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Measurement Report: New insights into the boundary layer revolution impact on new particle formation characteristics in three megacities of China

Hancheng Hu¹, Yidan Zhang ¹, Yuting Li¹, Dongyang Pu ¹, Hao Wu^{1,*}

¹College of Electronic Engineering, Chengdu University of Information Technology, Chengdu 610225

* Correspondence: wuhao@cuit.edu.cn; 86 18613878407

site	country	sta	GR	CS	P	Ref
Beijing	China	Asia	4.52	0.016	35.4	This study
Shanghai	China	Asia	4.52	0.013	34.37	This study
Guangzhou	China	Asia	2.75	0.007	23.96	This study
Mountain Tai	China	Asia	0.58– 7.76	0.014(0.001– 0.284)	70.7	(Lv, Sui, Chen, Jayaratne, & Mellouki, 2018)
Beijing	China	Aisa	0.5-9.0	0.0042	12	(Jayaratne et al., 2017)
Beijing	China	Aisa	3.7/3.9	0.01		(X. J. Shen et al., 2016)
Beijing	China	Aisa	1-6	0.0005-0.02		(Tuovinen et al., 2022)
Shangdianzi	China	Asia	3.6	0.020±0.020	55.6	(X. Shen et al., 2016)
Taishan	China	Asia	6	0.020±0.014	33.3	(X. Shen et al., 2016)

Lin'an	China	Asia	6.2	0.032±0.013	51.6	(X. Shen et al., 2016)
Lanzhou	China	Aisa	4.4(1.4–17.0)	1.6(0.9–2.4)		(Gao, Chai, Wang, & Wang, 2011)
Shanghai	China	Aisa	8.0(4.2–12)	2.0(1.0–3.3)		(Peng et al., 2014)
Guangzhou	China	Aisa	10.9(7.3–18.1)	3.9(2.6–5.6)		(Peng et al., 2014)
Wuxi	China	Asia	10.4(6.2–13.3)	1.7(0.9–2.8)		(Peng et al., 2014)
Kaiping	China	Asia	7.4(3.2–13.5)	2.5(0.3–8.6)		(Peng et al., 2014)
Jiaxing	China	Asia	2.2(1.1–4.1)	13.6(7.9–19.6)		(Peng et al., 2014)
New Delhi	India	Asia	5–7	15		(Mönkkönen et al., 2005)
Baengnyeong-do	Korea	Asia	1.69–6.93	2.37–10.3		(Kim et al., 2016)
Jeju	Korea	Asia	1.22–8.13	2.59–21.2		(Kim et al., 2016)
Jeju	Korea	Asia	3.3			(Kim, Kim, & Yoon, 2014)
Baengnyeong-do	Korea	Asia	1.1–15.7			(Lee, Lee, Kim, Choi, & Kim, 2008)
Budapest	Hungary	Europe	2.0–13.3	1.2		(Salma et al., 2011)
Po Valley	Italy	Europe	0.4–1.84.2–8	0.4–1.8	14	(Hamed et al., 2007)

Granada	Spain	Europe	4.5	0.67	14.9	(Casquero-Vera et al., 2020)
Northern Finland	Finland	Europe	2-4			(Asmi et al., 2011)
Hyytiala	Finland	Europe	3	0.2	15	(Dal Maso, Kulmala, Riipinen, & Wagner, 2005)
Mexico City	Mexico	North America	0.5-9			(Dunn et al., 2004)
Mexico City	Mexico	North America	15-40			(Iida, Stolzenburg, McMurry, & Smith, 2008)
Harrow	Canada	North America	6.4	0.96±0.06		(Jeong et al., 2010)
Ridgetown	Canada	North America	4.7	0.53±0.02		(Jeong et al., 2010)
Bear Creek	Canada	North America	2.9	0.67±0.01		(Jeong et al., 2010)
Egbert	Canada	North America	5.1	0.83±0.03		(Jeong et al., 2010)
Toronto	Canada	North America	6.7	1.22±0.26		(Jeong et al., 2010)
Nazko River	America	North America	0.003-0.33	0.0006-0.003		(Andreae, Andreae, Ditas, & Pöhlker, 2022)
Eagle Lake	America	North	0.2-5.2	0.0011-		(Andreae et

		America		0.0048		al., 2022)
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- Andreae, M. O., Andreae, T. W., Ditas, F., & Pöhlker, C. (2022). Frequent new particle formation at remote sites in the subboreal forest of North America. *Atmospheric Chemistry and Physics*, 22(4), 2487–2505. doi:10.5194/acp-22-2487-2022
- Asmi, E., Kivekäs, N., Kerminen, V. M., Komppula, M., Hyvärinen, A. P., Hatakka, J., . . . Lihavainen, H. (2011). Secondary new particle formation in Northern Finland Pallas site between the years 2000 and 2010. *Atmos. Chem. Phys.*, 11(24), 12959–12972. doi:10.5194/acp-11-12959-2011
- Casquero-Vera, J. A., Lyamani, H., Dada, L., Hakala, S., Paasonen, P., Román, R., . . . Alados-Arboledas, L. (2020). New particle formation at urban and high-altitude remote sites in the south-eastern Iberian Peninsula. *Atmos. Chem. Phys.*, 20(22), 14253–14271. doi:10.5194/acp-20-14253-2020
- Dal Maso, M., Kulmala, M., Riipinen, I., & Wagner, R. (2005). Formation and growth of fresh atmospheric aerosols: Eight years of aerosol size distribution data from SMEAR II, Hyytiälä, Finland. *Boreal Environment Research*, 10, 323–336.
- Dunn, M. J., Jiménez, J. L., Baumgardner, D., Castro, T., McMurry, P. H., & Smith, J. N. (2004). Measurements of Mexico City nanoparticle size distributions: Observations of new particle formation and growth. *Geophysical Research Letters*, 31(10). doi:10.1029/2004gl019483
- Gao, J., Chai, F., Wang, T., & Wang, W. (2011). Particle number size distribution and new particle formation (NPF) in Lanzhou, Western China. *Particuology*, 9(6), 611–618. doi:10.1016/j.partic.2011.06.008
- Hamed, A., Joutsensaari, J., Mikkonen, S., Sogacheva, L., Dal Maso, M., Kulmala, M., . . . Laaksonen, A. (2007). Nucleation and growth of new particles in Po Valley, Italy. *Atmos. Chem. Phys.*, 7(2), 355–376. doi:10.5194/acp-7-355-2007
- Iida, K., Stolzenburg, M. R., McMurry, P. H., & Smith, J. N. (2008). Estimating nanoparticle growth rates from size-dependent charged fractions: Analysis of new particle formation events in Mexico City. *Journal of Geophysical Research: Atmospheres*, 113(D5). doi:10.1029/2007jd009260
- Jayaratne, R., Pushpawela, B., He, C., Li, H., Gao, J., Chai, F., & Morawska, L. (2017). Observations of particles at their formation sizes in Beijing, China. *Atmos. Chem. Phys.*, 17(14), 8825–8835. doi:10.5194/acp-17-8825-2017
- Jeong, C. H., Evans, G. J., McGuire, M. L., Chang, R. Y. W., Abbatt, J. P. D., Zeromskiene, K., . . . Leaitch, W. R. (2010). Particle formation and growth at five rural and urban sites. *Atmospheric Chemistry and Physics*, 10(16), 7979–7995. doi:10.5194/acp-10-7979-2010
- Kim, Y., Kim, S.-W., & Yoon, S.-C. (2014). Observation of new particle formation and growth under cloudy conditions at Gosan Climate Observatory, Korea. *Meteorology and Atmospheric Physics*, 126(1–2), 81–90. doi:10.1007/s00703-

- Kim, Y., Kim, S.-W., Yoon, S.-C., Park, J.-S., Lim, J.-H., Hong, J., . . . Heo, B.-H. (2016). Characteristics of formation and growth of atmospheric nanoparticles observed at four regional background sites in Korea. *Atmospheric Research*, *168*, 80-91. doi:10.1016/j.atmosres.2015.08.020
- Lee, Y.-G., Lee, H.-W., Kim, M.-S., Choi, C. Y., & Kim, J. (2008). Characteristics of particle formation events in the coastal region of Korea in 2005. *Atmospheric Environment*, *42*(16), 3729-3739. doi:10.1016/j.atmosenv.2007.12.064
- Lv, G., Sui, X., Chen, J., Jayaratne, R., & Mellouki, A. (2018). Investigation of new particle formation at the summit of Mt. Tai, China. *Atmospheric Chemistry and Physics*, *18*(3), 2243-2258. doi:10.5194/acp-18-2243-2018
- Mönkkönen, P., Koponen, I. K., Lehtinen, K. E. J., Hämeri, K., Uma, R., & Kulmala, M. (2005). Measurements in a highly polluted Asian mega city: observations of aerosol number size distribution, modal parameters and nucleation events. *Atmos. Chem. Phys.*, *5*(1), 57-66. doi:10.5194/acp-5-57-2005
- Peng, J. F., Hu, M., Wang, Z. B., Huang, X. F., Kumar, P., Wu, Z. J., . . . He, L. Y. (2014). Submicron aerosols at thirteen diversified sites in China: size distribution, new particle formation and corresponding contribution to cloud condensation nuclei production. *Atmospheric Chemistry and Physics*, *14*(18), 10249-10265. doi:10.5194/acp-14-10249-2014
- Salma, I., Borsós, T., Weidinger, T., Aalto, P., Hussein, T., Dal Maso, M., & Kulmala, M. (2011). Production, growth and properties of ultrafine atmospheric aerosol particles in an urban environment. *Atmospheric Chemistry and Physics*, *11*(3), 1339-1353. doi:10.5194/acp-11-1339-2011
- Shen, X., Sun, J., Zhang, X., Zhang, Y., Zhang, L., & Fan, R. (2016). Key features of new particle formation events at background sites in China and their influence on cloud condensation nuclei. *Frontiers of Environmental Science & Engineering*, *10*. doi:10.1007/s11783-016-0833-2
- Shen, X. J., Sun, J. Y., Zhang, X. Y., Zhang, Y. M., Zhang, L., Fan, R. X., . . . Shi, Q. F. (2016). The influence of emission control on particle number size distribution and new particle formation during China's V-Day parade in 2015. *Sci Total Environ*, *573*, 409-419. doi:10.1016/j.scitotenv.2016.08.085
- Tuovinen, S., Cai, R., Kerminen, V.-M., Jiang, J., Yan, C., Kulmala, M., & Kontkanen, J. (2022). Survival probabilities of atmospheric particles: comparison based on theory, cluster population simulations, and observations in Beijing. *Atmospheric Chemistry and Physics*, *22*(22), 15071-15091. doi:10.5194/acp-22-15071-2022