

RIYANG LIU

Nicholas School of the Environment, Duke University, Durham, NC 27708, USA

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PROFESSIONAL SUMMARY

Riyang is a SCALES Postdoctoral Fellow at Duke University's Nicholas School of the Environment, where he works on the health impacts of climate change with a focus on heat exposure and human health. His background is in geospatial and computational methods for environmental exposure assessment. At the Yale School of Public Health, he developed spatiotemporally resolved models for estimating population-level exposure to air pollutants and climate stressors, integrating remote sensing, big data, and atmospheric science knowledge. His work has been published in journals including Environmental Science & Technology, Remote Sensing of Environment, and Environment International. At Duke, he is expanding into the heat and health space, particularly the link between environmental heat and physiological outcomes at the individual level. He is interested in building high-resolution heat exposure models and connecting them to health data to better understand how a warming climate translates into real human harm.

PROFESSIONAL APPOINTMENTS

Duke University, Durham, North Carolina

Postdoctoral Associate, Environmental Natural Sciences

Jul. 2026 - current

Mentors: Drs. Nishad Jayasundar, Mercedes Bravo, Liyin He, Heather Stapleton, and Christina Wyatt

Yale University, New Haven, Connecticut

Postdoctoral Associate, Environmental Health Sciences

Apr. 2024 – Jun. 2026

Advisor: Dr. Kai Chen

Yale University, New Haven, Connecticut

Postgraduate fellow, Environmental Health Sciences

Feb. 2022 - July 2022

Advisor: Dr. Kai Chen

EDUCATION

Nanjing University, Nanjing, China

Ph.D, Environmental Science and Engineering

Sep. 2019 – Mar. 2024

Advisors: Dr. Jun Bi & Dr. Zongwei Ma

Nanjing University, Nanjing, China

Master of Engineering, Environmental management

Aug. 2016 - June 2019

Xiamen University, Xiamen, China

Bachelor of Science, Environmental Science

Sep. 2012 - July 2016

Peer-Reviewed Research Articles

1. **Liu, R.**; Chu, L.; Deziel, N. C.; Chen, K. Four-Decade (1980–2023) Surface Ozone Concentrations across the Contiguous United States: Fine-Resolution Estimates and Health Implications. *Environmental Science & Technology* 2026. DOI: <https://doi.org/10.1021/acs.est.5c16412>.
2. Shao, Y.¹; **Liu, R.**¹; Huang, S.; Fang W.; Yang, J.; Liu, M.; Ma, Z.; Bi, J. Interpretable machine learning for ambient air pollution modeling: A systemic review. *Atmospheric Research* 2026. DOI: <https://doi.org/10.1016/j.atmosres.2026.108869>.
3. Lin, C.; Chu L.; **Liu, R.**; Gasparrini, A.; DeWan, A.T.; Forastiere, L.; Chen, K. Effects of hypothetical PM_{2.5} intervention on the risk of hospitalization for cardiovascular diseases. *JAMA Network Open* 2025. DOI: <https://doi.org/10.1001/jamanetworkopen.2025.39862>.
4. Zhang, Y.; Shao, Y.; **Liu, R.**; Bi, J.; Ma, Z. Exploring homogeneous learnware market for PM_{2.5} prediction: A case study in the Yangtze River Delta region of China. *Atmospheric Pollution Research* 2025. DOI: <https://doi.org/10.1016/j.apr.2025.102738>.
5. **Liu, R.**; Chu L.; Rogne, T.; Ma, X.; Chen, K. Racial and Ethnic Disparities in Exposure to Short-Term NO₂ Air Pollution in California during 1980-2022. *Journal of Hazardous Materials* 2025. DOI: <https://doi.org/10.1016/j.jhazmat.2025.139309>.
6. Lin, C.; **Liu, R.**; Sutton, C.; DeWan, A.T.; Forastiere, L.; Chen, K. Estimating the effects of hypothetical ambient PM_{2.5} interventions on the risk of dementia using the parametric g-formula in the UK Biobank cohort. *Environmental Health Perspectives* 2025. DOI: <https://doi.org/10.1289/EHP14723>.
7. Zhu, L.; Fang, J.; Yao, Y.; Yang, Z.; Wu, J.; Ma Z.; **Liu, R.**; Zhan, Y.; Ding, Z.; Zhang Y. Long-term ambient ozone exposure and incident cardiovascular diseases: National cohort evidence in China. *Journal of Hazardous Materials* 2024, 471:134158. DOI: <https://doi.org/10.1016/j.jhazmat.2024.134158>.
8. **Liu, R.**; Ma, Z.; Gasparrini, A.; de la Cruz, A.; Bi, J.; Chen, K. Integrating Augmented In Situ Measurements and a Spatiotemporal Machine Learning Model To Back Extrapolate Historical Particulate Matter Pollution over the United Kingdom: 1980–2019. *Environmental Science & Technology* 2023, 57 (51), 21605-21615. DOI: <https://doi.org/10.1021/acs.est.3c05424>.
9. Lam, P. H.; Zang, E.; Chen, D.; **Liu, R.**; Chen, K. Long-Term Exposure to Fine Particulate Matter and Academic Performance Among Children in North Carolina. *JAMA Network Open* 2023, 6 (10), e2340928-e2340928. DOI: <https://doi.org/10.1001/jamanetworkopen.2023.40928>.
10. Yuan, Y.; Wang, K.; Wang, Z.; Zheng, H.; Ma, Z.; **Liu, R.**; Hu, K.; Yang, Z.; Zhang, Y. Ambient ozone exposure and depression among middle-aged and older adults: Nationwide longitudinal evidence in China. *International Journal of Hygiene and Environmental Health* 2023, 251, 114185. DOI: <https://doi.org/10.1016/j.ijheh.2023.114185>.
11. Shao, Y.; Zhao, W.; **Liu, R.**; Yang, J.; Liu, M.; Fang, W.; Hu, L.; Adams, M.; Bi, J.; Ma, Z. Estimation of daily NO₂ with explainable machine learning model in China, 2007–2020. *Atmospheric Environment* 2023, 314, 120111. DOI: <https://doi.org/10.1016/j.atmosenv.2023.120111>.
12. Shao, Y.; **Liu, R.**; Yang, J.; Liu, M.; Fang, W.; Hu, L.; Bi, J.; Ma, Z. Economic Growth Facilitates Household Fuel Use Transition to Reduce PM_{2.5}-Related Deaths in China. *Environmental Science & Technology* 2023, 57 (34), 12663-12673. DOI: <https://doi.org/10.1021/acs.est.3c03276>.
13. Shao, Y.; **Liu, R.**; Li, W.; Bi, J.; Ma, Z. A MISR-Based Method for the Estimation of Particle Size Distribution: Comparison with AERONET over China. *Journal of Remote Sensing* 2023, 3, 0032. DOI: <https://doi.org/10.34133/remotesensing.0032>.
14. Kuang, Z.; Wang, K.; Ma, Z.; Zhan, Y.; **Liu, R.**; Peng, M.; Yang, J.; Zhang, Y. Long-term air pollution exposure accelerates ageing-associated degradation of lung function. *Atmospheric Pollution Research* 2023, 14 (10), 101899. DOI: <https://doi.org/10.1016/j.apr.2023.101899>.

15. Zhang, Y.; Li, Z.; Wei, J.; Zhan, Y.; Liu, L.; Yang, Z.; Zhang, Y.; **Liu, R.**; Ma, Z. Long-term exposure to ambient NO₂ and adult mortality: A nationwide cohort study in China. *Journal of Advanced Research* 2022, 41, 13-22. DOI: <https://doi.org/10.1016/j.jare.2022.02.007>.
16. Zhang, H.; Zhu, A.; Liu, L.; Zeng, Y.; **Liu, R.**; Ma, Z.; Liu, M.; Bi, J.; Ji, J. S. Assessing the effects of ultraviolet radiation, residential greenness and air pollution on vitamin D levels: A longitudinal cohort study in China. *Environment International* 2022, 169, 107523. DOI: <https://doi.org/10.1016/j.envint.2022.107523>.
17. Ma, Z.; Dey, S.; Christopher, S.; **Liu, R.**; Bi, J.; Balyan, P.; Liu, Y. A review of statistical methods used for developing large-scale and long-term PM_{2.5} models from satellite data. *Remote Sensing of Environment* 2022, 269, 112827. DOI: <https://doi.org/10.1016/j.rse.2021.112827>.
18. Lin, C.; Ma, Y.; **Liu, R.**; Shao, Y.; Ma, Z.; Zhou, L.; Jing, Y.; Bell, M. L.; Chen, K. Associations between short-term ambient ozone exposure and cause-specific mortality in rural and urban areas of Jiangsu, China. *Environmental Research* 2022, 211, 113098. DOI: <https://doi.org/10.1016/j.envres.2022.113098>.
19. Shi, W.; Bi, J.; **Liu, R.**; Liu, M.; Ma, Z. Decrease in the chronic health effects from PM_{2.5} during the 13th Five-Year Plan in China: Impacts of air pollution control policies. *Journal of Cleaner Production* 2021, 128433. DOI: <https://doi.org/10.1016/j.jclepro.2021.128433>.
20. **Liu, R.**; Ma, Z.; Liu, Y.; Shao, Y.; Zhao, W.; Bi, J. Spatiotemporal distributions of surface ozone levels in China from 2005 to 2017: A machine learning approach. *Environment International* 2020, 142, 105823. DOI: <https://doi.org/10.1016/j.envint.2020.105823>.
21. Pu, S.; Shao, Z.; Yang, L.; **Liu, R.**; Bi, J.; Ma, Z. How much will the Chinese public pay for air pollution mitigation? A nationwide empirical study based on a willingness-to-pay scenario and air purifier costs. *Journal of Cleaner Production* 2019, 218, 51-60. DOI: <https://doi.org/10.1016/j.jclepro.2019.01.270>.
22. Pu, S.; Shao, Z.; Fang, M.; Yang, L.; **Liu, R.**; Bi, J.; Ma, Z. Spatial distribution of the public's risk perception for air pollution: A nationwide study in China. *Science of The Total Environment* 2019, 655, 454-462. DOI: <https://doi.org/10.1016/j.scitotenv.2018.11.232>.
23. Ma, Z.; **Liu, R.**; Liu, Y.; Bi, J. Effects of air pollution control policies on PM_{2.5} pollution improvement in China from 2005 to 2017: a satellite-based perspective. *Atmospheric Chemistry and Physics* 2019, 19 (10), 6861-6877. DOI: <https://doi.org/10.5194/acp-19-6861-2019>. (ESI Highly Cited Paper)

Report

1. Bi, J., Liu, M., Qu, S., Ma, Z., Li, R., **Liu, R.**, Yang, R., Dong, J., Wang, X., Zhou, Q., Hu, Y., Wang, J., Zhu, T., Dang, X., Mao, J., Qin, X., & Shen, Y. Intelligent and accurate assessment and prevention technology for enterprise environmental risk, Chinese Society For Environmental Sciences, Expert group (Academician Wenqing Liu, Academician Zhifeng Yang, Academician Zuxin Xu, Academician Hongqiang Ren, Prof. Bin Yi, Prof. Zongguo Wen, Prof. Cunkuan Bao), **Appraised to reach the international leading level** (2020)

Patents

1. Bi, J., Yu, F., **Liu, R.**, Zhu, W., Gao Y., Xu Z., Ma, Z., Zhou X., Cao G. & Wang K. *Cumulative environmental risk assessment system and method for enterprises based on environmental risk system*, China, ZL202010037128.0 (2020).
2. Cao G., Bi, J., Zhou X., Zhu, X., Yu, F., **Liu, R.**, Wang K., Ma, Z., Xu Z. & Zhu, W. *Regional gridded cumulative environmental risk assessment system and method based on risk field*, China, ZL202010037422.1 (2020).
3. Bi, J., Ma, Z., Gao Y., Liu, M., Fang, W., **Liu, R.** & Hu, L. *Natech risk calculation method and system for coupled probabilistic modeling and information diffusion approach*, China, ZL202110992491.2 (2022).
4. Liu, M., Bi, J., Li, R., **Liu, R.**, Ma, Z., Fang, W. & Yang, J. *A method for simulating the enterprise environmental risk profile*, China, ZL202111325236.9 (2022).

OPEN-ACCESS DATA PRODUCTS

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1. **Liu, Riyang**; Kai Chen, 2026, "Daily Surface Ozone (O₃) MDA8 Concentrations across the Contiguous United States (0.01° × 0.01°), 1980-2023", <https://doi.org/10.60600/YU/M1WT9R>, Yale Dataverse, V1
 2. **Liu, Riyang**; Kai Chen, 2025, Daily 24-hour Average Nitrogen Dioxide (NO₂) Concentrations over California (0.01° × 0.01°), 1980-2022, <https://doi.org/10.60600/YU/EIVOUY>, Yale Dataverse, V1

3. **Liu, Riyang;** Kai Chen, 2025, "Daily 1 km Fine Particles (PM2.5) Concentrations across the United Kingdom, 1980-2019", <https://doi.org/10.60600/YU/JE6TUZ>, Yale Dataverse, V1

PROJECT EXPERIENCE

1. Cost-benefit analysis of air pollution control policies and plans, contributor, 2016-2019.
2. Study on environmental risk assessment and driving forces of regional short lived climate pollutants (SLCPs), contributor, 2017-2019.
3. Research on sewage discharge permission management techniques and systems in Lake Tai Basin based on water quality, contributor, 2017-2020.
4. Establishment of compulsory environmental impairment liability insurance risk assessment system, contributor, 2018-2021.
5. National survey on natural disaster risks, contributor, 2020-2022.
6. Effect of air pollution reductions on mortality during the COVID-19 lockdown: A natural experiment study, contributor, 2021-2023

HONORS

- Environmental Planning and Management Merit Scholarship, Nanjing University, 2020.

PROFESSIONAL SERVICE

Peer Reviewer

Science Advances, Nature Communications, Journal of Hazardous Materials, Sustainable Cities and Society, Science of the Total Environment, GeoHealth, Journal Of Exposure Science And Environmental Epidemiology, Environmental Pollution, Environmental Research, Urban Climate, Transportation Research Part D, Environmental Technology & Interactions, Atmospheric Pollution Research, Clean Technologies and Environmental Policy, Scientific Reports, Economic Analysis and Policy, International Journal of Data Science and Analytics.

CONFERENCE PRESENTATIONS

1. Spatiotemporal distribution of ground ozone levels in China from 2005 to 2016: a machine learning approach, the 13th National Environmental Conference for Doctoral Students, Beijing, China, Oct. 2019 (Poster presentation).
2. Spatiotemporal patterns of ground ozone levels in China from 2005 to 2019: a machine learning approach, Interdisciplinary Innovation Forum for Doctoral Students of Nanjing University, Nanjing, China, May 2021 (Oral presentation, **the first prize**).
3. Racial and Ethnic Disparities in Exposure to Short-Term NO₂ Air Pollution in California During 1980-2022, AGU24 annual meeting, Washington, D.C., USA, Dec. 2024 (Oral presentation).
4. Four-decade (1980–2023) Surface Ozone Concentrations across the Contiguous United States: Fine-Resolution Estimates and Health Implications, AGU25 annual meeting, New Orleans, USA, Dec. 2025 (Oral presentation).
5. Four-decade (1980–2023) Surface Ozone Concentrations across the Contiguous United States: Fine-Resolution Estimates and Health Implications, 2026 AGU-AMS Showcase, Online, Apr. 2026 (Invited talk).
6. Reconstructing Gridded Historical PM2.5 Over Six Decades: A Deep Learning Approach, Yale FDS Workshop: AI for Social Science Research Methods, New Haven, USA, May. 2026 (Poster presentation).

TECHNICAL SKILLS

- Programming & Software Development:
Python, R workflows; Git/GitHub
- Geospatial Analytics:
GeoPandas, GDAL, Rasterio, xarray, ArcGIS, Google Earth Engine; cloud-optimized formats (GeoParquet, Zarr, NetCDF, HDF)

- ML & GeoAI:
PyTorch, spatiotemporal DL frameworks (UNet), LightGBM/XGBoost, deep forest; AI-assisted analytics
- Computing & Data Systems:
HPC and cloud-based computing; scalable geospatial ETL; GPU-enabled modeling; reproducible research environments
- Visualization & Communication:
Scientific visualization in Python and R; preparation of publication-quality graphics for interdisciplinary audiences.