

## **XIAOLIANG WANG**

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Research Professor

Division of Atmospheric Sciences, Desert Research Institute, Reno, Nevada

Nevada System of Higher Education

### **Education**

University of Minnesota, Twin Cities, MN	Mechanical Engineering	Ph.D.	2006
University of Minnesota, Twin Cities, MN	Mechanical Engineering	M.S.	2002
Tsinghua University, Beijing, China	Thermal Engineering	B.E.	2000
Tsinghua University, Beijing, China	Environmental Engineering	B.E.	2000

### **Background**

Dr. Wang's overarching research theme is to understand air pollution source, transformation, and impacts. Specifically, his research interests include physical and chemical characterization of aerosols, pollution source characterization, air quality measurement, and aerosol instrument development. His research involves a wide range of instrument design, laboratory method development, field measurement, numerical simulation, and data integration. Dr. Wang has been involved in the development and use of a multitude of instruments for characterizing aerosol properties. He is a co-inventor of the nanoparticle aerodynamic lenses for efficiently delivering nanoparticles into aerosol mass spectrometers and the TSI DustTrak DRX Aerosol Monitor for real-time size segregated aerosol mass concentration measurement. He led the design of the DRI Portable Emissions Measurement System (PEMS) that has been used for characterizing gases and particles from vehicle exhaust, stack emissions, biomass burning, and biomass-derived syngas. Dr. Wang also led the design of the DRI Model 2015 Multiwavelength Thermal/Optical Carbon Analyzer. Dr. Wang is the principal investigator of ongoing projects to study dust exposure in underground coal mines, organic species partitioning between gas and particle phases from incinerator emissions, brake and tire wear emissions, and physical, chemical, and optical properties of smoke from burning of spacecraft relevant materials. He recently completed a study to measure vehicle fleet emissions in roadway tunnels and assess emission changes over the past decades. He conducted real-world multi-pollutant emission characterization from mining fleet, industrial stacks, and fugitive dust sources in the Athabasca Oil Sands Region in Alberta, Canada. He participated in recent projects to study the impact of visibility, air quality, and atmospheric deposition of particles generated from wildfires and prescribed burns in the Lake Tahoe Basin, the spatial distribution of residential wood combustion emissions in Reno and Sparks, NV, and the impact of the Los Angeles World Airports (LAX) operations on ultrafine particle concentrations in surrounding community. Dr. Wang is an active participant in several scientific organizations. He conducts peer reviews for scientific publications and funding agencies. He served as co-chair and chair of the Instrumentation Working Group of the American Association of Aerosol Research (AAAR) annual conferences and chair of the Young Investigators Committee of the AAAR. Dr. Wang has been granted three patents and published three book chapter and 70+ peer-reviewed journal articles.

## **Professional Experience**

2016 – Present	Research Professor, Division of Atmospheric Sciences, Desert Research Institute, Reno, NV
2013 – 2016	Associate Research Professor, Division of Atmospheric Sciences, Desert Research Institute, Reno, NV
2009 – Present	Graduate Faculty, Department of Physics, University of Nevada, Reno, NV
2009 – 2013	Assistant Research Professor, Division of Atmospheric Sciences, Desert Research Institute, Reno, NV
2007 – 2009	Senior Staff Development Engineer, TSI Inc., St Paul, MN
2005 – 2007	Senior Development Engineer, TSI Inc., St Paul, MN
2005 Summer	Visiting Scientist, Process and Aerosol Measurement Technology Lab, University of Duisburg-Essen, Germany
2004 Summer	Mechanical Engineer (internship), TSI Inc., St Paul, MN
2002 – 2006	Research Assistant, Particle Technology Lab and High Temperature and Plasma Technology Lab, University of Minnesota, Minneapolis, MN
2000 – 2002	Research Assistant, Particle Technology Lab, University of Minnesota, Minneapolis, MN

## **Honors and Awards**

- Outstanding Reviewer Award, Aerosol Science and Technology, 2019
- Best Paper of 2011 Award, Frontiers of Environmental Science and Engineering , 2011
- TSI High Performance Award, 2007, 2008
- TSI Change Marker Award, 2007
- Best Paper Award, Journal of Thermal Spray Technology, 2007
- Best paper award, International Thermal Spray Conference, 2006

## **Professional Activities and Services**

- Member, American Association for Aerosol Research (AAAR; 2001 – Present).
- Member, Air and Waste Management Association (A&WMA; 2009 – Present).
- Member, Fundamental Instrument Unit Working Group for the National Ecological Observatory Network (NEON) (2011– Present)
- Reviewer for journals (2003 - Present)
- Member, Editorial Advisory Board of Aerosol Science and Technology (2019-2023)
- Member, European Science Foundation (ESF) College of Expert Reviewers (2018–2021)
- Technical Advisory Committee for Research Division, California Air Resources Board (2018–present)
- Judge, Nevada State Science Olympiad (2016)
- Judge, Western Nevada Regional Science & Engineering Fair (2013–2016)
- Chair, Young Investigators Committee of AAAR (2011–2012)
- Member, Young Investigators Committee of AAAR (2010–2012)

- Chair, Instrumentation Working Group, American Association for Aerosol Research Annual Conference, 2007
- Co-chair, Instrumentation Working Group, International Aerosol Conference, 2006

### **Patents**

- 1) Wang, X.L.; Agarwal, J.K.; Chancellor, G.J.; et al. Size Segregated Aerosol Mass Concentration Measurement with Inlet Conditioners and Multiple Detectors. US Patent 8,047,055. November 1, 2011.
- 2) Wang, X.L.; Agarwal, J.K.; Chancellor, G.J.; and Evenstad, J. Size segregated aerosol mass concentration measurement device. US Patent 7,932,490. April 26, 2011.
- 3) Wang, X.L.; McMurry, P.H.; and Kruis, E. Aerodynamic focusing of nanoparticle or cluster beams. US Patent 7,476,851. January 13, 2009.

### **Journal Articles**

- 1) Cao, J.J., Wang, Q.Y., Li, L., Zhang, Y., Tan, J., Chen, L.-W.A., Ho, S.S.H., Wang, X.L., Chow, J.C., Watson, J.G. (2020). "Evaluation of the oxidation flow reactor for particulate matter emission limit certification." *Atmos. Environ.*:224, 117086.
- 2) Guo, Q., Zhu, Z., Cheng, Z., Xu, S., Wang, X.L., Duan, Y. (2020). "Correction of Light Scattering-based Total Suspended Particulate Measurements through Machine Learning." *Atmosphere* 11 (2):139.
- 3) Niu, X., Chuang, H.-C., Wang, X.L., Ho, S.S.H., Li, L., Qu, L., Chow, J.C., Watson, J.G., Sun, J., Lee, S., Cao, J., Ho, K.F. (2020). "Cytotoxicity of PM2.5 vehicular emissions in the Shing Mun Tunnel, Hong Kong." *Environ. Pollut.* 263:114386.
- 4) Peng, C., Tian, M., Wang, X.L., Yang, F., Shi, G., Huang, R.-J., Yao, X., Wang, Q., Zhai, C., Zhang, S., Qian, R., Cao, J., Chen, Y. (2020). "Light absorption of brown carbon in PM2.5 in the Three Gorges Reservoir region, southwestern China: Implications of biomass burning and secondary formation." *Atmos. Environ.* 229:117409.
- 5) Shen, J., Zhao, Q., Cheng, Z., Huo, J., Zhu, W., Zhang, Y., Duan, Y., Wang, X.L., Antony Chen, L.W., Fu, Q. (2020). "Evolution of source contributions during heavy fine particulate matter (PM2.5) pollution episodes in eastern China through online measurements." *Atmos. Environ.* 232:117569.
- 6) Wang, X.L., Hoekman, S.K., Han, Y., Chow, J.C., Watson, J.G., Wu, X., Wu, Y., Schuetzle, D., Schuetzle, R. (2020). "Potential emission reductions by converting agricultural residue biomass to synthetic fuels for vehicles and domestic cooking in China." *Particuology* 49:40-47.
- 7) Wang, X.L., Zhou, H., Arnott, W.P., Meyer, M.E., Taylor, S., Firouzkouhi, H., Moosmüller, H., Chow, J.C., Watson, J.G. (2020). "Evaluation of Gas and Particle Sensors for Detecting Spacecraft-Relevant Fire Emissions " *Fire Saf. J.* 113.
- 8) Zhang, J., Lance, S., Wang, X., Wang, J., Schwab, J.J. (2020). "Estimation of aerosol liquid water from optical scattering instruments using ambient and dried sample streams." *Atmos. Environ.* 239:117787.
- 9) Chan, T.W., Huang, L., Banwait, K., Zhang, W., Ernst, D., Wang, X.L., Watson, J.G., Chow, J.C., Green, M., Czimczik, C.I., Santos, G.M., Sharma, S., Jones, K. (2019). "Inter-comparison of the elemental and organic carbon mass measurements from three North American national long-term monitoring networks." *Atmospheric Measurement Techniques* 12, 4543–4560.

- 10) Chow, J.C., Cao, J.J., Chen, L.-W.A., Wang, X.L., Wang, Q.Y., Tian, J., Ho, S.S.H., Watts, A.C., Carlson, T.N., Kohl, S.D., Watson, J.G. (2019). "Changes in PM<sub>2.5</sub> peat combustion source profiles with atmospheric aging in an oxidation flow reactor." *Atmos. Meas. Tech.* 12:5475-5501.
- 11) Chow, J.C., Wang, X.L., Green, M.C., Watson, J.G. (2019). "Obtaining more information from existing filter samples in PM speciation networks." *EM 23* (May):15-19.
- 12) Wang, X.L., Zhou, H., Arnott, W.P., Meyer, M.E., Taylor, S., Firouzkhahi, H., Moosmuller, H., Chow, J.C., Watson, J.G. (2019). "Characterization of smoke for spacecraft safety." *J. Aerosol Sci.* 136:36-47.
- 13) Watson, J.G., Cao, J.J., Chen, L.-W.A., Wang, Q.Y., Tian, J., Wang, X.L., Gronstal, S.B., Ho, S.S.H., Watts, A.C., Chow, J.C. (2019). "Gaseous, PM<sub>2.5</sub> mass, and speciated emission factors from laboratory chamber peat combustion." *Atmos. Chem. Phys.* 19 (22):14173-14193.
- 14) Zhao, Z.Z., Cao, J.J., Chow, J.C., Watson, J.G., Chen, L.-W.A., Wang, X.L., Wang, Q.Y., Tian, J., Shen, Z.X., Zhu, C.S., Liu, S.X., Tao, J., Ye, Z.L., Zhang, T., Zhou, J.M., Tian, R.X. (2019). "Multi-wavelength light absorption of black and brown carbon at a high-altitude site on the Southeastern margin of the Tibetan Plateau, China." *Atmos. Environ.* 212:54-64.
- 15) Cheng, Z., Wang, S., Qiao, L., Wang, H., Zhou, M., Fu, X., Lou, S., Luo, L., Jiang, J., Chen, C., Wang, X.L., Hao, J. (2018). "Insights into extinction evolution during extreme low visibility events: Case study of Shanghai, China." *Science of The Total Environment* 618:793-803.
- 16) Chow, J.C., Riggio, G.M., Wang, X.L., Chen, L.W.A., Watson, J.G. (2018). "Measuring the Organic Carbon to Organic Matter Multiplier with Thermal/Optical Carbon-Quadrupole Mass Spectrometer Analyses." *Aerosol Science and Engineering* 2 (4):165-172.
- 17) Chow, J.C., Watson, J.G., Green, M.C., Wang, X.L., Chen, L.-W.A., Trimble, D.L., Cropper, P.M., Kohl, S.D., Gronstal, S.B. (2018). "Separation of brown carbon from black carbon for IMPROVE and CSN PM<sub>2.5</sub> samples." *Journal of the Air & Waste Management Association* 68, 494-510.
- 18) Cui, L., Wang, X.L., Ho, K.F., Gao, Y., Liu, C., Ho, S.S., Li, H., Wang, X., Jiang, B., Huang, Y., Chow, J.C., Watson, J.G., Chen, L.-W.A. (2018). "Decrease of VOC emissions from vehicular emissions in Hong Kong from 2003 to 2015: results from a tunnel study." *Atmospheric Environment* 177:64-74.
- 19) Das, K.K., Bancroft, L., Wang, X.L., Chow, J.C., Xing, B., Yang, Y. (2018). "Digestion Coupled with Programmed Thermal Analysis for Quantification of Multiwall Carbon Nanotubes in Plant Tissues." *Environmental Science & Technology Letters* 5 (7):442-447.
- 20) Harner, T., Rauert, C., Muir, D., Schuster, J.K., Hsu, Y.-M., Zhang, L., Marson, G., Watson, J.G., Ahad, J., Cho, S., Jariyasopit, N., Kirk, J., Korosi, J., Landis, M.S., Martin, J.W., Zhang, Y., Fernie, K., Wentworth, G.R., Wnorowski, A., Dabek, E., Charland, J.-P., Pauli, B., Wania, F., Galarneau, E., Cheng, I., Makar, P., Whaley, C., Chow, J.C., Wang, X.L. (2018). "Air synthesis review: polycyclic aromatic compounds in the oil sands region." *Environmental Reviews* 26 (4):430-468.
- 21) Riggio, G.M., Chow, J.C., Cropper, P.M., Wang, X.L., Yatavelli, R.L.N., Yang, X., Watson, J.G. (2018). "Feasibility of coupling a thermal/optical carbon analyzer to a quadrupole mass spectrometer for enhanced PM<sub>2.5</sub> speciation." *Journal of the Air & Waste Management Association* 68: 463-476.

- 22) Wang, X.L., Ho, K.F., Chow, J.C., Kohl, S.D., Chan, C.S., Cui, L., Lee, S.C., Chen, L.-W.A., Ho, S.S., Cheng, Y., Watson, J.G. (2018). "Hong Kong Vehicle Emission Changes from 2003 to 2015 in the Shing Mun Tunnel." *Aerosol Science and Technology* 52 (10):1085-1098.
- 23) Cheng, Z., Ma, X., He, Y., Jiang, J., Wang, X.L., Wang, Y., Sheng, L., Hu, J., Yan, N. (2017). "Mass extinction efficiency and extinction hygroscopicity of ambient PM<sub>2.5</sub> in urban China." *Environ. Res.* 156:239-246.
- 24) Ni, H., Tian, J., Wang, X.L., Wang, Q., Han, Y., Cao, J., Long, X., Chen, L.W.A., Chow, J.C., Watson, J.G., Huang, R.-J., Dusek, U. (2017). "PM<sub>2.5</sub> emissions and source profiles from open burning of crop residues." *Atmos. Environ.* 169:229-237.
- 25) Tai, A.Y.C., Chen, L.W.A., Wang, X.L., Chow, J.C., Watson, J.G. (2017). "Atmospheric deposition of particles at a sensitive alpine lake: Size-segregated daily and annual fluxes from passive sampling techniques." *Sci. Total Environ.* 579:1736-1744.
- 26) Tian, J., Ni, H., Cao, J., Han, Y., Wang, Q., Wang, X., Chen, L.W.A., Chow, J.C., Watson, J.G., Wei, C., Sun, J., Zhang, T., Huang, R. (2017). "Characteristics of carbonaceous particles from residential coal combustion and agricultural biomass burning in China." *Atmospheric Pollution Research* 8 (3):521-527.
- 27) Watson, J.G., Tropp, R.J., Kohl, S.D., Wang, X.L., Chow, J.C. (2017). "Filter processing and gravimetric analysis for suspended particulate matter samples." *Aerosol Science and Engineering* 1 (2):193-205.
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- 29) Cheng, Z., Luo, L., Wang, S., Wang, Y., Sharma, S., Shimadera, H., Wang, X.L., Bressi, M., de Miranda, R.M., Jiang, J., Zhou, W., Fajardo, O., Yan, N., Hao, J. (2016). "Status and characteristics of ambient PM<sub>2.5</sub> pollution in global megacities." *Environment International* 89–90:212-221.
- 30) Hsu, Y.-M., Wang, X.L., Chow, J.C., Watson, J.G., Percy, K.E. (2016). "Collocated comparisons of continuous and filter-based PM<sub>2.5</sub> measurements at Fort McMurray, Alberta, Canada." *Journal of the Air & Waste Management Association* 66 (3):329-339.
- 31) Pei, B., Wang, X.L., Zhang, Y., Hu, M., Sun, Y., Deng, J., Dong, L., Fu, Q., Yan, N. (2016). "Emissions and source profiles of PM<sub>2.5</sub> for coal-fired boilers in the Shanghai megacity, China." *Atmospheric Pollution Research* 7 (4):577–584.
- 32) Wang, X.L., Grose, M.A., Avenido, A., Stolzenburg, M.R., Caldow, R., Osmondson, B.L., Chow, J.C., Watson, J.G. (2016a). "Improvement of Engine Exhaust Particle Sizer (EEPS) Size Distribution Measurement - I. Algorithm and Applications to Compact-Shape Particles." *Journal of Aerosol Science* 92:95-108.
- 33) Wang, X.L., Grose, M.A., Caldow, R., Osmondson, B.L., Swanson, J.J., Chow, J.C., Watson, J.G., Kittelson, D.B., Li, Y., Xue, J., Jung, H., Hu, S. (2016b). "Improvement of Engine Exhaust Particle Sizer (EEPS) Size Distribution Measurement - II. Engine Exhaust Particles." *Journal of Aerosol Science* 92:83-94.
- 34) Wang, X.L., Chow, J.C., Kohl, S.D., Percy, K.E., Legge, A.H., Watson, J.G. (2016c). "Real-world emission factors for the Caterpillar 797B during mining operations." *Particuology* 28:22-20.

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- 36) Chen, L.-W.A., Chow, J.C., Wang, X.L., Robles, J.A., Sumlin, B.J., Lowenthal, D.H., Watson, J.G. (2015). "Multi-wavelength optical measurement to enhance thermal/optical analysis for carbonaceous aerosol." *Atmos. Meas. Tech* 8:451-461.
- 37) Chow, J.C., Yang, X.F., Wang, X.L., Kohl, S.D., Watson, J.G. (2015a). "Characterization of ambient PM<sub>10</sub> bioaerosols in a California agricultural town." *Aerosol Air Qual. Res.* 15 (4):1433-1447.
- 38) Chow, J.C., Lowenthal, D.H., Chen, L.-W.A., Wang, X.L., Watson, J.G. (2015b). "Mass reconstruction methods for PM<sub>2.5</sub>: A review." *Air Qual. Atmos. Health* 8:243-263.
- 39) Chow, J.C., Wang, X.L., Sumlin, B.J., Gronstal, S.B., Chen, L.-W.A., Trimble, D.L., Kohl, S.D., Mayorgal, S.R., Riggio, G.M., Hurbain, P.R., Johnson, M., Zimmermann, R., Watson, J.G. (2015c). "Optical calibration and equivalence of a multiwavelength thermal/optical carbon analyzer." *Aerosol and Air Quality Research* 15 (4):1145-1159.
- 40) Ni, H.Y., Han, Y.M., Cao, J.J., Chen, L.-W.A., Tian, J., Wang, X.L., Chow, J.C., Watson, J.G., Wang, Q.Y., Wang, P., Li, H., Huang, R.J. (2015). "Emission characteristics of carbonaceous particles and trace gases from open burning of crop residue in China." *Atmos. Environ.* 123:399-406.
- 41) Quiros, D.C., Hu, S., Hu, S., Lee, E.S., Sardar, S., Wang, X.L., Olfert, J.S., Jung, H.S., Zhu, Y., Huai, T. (2015). "Particle effective density and mass during steady-state operation of GDI, PFI, and diesel passenger cars." *Journal of Aerosol Science* 83:39-54.
- 42) Tian, J., Chow, J.C., Cao, J.J., Han, Y., Ni, H., Chen, L.-W.A., Wang, X.L., Huang, R., Moosmüller, H., Watson, J.G. (2015). "A Biomass Combustion Chamber: Design, Characterization, and Laboratory Tests." *Aerosol and Air Quality Research* 15:2104–2114.
- 43) Wang, X.L., Chow, J.C., Kohl, S.D., Percy, K.E., Legge, A.H., Watson, J.G. (2015a). "Characterization of PM<sub>2.5</sub> and PM<sub>10</sub> fugitive dust source profiles in the Athabasca Oil Sands Region." *J. Air Waste Manage. Assoc.* 65 (12):1421-1433.
- 44) Wang, X.L., Chow, J.C., Kohl, S.D., Yatavelli, R.L.N., Percy, K.E., Legge, A.H., Watson, J.G. (2015b). "Wind erosion potential for fugitive dust sources in the Athabasca Oil Sands Region." *Aeolian Res.* 18:121-134.
- 45) Xue, J., Li, Y., Wang, X.L., Durbin, T.D., Johnson, K.C., Karavalakis, G., Asa-Awuku, A., Villela, M., Quiros, D., Hu, S., Huai, T., Ayala, A., Jung, H.S. (2015). "Comparison of vehicle exhaust particle size distributions measured by SMPS and EEPS during steady-state conditions." *Aerosol Science and Technology* 49 (10):984-996.
- 46) Cahill, J.F., Darlington, T.K., Wang, X.L., Mayer, J., Spencer, M.T., Holecek, J.C., Reed, B.E., Prather, K.A. (2014). "Development of a High-Pressure Aerodynamic Lens for Focusing Large Particles (4-10  $\mu\text{m}$ ) into the Aerosol Time-of-Flight Mass Spectrometer." *Aerosol Science and Technology* 48 (9):948-956.
- 47) Giechaskiel, B., Maricq, M., Ntziachristos, L., Dardiotis, C., Wang, X.L., Axmann, H., Bergmann, A., Schindler, W. (2014). "Review of motor vehicle particulate emissions sampling and measurement: From smoke and filter mass to particle number." *Journal of Aerosol Science* 67:48-86.

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- 49) Li, Y., Xue, J., Johnson, K., Durbin, T., Villela, M., Pham, L., Hosseini, S., Zheng, Z., Short, D., Karavalakis, G., Asa-Awuku, A., Jung, H., Wang, X.L., Quiros, D., Hu, S., Huai, T., Ayala, A. (2014). "Determination of Suspended Exhaust PM Mass for Light-Duty Vehicles. Paper #: 2014-01-1594." *SAE Technical Paper*.
- 50) Hoekman, S.K., Robbins, C., Wang, X.L., Zielinska, B., Schuetzle, D., Schuetzle, R. (2013). "Characterization of trace contaminants in syngas from the thermochemical conversion of biomass." *Biomass Conversion and Biorefinery* 3 (4):271-282.
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- 52) Watson, J.G., Chow, J.C., Tropp, R.J., Wang, X.L., Kohl, S.D., Chen, L.-W.A. (2013). "Standards and traceability for air quality measurements: Flow rates and gaseous pollutants." *Mapan-Journal of Metrology Society of India* 28 (4):167-179.
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## **Book Chapters**



- 1) Watson, J.G., Chow, J.C., Engling, G., Chen, L.-W.A., Wang, X.L., (2016). Source apportionment: Principles and methods, in: Harrison, R.M. (Ed.), *Airborne Particulate Matter: Sources, Atmospheric Processes and Health*. Royal Society of Chemistry, London, UK, p. 72-125.
- 2) Wang, X.L.; Watson, J.G.; Chow, J.C.; Kohl, S.D.; Chen, L.-W.A.; Sodeman, D.A.; Legge, A.H.; and Percy, K.E. (2012). Measurement of real-world stack emissions with a dilution sampling system. In *Alberta Oil Sands: Energy, Industry, and the Environment*, Percy, K. E., Ed.; Elsevier Press: Amsterdam, The Netherlands, 171-192.
- 3) Watson, J.G.; Chow, J.C.; Wang, X.L.; Kohl, S.D.; Chen, L.-W.A.; and Etyemezian, V. (2012). Overview of real-world emission characterization methods. In *Alberta Oil Sands: Energy, Industry, and the Environment*, Percy, K. E., Ed.; Elsevier Press: Amsterdam, The Netherlands, 145-170.

### **Peer-Reviewed Conference Papers**

- 1) Wang, X.L., Chow, J.C., Watson, J.G., Meyer, M.E., Ruff, G.A., Easton, J., Berger, G.M., Mudgett, P.D. (2020). "Spacecraft Smoke Detector Characterization with Reference and Smoke Aerosols." 50th International Conference on Environmental Systems, July 12-16, 2020.

### **Selected Conference Presentations**

- 1) Wang, X., Chow, J. C., Daub, B. J., Gronstal, S. B., Chen, L.-W.A., Green, M. C., Watson, J. G., 2018: Estimation of Brown Carbon in PM<sub>2.5</sub> Samples from Long-Term Networks, 10th International Aerosol Conference: St. Louis, MO, September 2-7, 2018
- 2) Wang, X., Chow, J. C., Watson, J. G., Chen, L.-W.A., Ho, K. F., Lee, Shuncheng, Cui, L., 2018: Characterization of Vehicle Emission Changes in Hong Kong from 2003 to 2015 via Tunnel Studies, AGU/CAS Joint Conference on Atmospheric PM<sub>2.5</sub> in China: Change, Impact, Mitigation and Global Perspective: Xi'an, China, October 16-20, 2018
- 3) Wang, X.L., Khlystov, A. Y., Chow, J. C., Watson, J. G., Zielinska, B. K., Chen, L.-W.A., Ho, K. F., Lee, F.S.C., 2017: On-road Vehicle Emission Characterization from Tunnel Studies, 2017 Health Effects Institute Annual Conference: Alexandria, VA, April 30, 2017.
- 4) Wang, X.L., Riggio, G. M., Yang, X., Yatavelli, L., Chen, L.-W.A., Chow, J. C., Watson, J. G., 2016: Quantitative Off-line Particulate Matter Composition Analysis with Thermal Desorption Mass Spectrometry, 35th Annual Conference of the American Association for Aerosol Research: Portland, OR, October 17-21, 2016.
- 5) Wang, X.L., Sumlin, B., Mayorga, S., Gronstahl, S., Chen, L.-W.A., Chow, J.C., Watson, J.G., (2015). Design and Characterization of a Multiwavelength Thermal/Optical Carbon Analyzer. AAAR 34th Annual Conference: Minneapolis, MN, 10/13/2015.
- 6) Wang, X.L., Chow, J.C., Kohl, S.D., Yatavelli, L.N.R., Percy, K.E., Legge, A.H., Watson, J.G., (2015). Windblown Dust Characterization in the Canadian Oil Sands Region. AAAR 34th Annual Conference: Minneapolis, MN, 10/13/2015.
- 7) Wang, X.L., Watson, J.G., Chow, J.C., Kohl, S.D., Percy, K.E., Legge, A.H., (2015). Emission and Chemical Characterization of Fugitive Dust in the Athabasca Oil Sands Region. Joint Industry-AEMERA Workshop on Fugitive Emissions: Calgary, AB, Canada, 06/02/2015.
- 8) Wang, X.L., Khlystov, A., Chow, J.C., Watson, J.G., Zielinska, B., Chen, L.-W.A., Ho, K.F., Lee, S.C., (2015). Real-world Vehicle Emission Characterization for the Shing Mun Tunnel in Hong Kong and Ft. McHenry Tunnel in the U.S. Health Effects Institute 2015 Annual Conference: Philadelphia, PA, 5/3/2015.

- 9) Wang, X.L., Sumlin, B., Riggio, G., Robles, J.A., Chow, J., Chen, L.-W.A., Yatavelli, L.N.R., Chow, J.C., Watson, J.G., (2014). Enhanced Thermal/Optical Characterization of Aerosol Elemental, Molecular, and Optical Properties. AAAR 33rd Annual Conference: Orlando, FL, 10/20/2014.
- 10) Wang, X.L., Chow, J.C., Watson, J.G., Grose, M.A., Caldow, R., Osmondson, B.L., Swanson, J., Kittelson, D.B., Li, Y., Xue, J., Jung, H., (2014). Engine Exhaust Particle Sizer (EEPS) Improvement for Engine Emission Measurement. 18th ETH Conference on Combustion Generated Nanoparticles: Zurich, Switzerland, 6/22/2014.
- 11) Wang, X.L., Chow, J.C., Watson, J.G., Chen, L.-W.A., (2014). Enhanced Thermal/Optical Analysis for Aerosol Elemental, Molecular, and Optical Properties. The 7th World Congress on Particle Technology: Beijing, China, 5/20/2014.
- 12) Wang, X.L., Chow, J.C., Watson, J.G., Grose, M.A., Caldow, R., Osmondson, B.L., Swanson, J., Kittelson, D.B., Li, Y., Jian, X., Jung, H., (2014). Engine Exhaust Particle Sizer (EEPS) Improvement for Engine Emission Measurement. The 24th CRC Real World Emissions Workshop: San Diego, CA, 3/30/2014.
- 13) Wang, X.L.; Robles, J.A.; Yang, X.F.; Chen, L.-W.A.; Chow, J.C.; Watson, J.G. (2013). Enhanced Thermal/Optical Analyzer for Aerosol Elemental, Molecular, and Optical Property Characterization. In A&WMA Air Quality Measurement Methods and Technology Conference, Sacramento, CA, 9 November 2013
- 14) Wang, X.L.; Robles, J.A.; Yang, X.F.; Chen, L.-W.A.; Chow, J.C.; Watson, J.G. (2013). Thermal/Optical Analysis of Major Elements (C, H, N, S, and O) for Particles from Different Emission Sources. In 2013 European Aerosol Conference, Prague, Czech Republic, 1 September 2013
- 15) Wang, X.L.; Watson, J.G.; Chow, J.C.; and Kohl, S.D. (2012). Characterization of Stationary Source Emissions in the Athabasca Oil Sands Region. Presented in the WBEA TEEM Investigators/Members Workshop, Calgary, Alberta, Canada, 28 November 2012.
- 16) Wang, X.L.; Kohl, S.D.; Chow, J.C.; and Watson, J.G. (2012). Real-world Emission Characterization in the Canadian Oil Sands Region. Presented in the AAAR 31th Annual Conference, Minneapolis, MN, 8 October 2012.
- 17) Wang, X.L.; Robles, J.; Chen, L.-W.A.; Fung, K.K.; Watson, J.G.; and Chow, J.C. (2011). Analysis of Major Aerosol Elements (C, H, N, S, and O) on Filter Samples Using a Thermal/Optical Method. Presented in the AAAR 30th Annual Conference, Orlando, FL, 3 October 2011.
- 18) Wang, X.L.; Kohl, S.D.; Chow, J.C.; Watson, J.G.; and Gronstal, S. (2010). On-board emission measurements from the world's largest mining trucks. Presented in the AAAR 29th Annual Conference, Portland, OR, 25 October 2010.
- 19) Wang, X.L.; Kohls, S.; Gronstal, S.; Chow, J.C.; and Watson, J.G. (2010). On-board Emission Measurement from the World's Largest Mining Trucks. Presented in The Air and Waste Management Association's International Specialty Conference on Leapfrogging Opportunities for Air Quality Improvement, Xi'an, China, 10 May 2010.
- 20) Wang, X.L.; Grose, M.; Caldow, R.; J.Swason; W.Watts; and Kittelson, D.B. (2009). Improvement of Engine Exhaust Particle Sizer Spectrometer for Engine Emissions Measurement. Presented in the 28th AAAR Annual Conference, Minneapolis, MN, 26 October 2009.

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- 22) Wang, X.L.; Anderson, R.; and Johnson, T. (2009). Evaluation of Real-Time Vehicle Particulate Emissions Measurement Instruments. Presented in the 28th AAAR Annual Conference, Minneapolis, MN, 26 October 2009.
- 23) Wang, X.L.; Farnsworth, J.E.; Sreenath, A.; Agarwal, J.K. (2008). A novel instrument for real-time size segregated mass concentration measurement. Presented in the European Aerosol Conference, Thessaloniki, Greece, 24 August 2008.
- 24) Wang, X.L. Kaufman, S.L.; Sem, G.J.; Hama, N.; Sakurai, H.; Stolzenburg, M.R.; McMurry, P.H. (2007). Experimental and Numerical Studies of Particle Transmission Efficiency through Aerosol Neutralizers. Presented in 26th AAAR Annual Conference, Reno, NV, 24 September 2007.
- 25) Wang, X.L.; Caldow, R.; Sem, G.J.; Sakurai, H.; Hama, N. (2007). Evaluation of TSI 3068B Aerosol Electrometer and 3790 Engine Exhaust CPC. Presented in 26th AAAR Annual Conference, Reno, NV, 24 September 2007.
- 26) Wang, X.L.; McMurry, P.H. (2006). Aerodynamic focusing of heavy ions and nanoparticles. Presented in 54th ASMS Conference on Mass Spectrometry, Seattle, WA, 28 May 2006.
- 27) Wang, X.L.; Kruis, F.E.; McMurry, P.H. (2005). Designing Aerodynamic Lenses for Nanoparticles. Presented in 24th AAAR Annual Conference, Austin, TX, 17 October 2005.

### **Technical Reports**

- 1) Wang, X.L., Khlystov, A., Ho, K.F., Campbell, D., Chow, J.C., Kohl, S.D., Watson, J.G., Lee, S.C., Chen, L.-W.A., Lu, M., Ho, S.S.H., (2019). "Real-World Vehicle Emissions Characterization for the Shing Mun Tunnel in Hong Kong and Fort McHenry Tunnel in the United States." Health Effects Institute, Boston, MA.
- 2) Wang, X.L., Arnott, W.P., Moosmüller, H., Chow, J.C., Watson, J.G., (2018). "Particle Detection and Characterization for Spacecraft Fire Safety." Nevada NASA EPSCoR. Las Vegas, Nevada.
- 3) Wang, X., Kohl, S. D., Chow, J. C., Watson, J. G., 2016: Characterization of real-world emissions from heavy haulers and dozers in Syncrude, Prepared by Desert Research Institute: Reno, NV, for Syncrude Canada Ltd., Ft. McMurray, AB, Canada.
- 4) Chen, L.-W.A., Tai, Y.C., Wang, X.L., Holms, H., Chow, J.C., Watson, J.G., (2015). Evaluating Atmospheric Deposition of Particulate Matter in the Lake Tahoe Basin. Prepared by Desert Research Institute, Reno, NV, for USDA Forest Service.
- 5) Wang, X.L., (2015). Redesign of A Portable Emissions Measurement System. Final Report for the Institute Project Assignment. Desert Research Institute, Reno, NV.
- 6) Chen, L.-W.A., Malamakal, T., Wang, X.L., Green, M.C., Chow, J.C., Watson, J.G., (2014). Evaluation of prescribed burning emissions and impacts on air quality in the Lake Tahoe basin. Prepared by Desert Research Institute, Reno, NV, for USDA Forest Service.
- 7) Hoekman, K.S., Broch, A., Robbins, C., Wang, X.L., Gronstal, S., Zielinska, B., (2014). Demonstration of a Pilot Integrated Biorefinery (IBR) for the Economical Conversion of biomass to Diesel Fuel - Final Report DOE Project DE-EE0002876. Prepared by Desert

- Research Institute, Reno, NV, for Renewable Energy Institute International (REII), West Sacramento, CA.
- 8) Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D., (2014). Chemical Source Profiles for Geological Dust Samples from the Athabasca Oil Sand Region. Prepared by Desert Research Institute, Reno, NV, for Wood Buffalo Environmental Association, Ft. McMurray, AB, Canada.
  - 9) Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D., Yatavelli, L.N.R., (2014). Windblown Fugitive Dust Characterization in the Athabasca Oil Sands Region. Prepared by Desert Research Institute, Reno, NV, for Wood Buffalo Environmental Association, Ft. McMurray, AB, Canada.
  - 10) Green, M.C., Wang, X.L., Watson, J.G., Chow, J.C., Kohl, S.D., (2013). Spatial distribution of wintertime PM<sub>2.5</sub> in Sparks, NV: Analysis of air quality and meteorological data. Prepared by Desert Research Institute, Reno, NV, for Washoe County Health District, Reno, NV.
  - 11) Watson, J.G., Chow, J.C., Wang, X.L., Lowenthal, D.H., Kohl, S.D., Gronstal, S., (2013). Characterization of real-world emissions from nonroad mining trucks in the Athabasca Oil Sands Region during October, 2010. Prepared by Desert Research Institute, Reno, NV, for Wood Buffalo Environmental Association, Ft. McMurray, AB, Canada.
  - 12) Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D., Gronstal, S., Zielinska, B., (2013). Measurement of real-world stack emissions in the Athabasca Oil Sands Region with a dilution sampling system during March, 2011. Prepared by Desert Research Institute, Reno, NV USA, for Wood Buffalo Environmental Association, Ft. McMurray, AB, Canada.
  - 13) Watson, J.G.; Chow, J.C.; Lowenthal, D.H.; Chen, L.-W.A.; and Wang, X.L. (2012). Reformulation of PM<sub>2.5</sub> mass reconstruction assumptions for the San Joaquin Valley. Prepared by Desert Research Institute, Reno, NV, for San Joaquin Valley Unified Air Pollution Control District, Fresno, CA.
  - 14) Chen, L.-W.A.; Watson, J.G.; and Wang, X.L. (2011). Visibility Monitoring and Standards for Lake Tahoe Basin: Assessment of Current and Alternative Approaches. Prepared by Desert Research Institute, Reno, NV, for USDA Forest Service Pacific Southwest Research Station, Berkeley, CA.
  - 15) Hoekman, K.S.; Robbins, C.; and Wang, X.L. (2011). Dilution Sampling System for Biomass-Derived Syngas. Prepared by Desert Research Institute, Reno, NV, for Technology Transfer Gap Funding Initiative DE-FG30-08CC00057, UNR/DRI Technology Transfer Office.
  - 16) Hoekman, K.S.; Robbins, C.; and Wang, X.L. (2010). Gridley Biofuels Project Final Report. Prepared by Desert Research Institute, Reno, NV, for DOE Project DE-FC36-03GO13071.
  - 17) Watson, J.G.; Chow, J.C.; Chen, L.; and Wang, X.L. (2010). Measurement system evaluation for fugitive dust emissions detection and quantification. Prepared by Desert Research Institute, Reno, NV, for South Coast Air Quality Management District.
  - 18) Watson, J.G.; Chow, J.C.; Wang, X.L.; Kohl, S.D.; and Sodeman, D.A. (2010). Measurement of Real-World Stack Emissions with a Dilution Sampling System. Prepared by Desert Research Institute, Reno, NV, for Wood Buffalo Environmental Association, Ft. McMurray, AB, Canada.

### **Courses Taught**

- ATMS 743 (University of Nevada, Reno): Cloud and Aerosol Physics (2016-Present)
- ATMS 792 (University of Nevada, Reno): Air Quality Measurement and Data Analysis (2013)

### **Students Advised**

- Advisee:  
Hatef Firouzkouhi (M.S., expected 2020), Benjamin Sumlin (M.S., Graduated in 2015), Gustavo Riggio (M.S., Graduated in 2015), Joseph Knue (B.S., Graduated in 2016)
- Thesis Committee:  
Anna Tai (M.S., Graduated in 2015), Xia Sun (Ph.D., Graduated in 2019), Yang Han (Ph.D., Graduated in 2019), Jingting Huang (Ph.D., Expected in 2022), Samuel Taylor (M.S., Expected 2021)