

# Yishu Zhu

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## EDUCATION

<b>University of California Berkeley, Berkeley, CA, United States</b>	<i>Aug 2021 – Present</i>
Ph.D. in Earth & Planetary Science	
Dissertation (provisional title): <i>Quantifying Sectoral Emissions of NO<sub>x</sub>, CO, CO<sub>2</sub> and CH<sub>4</sub> in Cities Using Dense Stationary Sensor Networks</i>	
<b>Peking University, Beijing, China</b>	<i>Sep 2017 – Jul 2020</i>
M.Sc. in Environmental Sciences	
Thesis: <i>Mixing State of Atmospheric Aerosol Particles in Beijing</i>	
<b>Northeastern University, Shenyang, China</b>	<i>Sep 2013 – Jul 2017</i>
B.Eng. in Environmental Sciences (with highest honor)	

## RESEARCH EXPERIENCE

<b>Neighborhood-Scale Urban Emissions Mapping and Implication Evaluation</b>	<i>Aug 2021 – Present</i>
<i>Advisor: Prof. Ronald Cohen, University of California Berkeley</i>	
<ul style="list-style-type: none"><li>Assembled, deployed, and maintained dense stationary sensor networks measuring CO<sub>2</sub>, CO, NO, NO<sub>2</sub>, O<sub>3</sub>, and aerosols. Developed and implemented calibration models tailored to city-specific conditions, achieving substantial improvements in sensor accuracy and long-term stability.</li><li>Derived transportation and residential emission factors (<math>\Delta\text{NO}_x/\Delta\text{CO}_2</math> and <math>\Delta\text{CO}/\Delta\text{CO}_2</math>) by analyzing the seasonality of traffic and building energy use and the spatial gradients of enhancement ratios. Supported this analysis with three-dimensional advection–diffusion modeling to resolve source contributions.</li><li>Identified systematic residential NO<sub>x</sub> overestimates by comparing observation-derived emission factors with inventories (2–4× higher in Los Angeles, San Francisco Bay Area, and Providence, RI), likely due to combustion temperature assumptions.</li><li>Quantified <math>\Delta\text{CH}_4/\Delta\text{CO}_2</math> emission factors from natural gas combustion in homes using multi-year ground-based and tall-tower measurements, providing new constraints on urban methane sources.</li><li>Integrated network observations, WRF-GHG 1 km CO<sub>2</sub> simulations, and GIS-based mobility datasets to map fine-scale variability in adolescent exposure, advancing approaches to environmental justice assessments.</li><li>Developing statistical frameworks to quantify urban CO<sub>2</sub> uptake and emissions, including principal component analysis (PCA) and a hierarchical inversion approach incorporating co-emitted tracers.</li></ul>	
<b>Wind-driven Sea Surface pCO<sub>2</sub> Variations</b>	<i>Nov 2022 – May 2023</i>
<i>Advisor: Prof. Inez Fung, University of California Berkeley</i>	
<ul style="list-style-type: none"><li>Established climatological understanding of how wind-driven ocean circulation shapes the seasonal cycle and spatial variabilities of sea surface pCO<sub>2</sub> by integrating global wind reanalysis (MERRA-2) and gridded surface carbonate system datasets (OceanSODA-ETHZ).</li><li>Identified North Atlantic regions most affected by circulation-driven variability using wind stress curl diagnostics and evaluation of temperature, salinity, alkalinity, and dissolved inorganic carbon fields</li></ul>	

**Physicochemical Morphology of Aerosols and Ozone Formation Mechanism**

Oct 2018 – Jul 2021

Advisor: Prof. Zhijun Wu, Peking University; Collaborators: Prof. Keding Lu, Peking University; Prof. Markus Ammann, Paul Scherrer Institute

- Characterized the chemical mapping and water uptake of individual atmospheric particles collected in Beijing using electron microscopy and synchrotron-based photoelectron spectroscopy.
- Developed nanogram-level mass measurement approach based on quartz crystal microbalance to investigate the hygroscopicity, volatility, and condensed-phase diffusivities of organic particulate matter.
- Performed in-situ imaging and cluster data analysis (MATLAB, Python) to provide the direct evidence for phase separation of ambient atmospheric particles.
- Simulated the aerosol mixing state evolution using particle-resolved model to better understand the chemical and meteorological processes dominating over the North China Plain.
- Conducted source apportionment and sensitivity analyses of surface ozone, integrating observation-based constraints with statistical modeling to identify key precursors and guide mitigation strategies.

**Vertical Profiles of Particle Number Size Distribution**

Feb 2017 – Jan 2019

Advisor: Prof. Zhijun Wu, Peking University; Collaborators: Prof. Kang-ho Ahn, Hanyang University

- Assembled miniaturized portable scanning mobility particle sizer (Hy-SMPS; 8-245nm, 5.5kg) and optical particle spectrometer (POPS; 0.135-3.5 $\mu$ m, 0.7kg), excelling in drone-based measurements.
- Measured vertical distributions of the size, composition, and number of aerosol particles to characterize their physical and optical properties during haze episodes in Beijing.
- Captured a new particle formation event at 300 m above the ground before detection by ground-level instruments.

**PUBLICATIONS (h-index:8, [Google Scholar page](#))****Journal Articles**

- [1] **Zhu, Y.**; Patel M. Y.; Winter, A. R. et al., *Observational Inferences of NO<sub>x</sub> and CO Emission Factors for Vehicles and Homes in the San Francisco Bay Area*. **ACS ES&T Air** 2025, 2 (8), 1478-1487.
- [2] **Zhu, Y.**; Wu, Z.; Park, Y.; Fan, X. et al., *Measurements of atmospheric aerosol vertical distribution above North China Plain using hexacopter*. **Science of The Total Environment** 2019, 665, 1095-1102.
- [3] (Manuscript ready for submission to Geophysical Research Letters) **Zhu, Y.**; Cohen R. C.; et al., *Cross-City Comparison of Residential NO<sub>x</sub> and CO Emission Factors Inferred from Dense Urban Observations*.
- [4] (Manuscript in preparation) **Zhu, Y.**; Cohen R. C.; Ma, G. et al., *On the Sources of Methane to the San Francisco Bay Area Atmosphere*.
- [5] Asimow, N. G., Patel, M. Y., **Zhu, Y.**, et al., *Differences in regional home heating behavior in three U.S. Cities revealed by ground-based sensor network*. **Geophysical Research Letters** 2025, 52, e2025GL115772.
- [6] Winter, A. R., **Zhu, Y.**, et al., *Sustained Performance of Low-Cost Air Quality Sensors in Long-Term Deployments*. **ACS Sensors** 2025 10 (6), 4329-4335.
- [7] Patel, M. Y., **Zhu, Y.**, et al., *Plume Detection and Emissions Quantification Potential Using a Dense Sensor Network*. **ACS ES&T Air** 2025 2 (6), 1099-1106.
- [8] Winter, A. R., **Zhu, Y.**, et al., *A Scalable Calibration Method for Enhanced Accuracy in Dense Air Quality Monitoring Networks*. **Environmental Science & Technology** 2025 59 (5), 2599-2610.
- [9] Man, R., **Zhu, Y.**, et al., *Direct observation of core-shell structure and water uptake of individual submicron urban aerosol particles*, **EGUsphere [preprint]** 2025.

- [10] Zong, T., Wang, H., Wu, Z., Lu, K., Wang, Y., **Zhu, Y.**, et al., *Particle hygroscopicity inhomogeneity and its impact on reactive uptake*. **Science of The Total Environment** 2022, 811, 151364.
- [11] Zhao, G., Tan, T., **Zhu, Y.**, et al., *Method to quantify black carbon aerosol light absorption enhancement with a mixing state index*. **Atmospheric Chemistry and Physics** 2021, 21 (23), 18055-18063.
- [12] Zhao, G., **Zhu, Y.**, et al., *Impact of aerosol–radiation interaction on new particle formation*. **Atmospheric Chemistry and Physics** 2021, 21 (13), 9995-10004.
- [13] Chen, J., Pei, X., Wang, H., Chen, J., **Zhu, Y.**, et al., *Development, Characterization, and Validation of a Cold Stage-Based Ice Nucleation Array (PKU-INA)*. **Atmosphere** 2018, 9 (9), 357.
- [14] Wu, Z., Chen, J., Wang, Y., **Zhu, Y.**, et al., *Interactions between water vapor and atmospheric aerosols have key roles in air quality and climate change*. **National Science Review** 2018, 5 (4), 452-454.
- [15] Wu, Z., Wang, Y., Tan, T., **Zhu, Y.**, et al., *Aerosol Liquid Water Driven by Anthropogenic Inorganic Salts: Implying Its Key Role in Haze Formation over the North China Plain*. **Environmental Science & Technology Letters** 2018, 5 (3), 160-166.

### **Selected Conference Presentations (6 out of 12)**

- [1] **Zhu, Y.**, Patel M. Y., et al., *Observational Inferences of NO<sub>x</sub> and CO Emission Factors for Vehicles and Homes in the San Francisco Bay Area*. **US EPA Emissions Inventory Conference**, Sep 15-18, 2025 (virtual oral)
- [2] Yang P., **Zhu, Y.**, et al., *Mapping Air Pollution Microenvironments Among Adolescents Using Geospatial-Temporal Analysis and Community Engagement*. **Joint Annual Meeting of the International Society of Exposure Science and the International Society for Environmental Epidemiology** Atlanta, GA, USA August 17-20, 2025 (poster)
- [3] **Zhu Y.**, Winter A., Asimow, N. G., et al., *Mapping Nitrogen Oxides, Carbon Monoxide, and Carbon Dioxide in the San Francisco Bay Area*. **American Geophysical Union (AGU) meeting**, Washington D.C., USA, Dec 9-13, 2024 (poster)
- [4] **Zhu Y.**, Winter A., Asimow, N. G., Cohen, R. C., et al., *A High Spatial Resolution (~2km) Map of NO<sub>x</sub> in the Bay Area*, **American Chemical Society (ACS) meeting**, San Francisco, CA, USA, Aug 13-17, 2023 (oral)
- [5] **Zhu Y.**, Wu Z., Alpert A. P., Ammann M. et al, *Mixing State and Hygroscopicity of Atmospheric Aerosol Particles*, **The 6<sup>th</sup> International Conference on Environmental Simulation and Pollution Control**, Beijing, China, Nov 3-5, 2019 (oral).
- [6] **Zhu Y.**, Wu Z., Zhao G., Wang H. et al., *Vertical Profiles of Atmospheric Aerosol in the Urban Canopy of Beijing during Winter Haze Events*, **Asian Aerosol Conference (AAC)**, Hongkong, China, May 23-27, 2019 (poster)

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### **TEACHING EXPERIENCE**

Graduate Student Instructor for undergrad course *General Chemistry and Quantitative Analysis*, 2023 Spring, 2024 Spring, and 2025 Spring

Teaching assistant for undergrad course *Environmental Monitoring Experiments*, 2019 Spring

Teaching assistant for graduate course *Aerosol Measurement Principles, Techniques, and Applications*, 2018 Fall

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### **AWARDS**

Voices for Sciences Fellowship, AGU (2024-2025)

AGU Fall meeting travel grant (2024)

Summer School Fellow for Inverse Modeling of Greenhouse Gases, CIRA Colorado State University (2024)

Award for Academic Excellence, Peking University (Top 3%, 2019)

Annual Merit Student Scholarship, Northeastern University (Top 5%, 2013-2017)

## SKILLS & ACTIVITIES

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**Programming:** Python, SQL, R, Git, IGOR, LabView, Auto CAD

**Modeling & Simulation:** WRF, WRF-Chem, WRF-GHG, HRRR-STILT

**Field & Laboratory:** Air quality and CO<sub>2</sub> sensor assembly, calibration, deployment, and maintenance; aerosol instrumentation; atmospheric sampling and analysis

**Services & Leadership:**

- Organizer, Scientists for Knowledge of Atmospheric invERSions (SKATERS) (2024 Fall - present)
- Co-chair, AGU session: *Low-cost air quality sensors: challenges, opportunities, and collaborative strategies across the world* (2025)
- Mentor, undergrad research: methane emission ratio analysis (Grace Ma, 2024)
- Led successful congressional visits to four California and Hawaii senators' offices to advocate for youth climate education and climate adaptation policy (2024)
- Mentor, transfer students, Physical sciences Opportunities for Womxn in Education & Research (POWER-Bay Area, 2023 Fall)
- Instructor, *Introduction to Air Quality and Climate*, Fremont High School, Oakland, CA (2022 Spring)
- Event Planner, TEDx Berkeley (2021, 2022)