Pengfei Liu, Ph.D.

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RESEARCH & TEACHING INTERESTS

My general research interests are in the areas of **atmospheric chemistry, aerosol & clouds, air pollution, climate change, and environmental health**. My work involves laboratory, field, and modeling studies. I have received academic training in the fields of atmospheric sciences and environmental sciences, and I am interested in teaching relevant courses at both undergraduate and graduate levels.

ACADEMIC APPOINTMENTS

Dec. 2017 – present **Postdoctoral Research Fellow, Harvard University**
- Atmospheric Chemistry Modeling Group, Advisor: **Loretta J. Mickley**
- Project: ICECAP (Ice Age Chemistry and Proxies): Investigating Fire Activity and its Implications for Climate Across Multiple Timescales

May 2017 – Nov. 2017 **Postdoctoral Research Fellow, Harvard University**
- Advisor: **Scot T. Martin**
- Project: Hygroscopicity and Cloud Condensation Nuclei Activity of Organic Particulate Matter

EDUCATION

2011 – 2017 **Ph.D., Harvard University, Cambridge, MA**
- Engineering Sciences, Environmental Science and Engineering Program, John A. Paulson School of Engineering and Applied Sciences.
- **NASA Earth and Space Science Fellow**.
- GPA: 3.97/4.00, ten courses in Environmental Sciences, Earth & Planetary Sciences, Applied Math, and Statistics
- Dissertation: Optical, Physical, and Thermodynamic Properties of Organic Particulate Matter. Advisor: **Scot T. Martin**

2008 – 2011 **M.Sc., Peking University, China**
- Atmospheric Physics & Atmospheric Environment, Department of Atmospheric and Oceanic Sciences, School of Physics.
- Guest researcher at Leibniz Institute for Tropospheric Research, Germany (Host: **Alfred Wiedensohler**)
- Thesis: Hygroscopicity of Aerosol Particles at High Relative Humidity. Advisors: **Chunsheng Zhao** (Peking University)

2004 – 2008 **B.Sc., Peking University, China**
- Atmospheric and Oceanic Sciences, School of Physics.

PUBLICATIONS (Google scholar citations = 1385, H-index = 21)

Selected Publications:

[37]. **Liu, P. F.**; Song, M; Zhao, T.; Gunthe, S. S.; Ham, S., He, Y. P., Qin, Y. M., Gong, Z. H., Amorim, J. C.; Bertram, A. K.; Martin, S. T., Resolving the mechanisms of hygroscopic growth and cloud condensation nuclei activity for organic particulate matter. ***Nat. Commun.***, 2018, 9, 4076.

[36]. **Liu, P. F.**; Li, Y. J.; Wang, Y.; Bateman, A. P.; Zhang, Y.; Gong, Z.; Bertram, A. K.; Martin, S. T., Highly viscous states affect the browning of atmospheric organic particulate matter. ***ACS Cent. Sci.***, 2018, 4(2), 207-215.

[35]. **Liu, P. F.**; Li, Y. J.; Wang, Y.; Gilles, M. K.; Zaveri, R. A.; Bertram, A. K.; Martin, S. T., Lability of secondary organic particulate matter. ***Proc. Natl. Acad. Sci. USA***, 2016, 113(45), 12643-12648.

[34]. **Liu, P. F.**; Abdelmalki, N.; Hung, H. M.; Wang, Y.; Brune, W. H.; Martin, S. T., Ultraviolet and visible complex refractive indices of secondary organic material produced by photooxidation of the aromatic compounds toluene and *m*-xylene. *Atmos. Chem. Phys.* 2015, 15, (3), 1435-1446.

[33]. **Liu, P. F.**; Zhang, Y.; Martin, S. T., Complex refractive indices of thin films of secondary organic materials by spectroscopic ellipsometry from 220 to 1200 nm. *Environ. Sci. Technol.* 2013, 47, (23), 13594-13601.

[32]. **Liu, P. F.**; Zhao, C. S.; Göbel, T.; Hallbauer, E.; Nowak, A.; Ran, L.; Xu, W. Y.; Deng, Z. Z.; Ma, N.; Mildenberger, K.; Henning, S.; Stratmann, F.; Wiedensohler, A., Hygroscopic properties of aerosol particles at high relative humidity and their diurnal variations in the North China Plain. *Atmos. Chem. Phys.* 2011, 11, (7), 3479-3494.

[31]. **Liu, P. F.**; Zhao, C. S.; Zhang, Q.; Deng, Z. Z.; Huang, M. Y.; Ma, X. C.; Tie, X. X., Aircraft study of aerosol vertical distributions over Beijing and their optical properties. *Tellus B* 2009, 61, (5), 756-767.

[30]. Wang, Y.[#]; **Liu, P. F.**; Li, Y. J.; Bateman, A. P; Martin, S. T.; Hung, H. M., The reactivity of toluene-derived secondary organic material (SOM) with ammonia and the influence of water vapor. *J. Phys. Chem. A.*, 2018, 122(38), 7739-7747. ([#]mentored student)

[29]. Shi, L. H.[*]; **Liu, P. F.**[*]; Kloog, I; Lee, M; Kosheleva, A; Schwartz, J. D., Estimating daily air temperature across the Southeastern USA using high-resolution satellite data: A statistical modeling study. *Environ. Res.* 2016, 146, 51-58. ([*]contributed equally)

[28]. Bateman, A. P.; Gong, Z.; **Liu, P. F.**; Sato, B.; Cirino, G.; Zhang, Y.; Artaxo, P.; Bertram, A. K.; Manzi, A. O.; Rizzo, L. V.; Souza, R. A. F.; Zaveri, R. A.; Martin, S. T., Submicron particulate matter is primarily in liquid form over Amazon rain forest. *Nat. Geosci.*, 2016, 9, 34-37.

[27]. Shi, L. H.; Kloog, I.; Zanobetti, A.; **Liu, P. F.**; Schwartz, J. D., Impacts of temperature and its variability on mortality in New England. *Nat. Clim. Change*, 2015, 5, 988-991.

Other Peer-Reviewed Publications:

[26]. Gong, Z.; Han, Y.; **Liu, P.**; Ye, J.; Keutsch, F. N.; McKinney, K. A.; Martin, S. T., Influence of Particle Physical State on the Uptake of Medium-Sized Organic Molecules. *Environ. Sci. Technol.*, 2018, 52 (15), 8381-8389.

[25]. Zhang, Y.; **Liu, P.**; Gong, Z; Geiger, F. M.; Martin, S. T., Production and Measurement of Organic Particulate Matter in a Flow Tube Reactor. *J. Vis. Exp.*, 2018, 142, e55684.

[24]. Song, M.; **Liu, P. F.**; Martin, S. T.; Bertram, A. K., Liquid-liquid phase separation in particles containing secondary organic material free of inorganic salts, *Atmos. Chem. Phys.*, 2017, 17, 11261-11271.

[23]. Gray Be, A.; Upshur, M. A.; **Liu, P. F.**; Martin S. T.; Geiger, F; Thomson, R., Cloud activation potentials for atmospheric α-pinene and β-caryophyllene ozonolysis products. *ACS Cent. Sci.*, 2017, 3(7), 715-725.

[22]. Rastak, N., Pajunoja, A., Acosta Navarro, J. C., Ma, J., Song, M., Partridge, D. G., Kirkevåg, A., Leong, Y., Hu, W. W., Taylor, N. F., Lambe, A., Cerully, K., Bougiatioti, A., **Liu, P.**, Krejci, R., Petäjä, T., Percival, C., Davidovits, P., Worsnop, D. R., Ekman, A. M. L., Nenes, A., Martin, S., Jimenez, J. L., Collins, D. R., Topping, D. O., Bertram, A. K., Zuend, A., Virtanen, A., and Riipinen, I.: Microphysical explanation of the RH-dependent water affinity of biogenic organic aerosol and its importance for climate, *Geophys. Res. Lett.*, 2017, 10.1002/2017GL073056.

[21]. Li, Y. J.; **Liu, P. F.**; Bergoend, C.; Bateman, A. P.; Martin, S. T., Rebounding hygroscopic inorganic aerosol particles: liquids, gels, and hydrates. *Aerosol Sci. Tech.*, 2017, 51(3), 388-396.

[20]. Wang, Y.; Lee, M; **Liu, P. F.**; Shi, L. H.; Yu, Z.; Awad, Y. A.; Zanobetti, A; Schwartz, J. D., Doubly robust additive hazards models to estimate effects of a continuous exposure on survival. *Epidemiology*, 2017 28(6), 771-779.

[19]. Wang, Y.; Shi, L. H.; Lee, M; **Liu, P. F.**; Di, Q.; Zanobetti, A; Schwartz, J. D., Long-term exposure to PM2.5 and mortality among older adults in the Southeastern US. *Epidemiology*, 2017, 28(2), 207-214.

[18]. Song, M.; **Liu, P. F.**; Hanna, S. J.; Zaveri, R. A.; Potter, K.; You, Y.; Martin, S. T.; Bertram, A. K., Relative humidity-dependent viscosity of secondary organic material from toluene photo-oxidation and possible implications for organic particulate matter over megacities. *Atmos. Chem. Phys.*, 2016, 16, 8817-8830.

[17]. Renbaum-Wolff, L.; Song, M.; Marcolli, C.; Zhang, Y.; **Liu, P. F.**; Grayson, J. W.; Geiger, F. M.; Martin, S. T.; Bertram, A. K., Observations and implications of liquid–liquid phase separation at high relative humidities in secondary organic material produced by α-pinene ozonolysis without inorganic salts. *Atmos. Chem. Phys.*, 2016, 16, 7969-7979.

[16]. Shi, L. H.; **Liu, P. F.**; Zanebetti, A; Kosheleva, A; Schwartz, J. D., Chronic effects of temperature on mortality in the Southeastern USA using satellite-based exposure metrics. 2016, *Sci. Rep.*, 2016, 6, 30161.

[15]. Li, Y. J.; **Liu, P. F.**; Gong, Z.; Wang, Y.; Bateman, A. P.; Bergoend, C.; Martin, S. T., Chemical reactivity and liquid/non-liquid states of secondary organic material. *Environ. Sci. Technol.* 2015, 49(22), 13264-13274.

[14]. Zhang, Y.; Sanchez, M. S.; Douet, C.; Wang, Y.; Bateman, A. P.; Gong, Z.; Kuwata, M.; Renbaum-Wolff, L.; Sato, B. B.; **Liu, P. F.**; Bertram, A. K.; Geiger, F. M.; Martin, S. T., Changing shapes and implied viscosities of suspended submicron particles. *Atmos. Chem. Phys.* 2015, 15, (14), 7819-7829.

[13]. Song, M.; **Liu, P. F.**; Hanna, S. J.; Li, Y. J.; Martin, S. T.; Bertram, A. K., Relative humidity-dependent viscosities of isoprene-derived secondary organic material and atmospheric implications for isoprene-dominant forests. *Atmos. Chem. Phys.* 2015, 15, (9), 5145-5159.

[12]. Shrestha, M.; Zhang, Y.; Upshur, M. A.; **Liu, P. F.**; Blair, S. L.; Wang, H.-F.; Nizkorodov, S. A.; Thomson, R. J.; Martin, S. T.; Geiger, F. M., On surface order and disorder of α-pinene-derived secondary organic material. *J. Phys. Chem. A*, 2015, 119, (19), 4609-4617.

[11]. Tao, J. C.; Zhao, C. S.; Ma, N.; **Liu, P. F.**, The impact of aerosol hygroscopic growth on the single-scattering albedo and its application on the NO2 photolysis rate coefficient. *Atmos. Chem. Phys.* 2014, 14, (22), 12055-12067.

[10]. Xu, W. Y.; Zhao, C. S.; Ran, L.; Deng, Z. Z.; Ma, N.; **Liu, P. F.**; Lin, W. L.; Yan, P.; Xu, X. B., A new approach to estimate pollutant emissions based on trajectory modeling and its application in the North China Plain. *Atmos. Environ.* 2013, 71, (0), 75-83.

[9]. Wang, J.; Mao, J.; Zhao, C.; Yan, P.; Ma, N.; **Liu, P. F.**; Liu, X., A novel four-wavelength transmissometer for distinguishing haze and fog. *Acta Meteorologica Sinica* 2013, 27, (4), 556-565.

[8]. Chen, J.; Zhao, C. S.; Ma, N.; **Liu, P. F.**; Göbel, T.; Hallbauer, E.; Deng, Z. Z.; Ran, L.; Xu, W. Y.; Liang, Z.; Liu, H. J.; Yan, P.; Zhou, X. J.; Wiedensohler, A., A parameterization of low visibilities for hazy days in the North China Plain. *Atmos. Chem. Phys.* 2012, 12, (11), 4935-4950.

[7]. Ma, N.; Zhao, C. S.; Müller, T.; Cheng, Y. F.; **Liu, P. F.**; Deng, Z. Z.; Xu, W. Y.; Ran, L.; Nekat, B.; van Pinxteren, D.; Gnauk, T.; Müller, K.; Herrmann, H.; Yan, P.; Zhou, X. J.; Wiedensohler, A., A new method to determine the mixing state of light absorbing carbonaceous using the measured aerosol optical properties and number size distributions. *Atmos. Chem. Phys.* 2012, 12, (5), 2381-2397.

[6]. Ma, N.; Zhao, C. S.; Nowak, A.; Müller, T.; Pfeifer, S.; Cheng, Y. F.; Deng, Z. Z.; **Liu, P. F.**; Xu, W. Y.; Ran, L.; Yan, P.; Göbel, T.; Hallbauer, E.; Mildenberger, K.; Henning, S.; Yu, J.; Chen, L. L.; Zhou, X. J.; Stratmann, F.; Wiedensohler, A., Aerosol optical properties in the North China Plain during HaChi campaign: an in-situ optical closure study. *Atmos. Chem. Phys.* 2011, 11, (12), 5959-5973.

[5]. Ran, L.; Zhao, C. S.; Xu, W. Y.; Lu, X. Q.; Han, M.; Lin, W. L.; Yan, P.; Xu, X. B.; Deng, Z. Z.; Ma, N.; **Liu, P. F.**; Yu, J.; Liang, W. D.; Chen, L. L., VOC reactivity and its effect on ozone production during the HaChi summer campaign. *Atmos. Chem. Phys.* 2011, 11, (10), 4657-4667.

[4]. Xu, W. Y.; Zhao, C. S.; Ran, L.; Deng, Z. Z.; **Liu, P. F.**; Ma, N.; Lin, W. L.; Xu, X. B.; Yan, P.; He, X.; Yu, J.; Liang, W. D.; Chen, L. L., Characteristics of pollutants and their correlation to meteorological conditions at a suburban site in the North China Plain. *Atmos. Chem. Phys.* 2011, 11, (9), 4353-4369.

[3]. Deng, Z. Z.; Zhao, C. S.; Ma, N.; **Liu, P. F.**; Ran, L.; Xu, W. Y.; Chen, J.; Liang, Z.; Liang, S.; Huang, M. Y.; Ma, X. C.; Zhang, Q.; Quan, J. N.; Yan, P.; Henning, S.; Mildenberger, K.; Sommerhage, E.; Schäfer, M.; Stratmann, F.; Wiedensohler, A., Size-resolved and bulk activation properties of aerosols in the North China Plain. *Atmos. Chem. Phys.* 2011, 11, (8), 3835-3846.

[2]. Xiao, X. Z.; **Liu, P. F.**; Geng, F. H.; Gao, W.; Zhen, C. M.; Zhao, C. S., Comparison of black carbon aerosols in urban and suburban areas of Shanghai. *J. App. Meteorol. Sci.* 2011, 22, (2), 158-168 (in Chinese).

[1]. **Liu, P. F.**; Liu, S. H.; Hu, F.; Lv, S.; Liu, H.; Zhang, Y.; Chen, G.; Liang, F., A comparison of the different methods for estimating turbulent fluxes and their errors. *Acta Meteorologica Sinica* 2010, 68, (4), 487-500 (in Chinese).

PRESENTATIONS

Oral presentations

2018 "Investigating fire activity and its implications for climate across multiple timescales", ICECAP Science Team Annual Meeting, University of Rochester, Rochester, NY.

2017 "Highly viscous states affect the browning of atmospheric organic particulate matter", 14th Atmospheric Chemistry Colloquium for Emerging Senior Scientists (ACCESS XIV), Brookhaven National Laboratory, NY.

2015 "How physical states affect the volatility of secondary organic material and kinetic regimes of gas-particle partitioning", International Aerosol Modeling Algorithms Conference, Davis, CA.

2015 "Physical and optical properties of secondary organic material: applications using the oxidation flow reactor", 3rd Potential Aerosol Mass (PAM) user meeting, Oct. 2015, Minneapolis, MN.

2014 "Ultraviolet and visible complex refractive indices of brown carbon formed via photooxidation of aromatic toluene and m-xylene", American Association for Aerosol Research, Orlando, FL.

2010 "Hygroscopic properties of aerosol particles in the North China Plain", Annual Meeting of Chinese Meteorological Society, Beijing, China.

2008 "Aircraft measurements of aerosol vertical distribution over Beijing", Symposium on Aircraft Measurements of Cloud Physics, Beijing, China.

Conference posters

2017 "Highly viscous states affect the browning of atmospheric organic particulate matter", Gordon Research Conference in Atmospheric Chemistry, Sunday River, ME

2015 "Physical state of secondary organic material affects the production of brown carbon", American Association for Aerosol Research, Minneapolis, MN; American Geophysical Union Fall Meeting, San Francisco, CA.

2013 "Wavelength-dependent complex refractive indices of different types of secondary organic material", American Association for Aerosol Research, Portland, OR.

2012 "Monte Carlo simulation of aerosol dynamics in continuous mixed flow reactors", New England Atmospheric Chemistry Symposium (NEATChem), Harvard University, Cambridge, MA.

HONORS AND AWARDS

2017	Award in Natural Sciences (2nd class), Higher Education Outstanding Scientific Research Output Awards (Ministry of Education, China) – For the project "Haze in China" (Peking University)
2017	Chinese Government Award for Outstanding Student Abroad
2017	**ACCESS XIV Participant**: Atmospheric Chemistry Colloquium for Emerging Senior Scientists (with travel grant for Gordon Research Conference in Atmospheric Chemistry)
2013 – 2016	**NASA Earth and Space Science Fellowship (NESSF)**
2011 – 2012	Harvard University Graduate Student Fellowship
2010	Outstanding Winner in National Competition of Innovative Experiments (Ministry of Education, China)

2007 Hsieh Yi-Ping Award for Young Scientists in Meteorological Science and Technology (Peking University)
2006-2007 Presidential Undergraduate Research Fellowship (Peking University)

TEACHING & MENTORING EXPERIENCE

2017 **Lab Instructor** for ES 299R: Special Topics in Engineering Sciences (Harvard)
- Designed and taught a hands-on course "Aerosol Measurement Techniques" for three graduate students

2013 – 2017 **Mentor of five visiting students** (Harvard)
- Yipeng He (2017), Tianning Zhao (2016), Juliana Amorim (2015), Yan Wang (2014), and Nadia Abdelmalki (2013)

2013 **Teaching Fellow for undergraduate course ES 6**: Environmental Science and Technology (Harvard)
- Responsibilities includes developing new course materials, grading assignments/exams, supervising labs, and meeting with students individually

2010 Teaching Assistant for graduate course Cloud Physics (Peking University)
2009 Teaching Assistant for graduate course Atmospheric Chemistry (Peking University)

FIELD CAMPAIGNS, VISITING, AND TRAINING EXPERIENCE

2017 GISP2 ice core measurements, Desert Research Institute, Reno, NV (Host: Dr. Joe R. McConnell)
2012, 2013 Pre-campaign measurements for GoAmazon 2014/15, Manaus, Brazil
2009 – 2010 Haze in China (HaChi) field campaign, Tianjin, China. (ACP special issue)
2009 Advanced course "Measurements of Atmospheric Aerosols", Hyytiälä, Finland
2008, 2009 Guest researcher at Leibniz Institute for Tropospheric Research, Leipzig, Germany (Host: Prof. Alfred Wiedensohler)
2008 Spring school of Atmospheric Chemistry, Shanghai, China

PROFESSIONAL SERVICE

Peer-review referee

Atmospheric Chemistry & Physics, Environmental Science & Technology, Environmental International, Environmental Pollution, Aerosol Science & Technology, Journal of Geophysical Research, and Atmospheric Environment.

Proposal reviewer

NOAA AC4 Program

Professional Membership

American Association for Aerosol Research (AAAR)
American Geophysical Union (AGU)