Referee #1

Comment #5: The proper term is “electrical equivalent mobility”

Response: Line 130: The word “electric mobility” has been revised to “electrical equivalent mobility”.

Comment #6: There are work done in this issue, e.g. Chen et al. (2013) Dynamic variations of ultrafine, fine and coarse particles at the Lu-Lin background site in East Asia, Atmos. Enviorn. 78, 154-162.

Response: The work by Chen et al. (2013) has been discussed in the manuscript. Please refer to the response for technical comment #5.

Comment #15: Banana curve is not a proper wording in scientific literature to describe new particle formation and subsequent growth. Please modify the text.

Response: Line 378: The sentence “…nucleation event (a banana curve)…” has been revised to “*nucleation event (increase of nucleation mode particle concentrations with subsequent growth in particle size)*”.

Comment #25: Also refer here to the review article of Kulmala et al. (2004). The results are within typical values observed in the troposphere.

Response: The typical values of GR observed in other areas which listed in Kulmala et al. (2004) have been cited.

Line 404: The sentence “…Beijing (average: 5.2 nm h-1, Wang et al., 2013).” has been revised to “*…Beijing (average: 5.2 nm* h^{-1}*, Wang et al., 2013),* and also within the range observed in other nucleation studies across the globe *(~1 – 20 nm* h^{-1}*, Kulmala et al., 2004).*”.

Comment #26: For sulfuric acid proxy from UV*SO2/CS, you can refer to Petäjä et al. (2009). Sulfuric acid and OH concentrations in a boreal forest site, Atmos. Chem. Phys. 9, 7435-7448. There is also a conversion factor to convert the proxy to a real concentration.

Response: The pre-factor, k, used in sulfuric acid proxy calculation by Petäjä et al. (2009) could differ at different sites. In this study, actual measurement of H_2SO_4 and OH concentrations were unavailable and hence a site-specific k value cannot be estimated. Thus, the proxy value in this work cannot represent the real particle number concentration, but rather is used as an indicator of particle production strength contributed by H_2SO_4. The discussion between the proxy calculation between the present work and Petäjä et al. (2009) has been added.

Line 409: The following sentences have been inserted.
"*Petäjä et al. (2009) calculated the H_2SO_4 proxy with a pre-factor value, k, and use it to estimate the actual sulfuric acid concentration. The estimation of a site-specific k value requires an actual measurement of H_2SO_4 which is not available in this study area. The proxy value calculated in this study was therefore only used as an indicator of particle production strength contributed by H_2SO_4.*"

Technical comments:

Comment #1: Abstract: line 23:…with a peak level…
Response #1: The word "with peak level" has been revised to "with a peak level"

Comment #2: Line 29: sentence: The PSD information…is not well formulated. Median concentrations for different size distribution modes were…
Response #2: The sentence "The PSD information…" has been revised to "*Median concentrations for different size distribution modes peaked in different seasons. The nucleation mode PNC ($N_{4\text{-}25}$) peaked at 11.6×10^3 cm^{-3} in winter, whereas the Aitken mode ($N_{25\text{-}100}$) and accumulation mode ($N_{100\text{-}736}$) exhibited summer maxima at 6.0×10^3 and 3.1×10^3 cm^{-3}, respectively.*"

Comment #3: Line 30: also organics are important, not only sulfuric acid.
Response #3: We agreed that organics are important to photo-production of particles as well. However, VOCs were not measured in this study. The following sentence has been inserted to discuss the possible contribution of organic compounds in NPF:

Section 3.4, paragraph 3: After the sentence "The results of this work evidenced that low PM10 concentration…", the sentence "Nevertheless, it should be noted that condensing vapors other than sulfuric acid, for example VOCs, could also contribute to the observed particle formation, which requires further investigation." was added.

Comment #4: Page 3, line 64-66: There was considerable effort in ACE-ASIA to look into continental outflow. Please refer also to that work.
Response #4: Line 67: The work of Buzorius et al. (2004) carried in ACE-ASIA campaign has been cited.

Comment #5: Page 4, line 94: See above for Chen et al. (2013) and other works

Response #5: The work by Chen et al. (2013) has been discussed in the manuscript.
Line 93: The sentence "All these studies…" has been revised to "Chen et al. (2013) conducted a measurement of the particle number concentration at the background station on the mountain of central Taiwan in summer 2009 and autumn 2010. The result showed that particle number concentrations were dominated by local sources rather than long-range transport due to the short lifetime of nano-particles. Most of the previous studies mentioned above were limited to measurements in terms of PM_{10} or $PM_{2.5}$ for a particular period. However, the seasonal variations of particles in either ultrafine or sub-micron range have not been well illustrated."

Comment #6: Line 114: m.a.g.l not defined.
Response #6: Line 119: "a.g.l." has been revised to "*above ground level*".

Comment #7: Line 146: EC and OC not defined.
Response #7: Line 151: "(i.e. OC and EC)" has been revised to "*(i.e. organic carbon, OC and elemental carbon, EC).*".

Comment #8: Line 160: UVB not defined
Response #8: Line 166: Definition of UVB has been added.
"(i.e. wind direction/speed and UVB)" has been revised to "*(i.e. wind direction/speed and UVB (wavelength: 280-315 nm))*"

Comment #9: Line 163: … trace gas measurements…
Response #9: Line 169 "…trace gases measurement…" has been revised to "*trace gas measurements*".

Comment #10: Line 167-168. Can you really differentiate with such a precision (49.6 nm)?
Response #10: The particle size 49.6 nm mentioned in the manuscript was the mid-size cut of the measurement bin by SMPS. We have reported a value of 50 nm instead.

Line 173-174: The sentence of "The PSD of …" has been revised to "*The PSD of 4 – 736 nm presented in this study was combined from two sets of SMPS data, where the nano-SMPS corresponded to the size range of 4 – 50 nm, and the long-SMPS corresponded to the size > 50 nm.*".

Comment #11: Line 185. … disappear into the atmosphere? The nanoparticles are

lost by coagulation to the pre-existing aerosol population and/or other surfaces.
Response #11: The corresponding sentence has been revised to "*A NPF event is defined as the increase of the number concentration of nucleation mode particles, where those particles are growing into Aitken and/or accumulation mode size range (≥ 25 nm) and last for a few hours until they coagulate on the pre-existing aerosol and/or other surfaces in the atmosphere.*".

Comment #12: Line 189: Kulmala et al. (2012) Nature protocols – article gives a good overview of the methodology.

Kulmala, M., Petaja, T., Nieminen, T., Sipila, M., Manninen, H.E., Lehtipalo, K., Dal Maso, M., Aalto, P.P., Junninen, H., Paasonen, P., Riipinen, I., Lehtinen, K.E.J., Laaksonen, A. and Kerminen, V.-M. (2012) Measurement of the nucleation of atmospheric aerosol particles, Nature Protocols 7, 1651-1667.
Response #12: Section 2.3: The work by Kulmala et al. (2012) has been cited.

Comment #13: Line 191: The formation rate…
Response #13: Line 197: "Formation rate…" has been revised to "*The formation rate…*".

Comment #14: Line 194: …some fraction of…
Response #14: Line 200: "…some fractions of…" has been revised to "…some fraction of…".

Comment #15: Line 226 onwards: For median concentrations standard deviation does not a properly represent variability. Please show e.g. quartile ranges.
Response #15: Line 226 onwards. Standard deviation values of the particle concentrations were replaced by quartile ranges (Q1-Q3).

Comment #16: Line 226 onwards and Figure 2: How are the average calculated? Do you fit each single size distribution and compile the median GMD, GSD and N for each mode? Or do you average the distributions and then do fitting? It would be good make a table showing each season and each mode parameters.
Response #16: Firstly, we fit every hourly PSD data and then calculate the parameters of each mode. The fitting results have been listed in **Table S1** in appendix.

Comment #17: Line 254: Any references to other works about seasonal variability of

the PSD?

Response #17: Previous studies on seasonal variability of the PSD have been discussed and cited.

Section 3.1, paragraph 3. The following sentence has been inserted.

"This was different from that observed in urban Beijing where relatively larger GMD was observed in accumulation mode due to the enhancement of condensation by higher photochemical activities in summer but without significant seasonal variations in Aitken mode distribution (Wu et al., 2008)."

Wu Z., Hu, M., Lin, P., Liu, S., Wehner, B. and Wiedensohler, A. (2008). Particle number size distribution in the urban atmosphere of Beijing, China. Atmospheric Environment, 42, 7967-7980.

Comment #18: Line 362: do you see two nucleation bursts or just two occasions, when nucleation mode particles are observed, either form secondary or primary sources?

Response #18: We observed the increase of nucleation mode particles during the morning and afternoon peak hours, during which no obvious particle growth observed. Thus, we suggested that those particles were mainly contributed by vehicle emission. However, we cannot differentiate whether they were formed by primary and secondary processes.

Comment #19: Line 385: compare observed GR to typical values around the globe (Kulmala et al. 2004).

Response #19: Please refer to the response on referee #1's comment #25.

The sentence "The averaged particle…" has been revised to "*The averaged particle growth and formation rates were found to be 4.0±1.1 nm h^{-1} and 1.4±0.8 cm^{-3} s^{-1}, which were comparable to those measured in other urban studies in Asian countries such as Hong Kong (average: 6.7 nm h^{-1}, Wang et al., 2014) and Beijing (average: 5.2 nm h^{-1}, Wang et al., 2013)*".

The following studies have been added to the references list:

Wang, D., Guo, H., Cheung, K. and Gan, F. (2014). Observation of nucleation mode particle burst and new particle formation events at an urban site in Hong Kong. Atmospheric Environment, 99, 196-205.

Wang Z. B., Hu, M., Suu, J.Y., Wu, Z.J., Yue, D.L., Shen, X.J., Zhang, Y.M., Pei, X.Y.,

Cheng, Y.F. and Wiedensohler, A. (2013). Characteristics of regional new particle formation in urban and regional background environments in the North China Plain. Atmospheric Chemistry and Physics, 13, 12495-12506.

Comment #20: Line 435: You state that local vehicular emissions dominate the concentrations. Earlier you underlined the importance of secondary processes.
Response #20: In Section 3.3, we stated that the particles in nighttime were mainly emitted from the vehicular exhausts and the elevated PNCs in daytime were due to both the primary and secondary sources, and this occurred mainly in summertime when photochemical production of nucleation mode particles is more intense. Moreover, in Section 3.4, the importance of secondary processes as major contributor to NPF event was also discussed, and it was stated that clear NPF events were observed often in summer and occasionally in spring, but rarely in autumn and winter.

Hence, during colder season and when photochemical reactions were weak, vehicle emissions were the dominant source to PNC, which is discussed in Section 3.5.

To better clarify this, the following sentence has been added:
Section 3.3, last paragraph: "Nevertheless, the contribution of vehicle emission was also significant, and it was observed to be dominant source during colder seasons and when photochemical reactions were less intense. This will be discussed in detail in Section 3.5."

Comment #21: Line 443: …a moderate correction…
Response #21: Line 468: "Interestingly, moderate correlation…" has been revised to "*Interestingly, a moderate correlation…*".

Comment #22: Line 485: Banana shape is not suitable for scientific literature. Please reformulate.
Response #22: Line 514. The term "banana shape" has been revised to "*nucleation*". Line 516: "The banana shape of…" has been revised to "*The nucleation event initiated since ~06:00 LT until 21:00 LT, when the northeasterly wind prevailed.*".

Comment #23: Line 505: Significantly higher? Maybe for the Aitken mode, how about the other modes?
Response #23: Line 529: The sentence "The median $N_{4\text{-}25}$…" has been revised to "T*he PNCs of different modes observed in non-LRT events were 8.6x10^{3} cm^{-3} (nucleation mode), 9.3x10^{3} cm^{-3} (Aitken mode) and 2.6x10^{3} cm^{-3} (accumulation*

mode). The PNCs of LRT events were 9.2x10^3 cm^{-3} (nucleation mode), 4.0x10^3 cm^{-3} (Aitken mode), and 1.3x10^3 cm^{-3} (accumulation mode), respectively. The nucleation mode PNC observed in non-LRT was comparable with that in LRT events, whereas significant higher PNCs for the Aitken mode and accumulation mode were observed during non-LRT periods.

Comment #24: Line 554: References to compare with other studies.
Response #24: The comparison has been discussed in Section 3.4, paragraph 1. Please refer to the response to comment #19.

Comment #25: Table 1. Show quartile ranges.
Response #25: Quartile ranges (Q1-Q3) have replaced the standard deviation values in Table 1.

Comment #26: Table 2. Show average J and GR + standard deviation.
Response #26: Average J and GR and their standard deviation values have already been listed in Table 2.

Comment #27: Table 3. Show variability
Response #27: Standard deviation values for the parameters have been added in Table 3.

Table 3. Average of $N_{4\text{-}25}$, PM_{10}, UVB, SO_2, condensation sink (CS), H_2SO_4 proxy and wind speed of different seasons. Standard deviation values shown in brackets (Note: the data with observation of rainfall was not used in calculation).

Periods	***$N_{4\text{-}25}$ (10^3 #/cm^3)***	***PM_{10} (μg m^{-3})***	***UVB (Wm^{-2})***	***SO2 (ppb)***	***CS (10^{-2} s^{-1})***	***H_2SO_4 proxy (ppb Wm^{-2} s)***	***Wind speed (ms^{-1})***
Autumn	8.6 (±4.5)	53.9 (±21.4)	1.04 (±1.75)	2.27 (±1.44)	0.85 (±0.52)	307.1 (±609.1)	2.82 (±1.04)
Winter	11.6 (±9.2)	48.4 (±23.9)	0.80 (±1.47)	2.58 (±1.61)	0.75 (±0.61)	240.0 (±472.1)	2.34 (±0.89)
Spring	10.2 (±9.2)	61.1 (±27.0)	0.99 (±1.73)	2.76 (±1.67)	1.35 (±0.67)	238.4 (±533.6)	2.17 (±1.19)
Summer	6.9 (±9.1)	35.6 (±13.7)	1.97 (±2.95)	3.19 (±2.55)	1.89 (±1.51)	493.1 (±1066)	2.35 (±1.13)

Comment #28: Figure 2: Y-labels are too close to each other. Move values describing the fit results (GMD, N) to a separate table.

Response #28: Figure 2 has been modified, and the fitting results have been moved to a separate table.

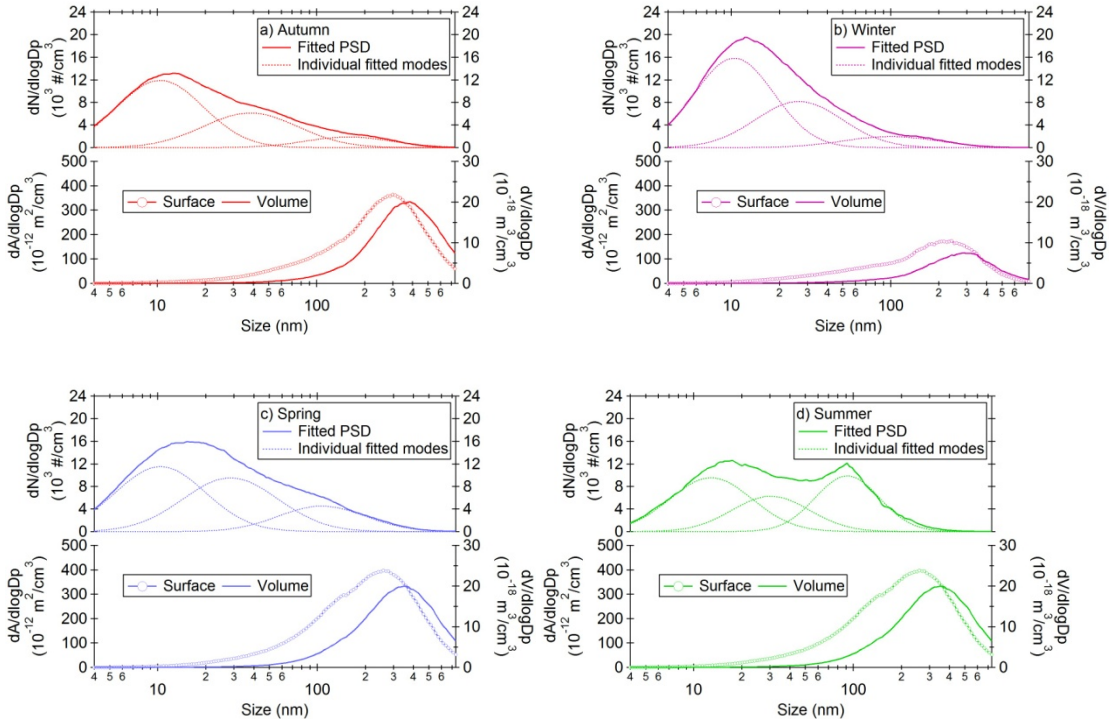

Table S1. Fitting results of the particle number size distributions of each season, and during long-range (LRT) and non long-range transport (non-LRT).

	Mode 1		**Mode 2**		**Mode 3**	
	n **(10^3 #/cm^3)**	***GMD***	***n*** **(10^3 #/cm^3)**	***GMD***	***n*** **(10^3 #/cm^3)**	***GMD***
Autumn	8.1	10.4	4.6	38.4	1.3	159
Winter	9.9	10.4	5.6	26.5	1.5	100
Spring	8.1	10.4	7.1	28.6	3.1	107
Summer	6.2	12.8	3.8	30.4	5.0	91.8
LRT	9.2	10.4	4.0	37.2	1.3	158
Non-LRT	8.6	11.4	9.3	30.4	2.6	114

Comment #29: Figure 7: Scale to sulfuric acid mixing ratio.
Response #29: The Y-axis of **Figure 7** is UVB*SO_2, instead of the actual sulfuric acid (by *k*UVB*SO_2). Therefore, we would like to keep the original label of the **Figure 7**. (see **response to Referee #1's comment #25**)

Comment #30: Figure 10: also show the fitted parameters in a table (maybe together with seasonal parameters).
Response #30: Fitted parameters were shown in **Table S1** in appendix (see **response #28**).