

KEER ZHANG

Guyot Hall M26
Princeton, NJ 08544

Email: kz7693@princeton.edu
Phone: (203) 606-7776

Education

Princeton University, High Meadows Environmental Institute, Princeton, NJ
Postdoctoral Environmental Fellow 2024 - present
Advisor: Elie Bou-zeid

Yale University, School of the Environment, New Haven, CT
Ph.D. in Environmental Studies 2019 - 2024
Dissertation: Global analysis of urban effect on thermal environment
Advisor: Xuhui Lee

Sun Yat-sen University, School of the Atmospheric Sciences, Guangzhou, China
B.S. in Atmospheric Science 2015-2019
Thesis: Numerical study of flow and pollutant exposure in high-rise deep street canyons with different building configuration and viaduct settings
Advisor: Jian Hang

Research Interests

Urban climate
Climate modeling
Land-atmosphere interaction
Boundary layer meteorology
Land cover and land use change

Publications

Published and in press

[11] Tang, T., X. Lee, **K. Zhang** (2024), Historical land use and land cover change reduced the temperature of cold extremes more than that of hot extremes. *The Innovation Geoscience*. 2, 100079.

[10] Li, X., L. Zhao, K. Oleson, Y. Zhou, Y. Qin, **K. Zhang**, B. Fang (2024), Enhancing Urban Climate-Energy Modeling in the Community Earth System Model (CESM) Through Explicit Representation of Urban Air-Conditioning Adoption. *Journal of Advances in Modeling Earth Systems*. 16, e2023MS004107.

[9] Lyu, H., W. Wang, **K. Zhang**, C. Cao, W. Xiao, X. Lee (2024), Factors influencing the spatial variability of air temperature urban heat island intensity in Chinese cities. *Advances in Atmospheric Sciences*. 41, 817–829.

- [8] Chu, H., C. Cao, W. Wang, W. Xiao, **K. Zhang**, M. Zhang, X. Lee (2024), The Land Wet-Bulb Temperature Increases Faster Than the Sea Surface Temperature. *Geophysical Research Letters*. 51, e2023GL106617.
- [7] **Zhang, K.**, C. Cao, H. Chu, L. Zhao, J. Zhao, X. Lee (2023), Increased heat risk in wet climate induced by urban humid heat. *Nature*. 617, 738-742.
- [6] Tang, T., X. Lee, N. M. Schultz, **K. Zhang**, L. Cai, D. M. Lawrence, E. Shevliakova (2022), Biophysical impact of land use and land cover change on subgrid temperature in CMIP6 models. *Journal of Hydrometeorology*. 24, 373-388.
- [5] **Zhang, K.**, X. Lee, N. M. Schultz, L. Zhao, C. He, Q. Huang, Z. Liu, H. Chu, J. Zhao (2022), A global dataset on subgrid land surface climate (2015–2100) from the Community Earth System Model. *Geoscience Data Journal*., 10, 208-219.
- [4] **Zhang, K.**, G. Chen, Y. Zhang, S. Liu, X. Wang, B. Wang, J. Hang (2020), Integrated impacts of turbulent mixing and NO_x-O₃ photochemistry on reactive pollutant dispersion and intake fraction in shallow and deep street canyons. *Science of The Total Environment*., 712, 135553.
- [3] Zhang, Y., X. Yang, H. Yang, **K. Zhang**, X. Wang, Z. Luo, J. Hang, S. Zhou (2020), Numerical investigations of reactive pollutant dispersion and personal exposure in 3D urban-like models. *Building and Environment*., 169, 106569.
- [2] **Zhang, K.**, G. Chen, X. Wang, S. Liu, C. Mak, Y. Fan, J. Hang (2019), Numerical evaluations of urban design technique to reduce vehicular personal intake fraction in deep street canyons. *Science of the Total Environment*., 653, 968-994.
- [1] S. Liu, Z. Luo, **K. Zhang**, J. Hang (2018), Natural ventilation of a small-scale road tunnel by wind catchers: a CFD simulation study. *Atmosphere*, 9, 411.

Working papers

- [4] Yang, Y., C. Cao, I. Bogoev, C. Deetman, G. Dietz, J. Hang, L. Howard, X. Huang, N. Kendall, J. Lai, H. Lam, K. Tam, C. Yoo, **K. Zhang**, X. Lee (2024), Regulation of humid heat by urban greenspace across a climate wetness gradient. Submitted to *Nature Cities*.
- [3] **Zhang, K.**, L. Zhao, K. Oleson, X. Li, X. Lee (2024), Enhancing urban thermal environment and energy sustainability with temperature-adaptive emissivity roofs. Submitted to *Earth's Future*.
- [2] **Zhang, K.**, B. Fang, K. Oleson, L. Zhao, C. He, Q. Huang, Z. Liu, C. Cao, X. Lee (2024), Indirect biophysical effect of global urban land expansion on the surface climate. Submitted to *Journal of Geophysical Research: Atmospheres*.
- [1] Fang, B., L. Zhao, K. Oleson*, **K. Zhang**, P. Lawrence, B. Sacks, C. Cao, C. He, Q. Huang, Z. Liu, X. Lee (2024), Representing dynamic urban land change in the Community Earth System Model (CESM). Submitted to *Journal of Advances in Modeling Earth Systems*.

Academic Services

Journal Reviewer

Science Advances (1); Earth's Future (4); Geophysical Research Letters (3); Quarterly Journal of the Royal Meteorological Society (2); Journal of Geophysical Research: Atmospheres (2); Urban Climate (1)

Presentations

- 01/2024 American Meteorological Society (AMS) 104th Annual Meeting, Baltimore, MD (oral)
- 12/2023 American Geophysical Union (AGU) Fall Meeting, San Francisco, CA (oral)
- 06/2023 School of the Atmospheric Sciences, Sun Yat-sen University, Virtual (invited talk)
- 05/2023 Yale-NUIST Center on Atmospheric Environment Video Conference, Virtual (invited talk)
- 04/2023 Yale School of the Environment Research Conference, New Haven, CT (oral)
- 02/2023 CESM Land Model/Biogeochemistry Model Winter Working Group Meeting, Virtual (oral)
- 12/2022 American Geophysical Union (AGU) Fall Meeting, Chicago, IL (poster)
- 10/2022 Yale-NUIST Center on Atmospheric Environment Video Conference (invited talk)
- 11/2021 Department of Civil and Environmental Engineering, University of Illinois Urbana-Champaign (invited talk)
- 04/2020 Yale-NUIST Center on Atmospheric Environment Video Conference (invited talk)
- 03/2019 2nd International Alliance for Sustainable Urbanization and Regeneration, Xi'an, China (oral)
- 11/2018 24th National Conference on Atmospheric Environment and Technology, Qingdao, China (poster)
- 11/2018 24th National Conference on Atmospheric Environment and Technology, Qingdao, China (oral)

Awards & Grants

High Meadows Environmental Institute Postdoctoral Environmental Fellowship	2024
The 37th Conference on Climate Variability and Change Student Travel Award	2023
CESM Land Model Working Group Andrew Slater Award	2023
Yale School of the Environment Student Conference Travel Grant	2022-2023
Yale University Teaching Assistantship	2020-2023
First Prize Scholarship for Outstanding Students, Sun Yat-sen University	2018
Finalist of Li Xuerou Award, Sun Yat-sen University	2018
Second Prize Scholarship for Outstanding Students, Sun Yat-sen University	2016-17
Zhuhai Coca Cola Scholarship for Outstanding Students	2016-17

Research Experience

Graduate Researcher

12/2023-present

Yale School of the Environment

Enhancing Urban Thermal Comfort and Sustainability with Temperature-Adaptive Radiative Cooling Roofs

- Implemented a novel roof coating with temperature adaptive emissivity in the Community Earth System Model (CESM).
- Evaluated the climate and energy benefits of adopting temperature adaptive emissivity roofs with and without high albedo.
- Developed a simple parameterization of air temperature responses to emissivity and albedo to facilitate the development of city-specific radiative mitigation strategies.

Graduate Researcher

06/2022-present

Yale School of the Environment

Direct and indirect climate impacts of global urban expansions on future climate

- Improved Community Earth System Model's (CESM) mksurfddata_map tool to generate new surface data with transient urban land cover.
- Conducted four sets of CESM simulations with a dynamic urban scheme and quantified the direct and indirect climate impacts of global urbanization.
- Investigated the underlying mechanisms responsible for indirect climate effects, including solar brightening, regional drying, and stomatal response.

Graduate Researcher

09/2019 - 05/2023

Yale School of the Environment

Impact of local climate and urbanization on wet-bulb temperatures and urban heat islands

- Introduced a novel concept of urban wet-bulb island (ΔT_w) to effectively quantify the additional urban humid heat stress induced by urban heat island and urban dry island.
- Analyzed data from 140 pairs of urban and rural weather stations and simulations using Community Land Model 5 to characterize the climate gradient of ΔT_w .
- Delved into the mechanisms behind ΔT_w formation by dissecting ΔT_w into contributions from various biophysical drivers.
- Evaluated the societal impact of ΔT_w by quantifying the extra dangerous heat-stress days experienced by urban residents.

Graduate Researcher

09/2020 - 04/2022

Yale School of the Environment

Utilizing subgrid information from earth system models to evaluate climate impacts of land use and land cover change

- Implemented a new individual soil column scheme in CESM and conducted a fully-coupled simulation from 2015 to 2100 under the RCP 8.5 scenario.
- Curated and disseminated critical data related to key land surface climate variables for eight subgrid tiles (urban, rural, tree, grass, shrub, bare soil, crop, and lake). This dataset has been published for wider research community access.

- Collaborated with multidisciplinary researchers to leverage this dataset effectively, enabling comprehensive characterization of local climate changes induced by deforestation, urbanization, and presence of lakes.

Undergraduate Research Fellow

06/2018-11/2019

Sun Yat-sen University

Advisor: Jian Hang

Impacts of building configuration and photochemical reactions on ozone pollution and personal exposure in idealized street canyons

Funded by National Key Research and Development Program, the influence of Volatile organic compounds (VOCs) on regional air quality and its effect on environment (sub-Project No, 2016YFC0202206)

- Conducted Computational Fluid Dynamics (CFD) simulations with NO-NO₂-O₃ chemistry in 2D street canyons.
- Calculated personal intake fraction of NO₂ to quantify pollutant exposure in near-road buildings.
- Investigated the impacts of aspect ratios, elevated-building design, wind catchers and different background ozone concentrations on reactive pollutant dispersion.

Undergraduate Research Fellow

06/2017-06/2018

Sun Yat-sen University

Advisor: Jian Hang

Numerical evaluations of flow and vehicular pollutant exposure in deep street canyons with various urban designs

Funded by National Natural Science Foundation of China (NSFC)-Outstanding Youth Foundation, Urban climate (Project No, 41622502).

- Conducted CFD simulations validated by wind tunnel data and scale-model outdoor field measurement in 2D street canyons.
- Introduced intake fraction into numerical simulation results to measure vehicular pollutant exposure to near-road building residents.
- Investigated the integrated impacts of aspect ratios, elevated building designs, viaduct settings, height variation and wind catchers on the ventilation and carbon dioxide exposure.

Technical Skills

- Programming/Software: Python, Fortran, ENVI
- Areas of Expertise: Climate modeling, Remote sensing

Teaching and Mentoring Experience

Teaching Fellow

Spring 2021-2023

ENV 726: Observing Earth from the Space, Yale University

Facilitated weekly 2-hour lab exercises, guiding students through hands-on practices. Led roundtable discussions on term project progress reports. Graded assignments and exams, providing students with detailed feedback. Held weekly office hours and proctored exams.

Achieved excellent feedback from students in Spring 2022 with a score of 5/5 in TF evaluation, well above school average (4.4).

Teaching Fellow

Spring & Fall 2017-2019

Physics Laboratory, Sun Yat-sen University

Instructed students in weekly lab experiments. Examined the lab instruments and equipment before class. Graded lab reports.

Language Partner

2022-2023

Yale Center for Language Study's Fields Program

Guided weekly reading and discussion with students on environmental topics. Provided tutoring and support for Chinese language proficiency.

Played a crucial role as a reference for a student's successful application for the Foreign Language and Area Studies Fellowships (FLAS)

Membership

American Geophysical Union (AGU)

2022-present

American Meteorological Society (AMS)

2023-present