ZEXUAN ZHANG

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EDUCATION

- PhD Candidate, Earth Climate and Environment, School of Earth Sciences, **Zhejiang University**, China — Sep. 2022 – Present
  - Research topic: Microphysical and optical properties of atmospheric carbonaceous aerosols
  - Supervisor: Prof. Weijun Li
- M.S. Environmental Engineering, School of Environmental Sciences, **China University of Geosciences**, China — Sep. 2019 – Jun. 2022
  - Research topic: Benefits of refined NH_3 emission controls on $PM_{2.5}$ mitigation in China
  - Supervisor: Prof. Shihua Qi, Prof. Shaofei Kong and Associate Prof. Yingying Yan
- B.S. Environmental Engineering (Excellence Program), School of Environmental Science and Engineering, **Tiangong University**, China — Sep. 2014 – Jun. 2018

RESEARCH EXPERIENCE

- Visiting PhD student, Department of Earth and Environmental Sciences, **The University of Manchester**, UK — Sep. 2024 – Sep. 2025
  - Supervisor: **Associate Prof. Zhonghua Zheng**
- R.A., **Institute of Urban Environment, Chinese Academy of Sciences**, China — Aug. 2018 – Aug. 2019
- J.P., **Institute of Urban Environment, Chinese Academy of Sciences**, China — Feb. 2018 – Jun. 2018

SELECTED AWARDS AND HONORS

- PhD Student Academic Scholarship (Second Prize), Zhejiang University, Hangzhou — 2022–2025
- Outstanding Master Graduate, China University of Geosciences, Wuhan — 2022
- Postgraduate Academic Scholarship (First Prize), China University of Geosciences, Wuhan — 2019–2021
- Outstanding Poster Award (First Prize), Jiangsu Provincial Postgraduate Innovation Forum, Nanjing — 2020
- Third prize, 30th Science and Technology Report, China University of Geosciences, Wuhan — 2019
- Air Quality Protection Service Award, 7th World Military Games 2019, Wuhan — 2019
- Excellent Engineer in Environmental Engineering, Tiangong University, Tianjin — 2018

FIELD OBSERVATION EXPERIENCE

- Conducted multi-city aerosol sampling using large-flow and medium-flow samplers in Suizhou, China
- Led mobile air quality monitoring for the 7th World Military Games in 2019 in Wuhan, China
- Performed tunnel air pollutant monitoring in Yichang, China
- Managed medium-flow and single-particle sampling for the 19th Asian Games in 2023 in Hangzhou, China
- Collected single-particle samples from rubber, wooden furniture, textile & chemical fiber factories in Jingmen, China
- Executed medium-flow and single-particle sampling during spring sandstorm observations in Hangzhou, China

SELECTED MEETINGS

- Oral Presentation, The EGU General Assembly 2025, Vienna, Austria
- Oral Presentation, The Cambridge Particulate Matter Conference 2025, Cambridge, UK
- Oral Presentation, The 8th Air Benefit and Cost and Attainment Assessment Conference (ABaCAS 2020), Guangzhou, China
- Oral Presentation, The 4th Academic Meeting of the Department of Atmospheric Sciences, China University of Geosciences, Wuhan, China
- Oral Presentation, The 1st Academic Seminar of the Hubei Provincial Atmospheric Environment Professional Committee, Wuhan, China
- Oral Presentation, The Workshop on the Causes of Air Pollution in Wuhan and Surrounding Regions, Wuhan, China

SKILLS

- **Experiment:**
  - Operation of transmission electron microscope (TEM), energy-dispersive X-ray spectroscopy (EDS), and associated analysis software
  - Operation of organic carbon/elemental carbon (OC/EC) analyzers
  - Operation of atmospheric sampling instruments, including large/medium-flow samplers and single-stage impactors
  - Application of 3D single-particle optical modeling using the Discrete Dipole Approximation (DDA) method
  - Optimization of the DDA algorithm using deep learning and creation of a black carbon single-particle optical property database
  - Proficient in GEOS-Chem global 3D chemical transport model for atmospheric simulations
  - Familiar with Linux-based HPC environments and job submission via PBS and Slurm
  - Proficient in Python (primary) and NCL for data analysis and scientific computing
  - Skilled in scientific tools such as ArcGIS, Panoply, EndNote, Zotero, Origin, and ChemDraw
  - Development of a computer vision-based software tool for calculating single-particle projected areas
  - Construction and maintenance of a cloud-based observational database integrating 200+ field campaigns

- **Project and Grant Writing:**
  – Contributed to national-level research proposals, with responsibilities including background research, methodology design, etc.
  – Participated in the preparation of annual progress and final reports for multiple research projects
- **Teaching:**
  – Tutoring of undergraduate for graduate-level specialized course exams
  – Mentoring of postgraduate on structuring research frameworks and conducting data analysis
  – Delivery of foundational GEOS-Chem training at an online conference attended by over 500 participants
  – Served as a teaching assistant, introducing lab instruments to undergraduate students and explaining their usage and analysis methods
- **Conference Organization:**
  – Served as secretary for a provincial-level academic conference, including coordinating personnel and venue, scheduling presentations, and managing materials printing

PUBLICATIONS

- **Zhang, Z.**, Wang, Y., Chen, X., Xu, L., Zheng, Z., Ching, J., Zhu, S., Liu, D., and Li, W., 2025. Absorption enhancement and shielding effect of brown organic coating on black carbon aerosols. *npj Climate and Atmospheric Science*.
- **Zhang, Z.**, Yan, Y., Kong, S., et al., 2021. Benefits of refined NH_3 emission controls on $PM_{2.5}$ mitigation in Central China. *Science of the Total Environment*.
- Wang, Y., Zheng, Z., Sun, Y., Yao, Y., Ma, P., Zhang, A., Zhu, S., **Zhang, Z.**, Chen, X., Pang, Y., Wang, Q., Che, H., Ching, J., and Li, W., 2025. Improved representation of black carbon mixing structures suggests stronger direct radiative heating. *One Earth*.
- Wang, Y., Xu, L., **Zhang Z.**, … Liu D. and Li W., 2024. Variability in morphology of soot particles during non-cloud and in-cloud processes. *Atmospheric Environment.*
- Cai, X., Yan, Y., Li S., Kong S., Liu M. and **Zhang Z.**, 2022. Trend reversal from source region to remote tropospheric NO_2 columns. *Environmental Science and Pollution Research*.
- Yan, Y., Zhou, Y., Kong, S., Lin, J., Wu, J., Zheng, H., **Zhang, Z.**, Song, A., Bai, Y., Zhang, L., Liu, D., Zhao, T., 2021. Effectiveness of emission control in reducing $PM_{2.5}$ pollution in central China during winter haze episodes under various potential synoptic controls. *Atmospheric Chemistry and Physics*.
- Yao, L., Kong, S., Zheng, H., Chen, N., Zhu, B., Xu, K., Cao, W., Zhang, Y., Zheng, M., Cheng, Y., Hu, Y., **Zhang, Z.**, Yan, Y., Liu, D., Zhao, T., Bai, Y., Qi, S., 2021. Co-benefits of reducing $PM_{2.5}$ and improving visibility by COVID-19 lockdown in Wuhan. *npj Climate and Atmospheric Science*.
- Wang, Y., Yan, Y., Duan, K., Kong, S., Lin, J., Zheng, H., Song, A., **Zhang, Z.**, 2021. Effect of springtime thermal forcing over Tibetan Plateau on summertime ozone in Central China during the period 1950–2019. *Atmospheric Research*.
- **Zhang, Z.**, et al. (**In internal review**). Light absorption of wildfire tarballs: Insights into their mixing structures and compositions.
- **Zhang, Z.**, et al. (**in preparation**). Analytical prediction of optical properties of black carbon aggregates with deep learning.

POSTDOCTORAL RESEARCH PLAN

My PhD work using Transmission Electron Microscopy (TEM) provided me with deep insights into aerosol microphysics, including the morphology, mixing structure, and composition of black carbon, tarball, mineral dust, and iron particles. Combined with expertise in single-particle analysis and 3D optical modeling, my postdoctoral research plan includes:

- **Enhancing Black Carbon (BC) Optical Schemes in Climate Models:**
  Integrate a novel, deep-learning-based optical database of BC single particles (developed during my PhD) into climate models. This will help address current uncertainties in modeling BC radiative forcing, which arise from simplified assumptions (e.g., volume-average or core-shell models) that fail to adequately capture the complex microphysics of BC particles.

- **Refining Tarball Microphysical Parameterizations and Radiative Impact:**
  Refine parameterizations of tarball microphysics in climate models based on insights from my extensive PhD TEM analysis (9,700+ TEM images). This analysis identified approximately 20 distinct tarball mixing structures and demonstrated that common spherical morphologies underestimate tarball absorption. The goal is to improve our understanding of tarball absorption and more accurately quantify its radiative forcing.

- **Investigating Optical Properties of Black Carbon-Mineral Dust Mixtures:**
  Investigate how light absorption changes when BC mixes with mineral dust—a phenomenon I frequently observed in my TEM work (especially the sample during dust storms). This study will build on my PhD findings regarding optical interactions in other BC mixtures (BC-secondary brown carbon and BC-tarball), expanding the scope to BC-dust interactions, an area often overlooked in previous studies.

- **Exploring Potential Health Implications of BC Morphology:**
  Investigate whether the larger surface area of BC aggregates enhances their capacity to act as a carrier for atmospheric pollutants and facilitate surface reactions, potentially leading to more severe health impacts than those predicted based on simplified core-shell models of BC. (This exploratory direction will be pursued through collaboration with toxicological experts.)