

Benjamin Seth Werden, Ph.D.

Environmental engineer with over 17 years of expertise in atmospheric chemistry and instrumentation development. Research focuses on atmospheric field measurements, pollutant impact assessment, and molecular analysis to address critical environmental and public health challenges. Managed aerosol field measurements and chemical analysis for major inter-institutional projects including:

- Beyond Petrochemicals' Hazardous Air Pollution and Monitoring Assessment Project
Field Scientist; Pennsylvania, USA, 2021, Louisiana, USA, 2022; Lead Field Scientist; Texas, USA 2025
- DoE Cross Urban Integrated Field Laboratory Project *Co-Investigator; Maryland, USA 2025*
- NIST's Investigating Impacts of Residential HVAC Systems on Aerosol Properties
Co-Investigator; Maryland, USA 2025
- Environmental Defense Fund's impact measurements *Lead Scientist; Louisiana, USA 2025*
- National Institute of Standards and Technology's Wildfire Urban Interface Study
Lead Scientist; Maryland, USA 2024
- IITM's Cloud Aerosol Interaction and Precipitation Enhancement Experiment
Solapur, India 2018
- Nepal Ambient Monitoring and Source Testing Experiment Campaigns
Kathmandu, Nepal 2015, 2017, 2018

Research contributions include publications in leading journals (ACS Earth and Space Chemistry, Bulletin of the American Meteorological Society) and presentations at major conferences (AGU Fall Meeting, AAAR Conference, IICNA). Collaborated across disciplines to advance pollution monitoring and climate science. Recently awarded the CHARMED Center Early Career Grant to study air quality disparities across neighborhoods of varying socioeconomic status in Baltimore, MD.

Teaching experience includes mentoring postdoctoral researchers, graduate students, and undergraduates, and assistant teaching in computer engineering, and environmental engineering. Teaching philosophy focuses on experiential practice and collaboration, emphasizing practical skills, research precision, intellectual curiosity, and critical thinking.

Future research aims to implement high-resolution urban mobile mapping, low cost drone swarms, and software modelling to investigate hazardous pollutants impacts on human health, correlating exposure data with longitudinal health outcomes to inform urban policy and public health initiatives.

Research Interests:

- Ambient urban gas and aerosol measurement
- Spatial analysis using mobile platforms
- Exposure analysis for public health
- Community driven research

Education:

Doctor of Philosophy in Environmental Engineering Drexel University, Philadelphia, PA *March 2021*
Chemical Source Apportionment of Ambient Particulate Matter in the Kathmandu Valley, Nepal
Advisors: Professors Peter DeCarlo (Johns Hopkins University) and Michael Waring (Drexel University)

Bachelor of Science in Computer Engineering Binghamton University, Vestal, NY, *June 2008*

Experience:

Assistant Research Scientist

Johns Hopkins University Baltimore, MD *March 2024 - Present*

- Design and implement air quality experiments, and analyze resultant data of environmental pollutants, meteorology, and source impacts for various studies.
- Conduct and manage air quality campaign field deployments using mobile and stationary atmospheric chemistry laboratories to assess public health risk in multiple neighborhoods.
- Collaborate, communicate, and provide expertise for government agencies, non-profits, academic researchers, and community partners, including DoE, NIST, EDF, DSCEJ and more.
- Mentor students and researchers including NASA's SARP field research training program.

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Post-Doctoral Research Scientist

Aerodyne Research Inc.

Billerica, MA

May 2021 – Oct 2023

- Managed aerosol measurements for multiple HAP-MAP field deployments in communities heavily impacted by industry in Louisiana's Riverward Parishes and Marcus Hook, PA.
- Analyzed aerosol concentrations and chemistry for HAP-MAP and CAIPEEX campaigns.
- Measured the effects of cloud seeding on cloud condensation nuclei through aircraft-based field experiments.
- Co-authored a publication on the interaction between monsoon season thermodynamics and atmospheric chemistry.
- Published a novel method to measure cloud seed without using greenhouse gas tracers

Teaching Assistantship:

Drexel University

Philadelphia, PA

Spring 2018 – Winter 2021

- Delivered lectures, led discussions, and provided mentorship for courses including Statistics for Engineers, Field Research Methods, Engineering Economics, Fluid Dynamics, and System Balances and Design.
- Developed and graded exams and assignments to evaluate student performance.

Research Assistantship:

DeCarlo Lab Drexel University :

Philadelphia, PA

Fall 2014 – Winter 2017

- Led aerosol measurement campaigns in Kathmandu, Nepal, as part of multiple field studies.
- Managed aerosol measurements for the 2019 CAIPEEX aircraft campaign in Solapur, India.
- Maintained laboratory standards
- trained students on instrumentation, field operations, and research methodologies.

Peer-reviewed publications:

Werden, B., Giordano, M.R., Mahata, K., Islam, M.R., Goetz, J.D., Puppala, P.S., Saikawa, E., Panday, A.K., Yokelson, R.J., Stone, E.A., and DeCarlo, P.F.: *Submicron Aerosol Composition and Source Contribution across the Kathmandu Valley, Nepal, in Winter*. ACS Earth Space Chem., <https://doi.org/10.1021/acsearthspacechem.2c00226>, 2022.

Werden, B., Giordano, M.R., Goetz, J.D., Islam, M.R., Bhave, P.V., Puppala, P.S., Rupakheti, M., Panday, A.K., Yokelson, R.J., Stone, E.A., and DeCarlo, P.F.: *Aerosol Composition and Source Contribution in the Kathmandu Valley, Nepal: Premonsoon*. RCS Atmosphere, <https://doi.org/10.1039/D2EA00008C>, 2022.

Konwar, M., **Werden, B.**, Fortner, E. C., Bera, S., Varghese, M., Chowdhuri, S., Hibert, K., Croteau, P., Jayne, J., Canagaratna, M., Malap, N., Jayakumar, S., Dixit, S. A., Murugavel, P., Axisa, D., Baumgardner, D., DeCarlo, P. F., Worsnop, D. R., and Prabhakaran, T.: Identifying the seeding signature in cloud particles from hydrometeor residuals, *Atmos. Meas. Tech.*, 17, 2387–2400, <https://doi.org/10.5194/amt-17-2387-2024>, 2024.

Prabhakaran, T., Murugavel, P., Konwar, M., Malap, N., Gayatri, K., Dixit, S., Samanta, S., Chowdhuri, S., Bera, S., Varghese, V., Rao, J., Sandeep, J., Safai, P. D., Sahai, A. K., Axisa, D., Karipot, A., Baumgardner, D., **Werden, B.**, Fortner, E., Hibert, K., Nair, S., Bankar, S., Gurnule, D., Todekar, K., Jose, J., Jayachandran, V., Soyam, P.S., Gupta, A., Choudhary, H., Aravindhavel, Kantipudi, S.B., Pradeepkumar P., Krishnan R., Nandakumar K., DeCarlo, P.F., Worsnop, D., Bhat, G.S., Rajeevan, M., Nanjundiah, R. *CAIPEEX - Indian cloud seeding scientific experiment*. Bulletin of the American Meteorological Society, <https://doi.org/10.1175/BAMS-D-21-0291.1>, 2023.

Tehrani, M., Fortner, E. C., Robinson, E. S., Chiger, A. A., Sheu, R., **Werden, B.**, Gigot, C., Yacovitch, T., Van Bramer, S. E., Burke, Koehler, K., Nachman, K. E., Rule, A. M., and DeCarlo, P. F., *Characterizing metals in particulate pollution in communities at the fenceline of heavy industry: Combining mobile monitoring and size-resolved filter measurements*. *Environ. Sci.: Processes Impacts*, <https://doi.org/10.1039/D3EM00142C>, 2023.

Islam, Md. R., Jayarathne, T., Simpson, I. J., **Werden, B. S.**, Maben, J., Gilbert, A., Praveen, P. S., Adhikari, S., Panday, A. K., Rupakheti, M., Blake, D. R., Yokelson, R. J., DeCarlo, P. F., Keene, W. C. and Stone, E. A.: *Wintertime Ambient air quality in the Kathmandu Valley, Nepal: concentrations and sources of particulate matter and trace gases*. ACS Earth Space Chem., <https://doi.org/10.1021/acsearthspacechem.2c00243>, 2022.

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- Islam, Md. R., Li, T., Mahata, K., Khanal, N., **Werden, B.**, Giordano, M. R., Praveen, P. S., Dhital, N. B., Gurung, A., Panday, A. K., Joshi, I. B., Poudel, S. P., Wang, Y., Saikawa, E., Yokelson, R. J., DeCarlo, P. F. and Stone, E. A.: *Wintertime Air Quality in Lumbini, Nepal: Sources of Fine Particle Organic Carbon*. ACS Earth Space Chem., <https://doi.org/10.1021/acearthspacechem.0c00269>, 2021.
- Islam, Md. R., Jayarathne, T., Simpson, I. J., **Werden, B.**, Maben, J., Gilbert, A., Praveen, P. S., Adhikari, S., Panday, A. K., Rupakheti, M., Blake, D. R., Yokelson, R. J., DeCarlo, P. F., Keene, W. C. and Stone, E. A.: *Ambient air quality in the Kathmandu Valley, Nepal, during the pre-monsoon: concentrations and sources of particulate matter and trace gases*. Atmos. Chem. Phys., 20(5), 2927–2951, <http://doi:10.5194/acp-20-2927-2020>, 2020.
- Goetz, J. D., Avery, A., **Werden, B.**, Floerchinger, C., Fortner, E. C., Wormhoudt, J., Massoli, P., Herdon, S. C., Kolb, C. E., Knighton, W. B, Peischel, J., Warneke, C., de Gouw, J. A., Shaw, S. L., DeCarlo, P. F.: *Analysis of local-scale background concentrations of methane and other gas-phase species in the Marcellus Shale*. Elem Sci Anth. <http://doi.org/10.1525/elementa.182>, 2017.

Conference Presentations:

- Werden, B.**, Nault, B.A., Fortner, E., Robinson, E., Yassine, A., Agarwal, S., Tehrani, M., Chiger, A., Gigot, C., Lunny, E., Roscioli, J., Herndon, S., Yacovitch, T., Rule, A., Daube, C., Burke, T., Claffin, M., Koehler, K., Nachman, K., DeCarlo, P.F.: *PM₁ Risk in an Industrial Corridor in Louisiana*. AAAR 2024, 12AE.2
- Werden, B.***, Giordano, M.R., Mahata, K., Goetz, J.D., Islam, Md. R., Puppala, P. S., Panday, A.K., Yokelson, R., Stone, E.A., DeCarlo, P.F.: *Submicron Aerosol Spatial Variation in the Kathmandu valley, Nepal 2018*. AAAR 2023, 1.SS.7
- Konwar, M., **Werden, B.***, Fortner, E.C., Patil, S., Chowdhuri, S., Sandeep, J., Varghese, M., Malap, N., Bera, S., Croteau, P., Jayne, J., Canagaratna, M., Hibert, K., Axisa, D., Baumgardner, D., Decarlo, P.F., Worsnop, D., and Prabhakaran, T.: *Direct Observation of Cloud Seed Aerosols via Airborne AMS Measurements* ICNAA 2023
- Werden, B.***, Giordano, M.R., Mahata, K., Goetz, J.D., Islam, Md.R., Puppala, P., Panday, A.K., Yokelson, R.J., Stone, E.A., DeCarlo, P.F.: *Submicron Aerosol Spatial Variation from Mobile and Ambient Measurements by mAMS in the Kathmandu valley, Nepal 2018*. IAC 2022, ATAS-P2 048
- Werden, B.***, Giordano, M.R., Goetz, J.D., Islam, Md.R., Fortner, E.C., Croteau, P., Katz, P., Worsnop, D., Jayne, J., Panday, A.K., Yokelson, R.J., Stone, E.A., and DeCarlo, P.F.: *Field Deployments of the mini Aerosol Mass Spectrometer*. IAC 2022, AMT-P2 020
- Chowdhuri, S., **Werden, B.***, Fortner, E.C., Konwar, M, Patil, S, Sandeep, J., Varughese, M., Malap, N., Bera, S., Murugavel, P., Croteau, P., Jayne, J., Canagaratna, M., Hibert, K., Axisa, D., DeCarlo, P.F., Worsnop, D., Prabhakaran, T.: *Seeding signature in clouds and its tracking with mini-AMS* ICCP 2021
- Werden, B.**, Mahata, K., Islam, M.R., Giordano, M.R., Katz E., Puppala, P.S., Panday, A.K., Yokelson, R.J., Stone, E.A., Blake, D., Decarlo, P.F.*: *Submicron Aerosol Composition and Source Contributions across the Kathmandu Valley, Nepal*. AAAR 2021, 1RA.11
- Werden, B.***, Giordano, M.R., Goetz, J.D., Puppala, P.S., Panday, A.K., Yokelson, R.J., Stone, E.A., Decarlo, P.F.: *Source apportionment of regional aerosols and spatial variability from The 2nd Nepal Ambient Measurement and Source Testing Experiment [NAMAStE]-2 in the Kathmandu valley, Nepal*. AGUFM 2020, A203-02
- Werden, B.***, Giordano, M.R., Katz E., Puppala, P.S., Panday, A.K., Yokelson, R.J., Stone, E.A., Blake, D., Decarlo, P.F.: *Spatial Variation of Wintertime Aerosol Composition and Source Contribution across the Kathmandu Valley, Nepal*. AAAR 2019, 2SA.7
- Werden, B.***, Mahata, K., Giordano, M.R., Katz E., Puppala, P.S., Panday, A.K., Yokelson, R.J., Stone, E.A., Blake, D., Decarlo, P.F.: *Drexel University Mobile Measurements to Identify Spatial and Temporal Variability of Aerosol Composition during the NAMAStE Campaign*. AAAR 2019, 2UA.12
- Werden, B.***, Giordano, M.R., Goetz, J.D., Islam, M.R., Katz, E., Bhave, P.V., Puppala, P.S., Rupakheti, M., Panday, A.K., Yokelson, R.J., Stone, E.A., and DeCarlo, P.F.: *Apportionment Of Regional Pollution And Spatial Variation Of Aerosol Composition In The Kathmandu Valley, Nepal*. ACS MARM 2019
- Werden, B.***, Giordano, M.R., Goetz, J.D., Islam, M.R., Katz, E., Bhave, P.V., Puppala, P.S., Rupakheti, M., Panday, A.K., Yokelson, R.J., Stone, E.A., and DeCarlo, P.F.: *Source Apportionment Of Regional Sources And Spatial Difference Of Aerosol Composition From The Nepal Ambient Monitoring And Source Testing Experiment [NAMAStE] In The Kathmandu Valley*. AGUFM 2018, A34A-02

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Werden, B., Giordano, M.R., Goetz, J.D., Islam, M.R., Katz, E., Bhave, P.V., Puppala, P.S., Rupakheti, M., Panday, A.K., Yokelson, R.J., Stone, E.A., and DeCarlo, P.F.*; *In situ measurement and source apportionment of aerosols in the Kathmandu valley, Nepal, April 2015*. AGUFM 2017, A231-07

Industry Engineering Experience:

System Integration Contractor Philadelphia, PA July 2013 – Sept 2014

- Designed, developed, and tested software simulation systems for atmospheric imaging instruments.
- Developed integrated, embedded, and autonomous research systems.
- Provided software maintenance, bug tracking, control documentation, and lifecycle management consulting services.

Droplet Measurement Technologies Boulder, CO Jan 2009 – July 2013

- Designed and implemented software architecture and hardware integrated for real-time Particle Acquisition and Display System (PADS 3) used for aerosol measurement and imaging.
 - Developed custom software for data acquisition, system drivers, client-server communication protocols and user interfaces for instruments including Photoacoustic Extinctionmeter (PAX).
 - Implemented custom novel solutions for autonomous and remote measurement systems.
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HONORS / AWARDS:

CHARMED Center Early Career Award 2025
GAANN Grant 2017, 2018, 2019, 2020
Koerner Family Awards for Graduate Students 2018

Professional Affiliations:

Member AAAR 2017 - Present
Member AGU 2017 - Present
Member ACS 2019 - Present
Journal Reviewer RCS 2024 - Present
Journal Reviewer ACS 2025 - Present