 110- and 145-nm particles. The latter two sizes are in the typical size range of fresh diesel emissions (Charron and Harrison, 2003)". Please explain that.

References: Cai, M. et al, Comparison of Aerosol Hygroscopcity, Volatility, and Chemical Composition between a Suburban Site in the Pearl River Delta Region and a Marine Site in Okinawa. Aerosol and Air Quality Research. Doi:10.4209/aaqr.2017.01.0020