Jiameng Lai

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Education

Ph.D. in Soil and Crop Science, Cornell University 2020.09-2025.07 (expected)

Dissertation working title: Quantifying terrestrial photosynthesis and its environmental controls through synergies of carbonyl sulfide (OCS), and carbon 13 isotope

Advisor: Ying Sun; *Committee members*: Yiqi Luo, Peter Hess, Xiangtao Xu

M.S. in Cartography and Geographic Information Science, Nanjing University 2017.09-2020.07

Overall GPA: 4.48/5.0 Major GPA: 4.57/5.0

Dissertation: Attribution and prediction of spatio-temporal evolution of surface urban heat islands

Advisor: Wenfeng Zhan

B.S. in Geographic Information Science, Nanjing University 2013.09-2017.07

Overall GPA: 4.46/5.0 Major GPA: 4.48/5.0

Dissertation: Identification of typical diurnal patterns for clear-sky climatology of surface urban heat islands *Advisor*: Wenfeng Zhan

Research interests

Terrestrial carbon-water cycle; terrestrial biosphere modeling; remote sensing; urban climate

Particularly, my research aims to answer the following two questions:

[1] For natural/agricultural ecosystems, how to understand and predict the long-term response/feedbacks of carbon-water cycle to climate change/variability?

[2] For urban ecosystems, how to better monitor, understand, and adapt to the human-induced climate modifications?

Grant

2018-2019 **PI**, "Attribution and prediction of spatio-temporal evolution of surface urban heat islands", funded by Jiangsu Provincial Education Department, China, **RMB 15,000**.

Unfunded applications

Partition of terrestrial evapotranspiration (ET) using solar-induced chlorophyll fluorescence (SIF) by integrating OCO-3, ECOSTRESS, and GEDI onboard ISS, Future Investigator in NASA Earth and Space Science and Technology (FINESST), 2021.

Quantifying terrestrial photosynthesis and its environmental controls through synergies of solar-induced chlorophyll fluorescence (SIF) and carbonyl sulfide (OCS), FINESST, 2023.

Publications (* denotes corresponding author)

(31 published, total citations=1011, h-index=22 on Google Scholar, last access 07/16/2024)

❖ ***Terrestrial carbon-water cycle, terrestrial biosphere model, remote sensing***

Accepted & in progress

1. **Lai, J.**, Kooijmans, L. M. J., Sun, W., Lombardozzi, D., Campbell, J. E., Gu, L., Luo, Y., Kuai, L. and Ying, S.*, Stronger Terrestrial Gross Primary Production Inferred from Carbonyl Sulfide. [in principle accepted by *Nature*]
2. **Lai, J.**, et al., and Ying, S.*, Mesophyll diffusion dominates the long-term increase in Carbon-13 discrimination over global natural ecosystems and has implications for water use efficiency. [Draft finished. Target journal: *Nature Plant*]
3. **Lai, J.**, et al., and Ying, S.*, Global evolution of water use efficiency increase with CO2 enhancement. [in progress]
4. **Lai, J.**, Luo, Z., et al., and Ying, S.*, Assimilating MODIS LAI and SMAP soil moisture to monitor carbon exchange in Africa. [in progress].

Published

1. **Lai, J.**, Li, Y., Chen, J., Niu, G., Lin, P., Li, Q., Wang, L., Han, J., Luo, Z., and Ying, S.*, 2021. Massive cropland expansion caused secular freshwater depletion in arid northwestern China. *Environmental Research Letters,* 17, 034003.
2. Sun, Y., Gu, L., Wen, J., van Der Tol, C., Porcar-Castell, A., Joiner, J., Chang, C. Y., Magney, T., Wang, L., Hu, L., Rascher, U., Zarco-Tejada, P., Barrett, C. B., **Lai, J.**, Han, J., and Luo, Z. 2023. From remotely sensed solar‐induced chlorophyll fluorescence to ecosystem structure, function, and service: Part I—Harnessing theory. *Global change biology*. 29(11):2926-52.
3. Sun, Y., Wen, J., Gu, L. Joiner, J., Chang, C. Y., van der Tol, C., Porcar-Castell, A., Magney, T., Wang, L., Hu, L., Rascher, U., Zarco-Tejada, P., Barrett, C. B., **Lai, J.**, Han, J., and Luo, Z. 2023. From remotely sensed solar‐induced chlorophyll fluorescence to ecosystem structure, function, and service: Part II—Harnessing data. *Global change biology*. 29(11), 2893-925.

❖ ***Urban climate, remote sensing***

Published

4. **Lai, J.**, Zhan, W.*, Quan, J., Liu, Z., Li, L., Huang, F., Hong, F., and Liao, W., 2021. Reconciling Debates on Controls of Surface Urban Heat Island: The Effect of Scale and Sampling. *Geophysical Research Letters,* 48, e2021GL094485.
5. **Lai, J.**, Zhan, W.*, Voogt, J., Quan, J., Huang, F., Zhou, J., Bechtel, B., Hu, L., Wang, K., Cao, C., and Lee, X., 2021. Meteorological controls on daily variations of nighttime surface urban heat islands. *Remote Sensing of Environment*, 253, 112198.
6. **Lai, J.**, Zhan, W.*, Quan, J., Bechtel, B., Wang, K., Zhou, J., Huang, F., Chakraborty, T., Liu, Z., and Lee, X., 2021. Statistical simulation of next-day nighttime surface urban heat islands. *ISPRS Journal of Photogrammetry and Remote Sensing*. 176, 182-195.
7. **Lai, J.**, Zhan, W.*, Huang, F., Voogt, J., Bechtel, B., Allen, M., Peng, S., Hong, F., Liu, Y., and Du, P.*, 2018. Identification of typical diurnal patterns for clear-sky climatology of surface urban heat islands. *Remote Sensing of Environment*, 217, 203-220.

8. **Lai, J.**, Zhan, W.*, Huang, F., Quan, J., Hu, L., Gao, L., and Ju, W., 2018. Does quality control matter? Surface urban heat island intensity variations estimated by satellite-derived land surface temperature products. *ISPRS Journal of Photogrammetry and Remote Sensing*, 139, 212-227.
9. Liu, Z., **Lai, J.**, Zhan, W., Bechtel, B., Voogt, J., Quan, J., Hu, L., Fu, P., Huang, F., Li, L., and Guo, Z., 2022. Urban Heat Islands Significantly Reduced by COVID-19 Lockdown. *Geophysical Research Letters*. e2021GL096842. (I contributed equally with Liu, Z.)
10. Liu, Z., Zhan, W.*, **Lai, J.**, Hong, F., Quan, J., Bechtel, B., Huang, F., and Zou, Z., 2019. Balancing prediction accuracy and generalization ability: A hybrid framework for modelling the annual dynamics of satellite-derived land surface temperatures. *ISPRS Journal of Photogrammetry and Remote Sensing*, 151, 189-206.
11. Liu, Z., Zhan, W.*, **Lai, J.**, Bechtel, B., Lee, X., Hong, F., Li, L., Huang, F., and Li, J., 2022. Taxonomy of seasonal and diurnal clear-sky climatology of surface urban heat island dynamics across global cities. *ISPRS Journal of Photogrammetry and Remote Sensing*. 187, 14-33.
12. Miao, S., Zhan, W. *, **Lai, J.**, Li, L., Du, H., Wang, C., Wang, C., Li, J., Huang, F., Liu, Z., and Dong, P., 2022. Heat wave-induced augmentation of surface urban heat islands strongly regulated by rural background. *Sustainable Cities and Society*. 82, 103874.
13. Li, L., Zhan, W.*, Du, H., **Lai, J.**, Wang, C., Fu, H., Huang, F., Liu, Z., Wang, C., Li, J., Jiang, L., and Miao, S., 2022. Long-Term and Fine-Scale Surface Urban Heat Island Dynamics Revealed by Landsat Data Since the 1980s: A Comparison of Four Megacities in China. *Journal of Geophysical Research: Atmospheres*. 127(5), e2021JD035598.
14. Hong, F., Zhan, W.*, Göttsche, F. M., **Lai, J.**, Liu, Z., Hu, L., Fu, P., Huang, F., Li, J., Li, H., and Wu, H.,2021. A simple yet robust framework to estimate accurate daily mean land surface temperature from thermal observations of tandem polar orbiters. *Remote Sensing of Environment*. 264, 112612.
15. Li. J., Zhan, W.*, Hong, F., **Lai, J.**, Dong, P., Liu, Z., Wang, C., Huang, F., Li, L., Wang, C., Fu, Y., 2021. Similarities and disparities in urban local heat islands responsive to regular-, stable-, and counter-urbanization: A case study of Guangzhou, China. *Building and Environment*. 199, 107935.
16. She, Y., Liu, Z., Zhan, W. *, **Lai, J.**, and Huang, F., 2022. Strong regulation of daily variations in nighttime surface urban heat islands by meteorological variables across global cities. *Environmental Research Letters.* 17, 1.
17. Liu, Z., Zhan, W. *, Bechtel, B., Voogt, J., **Lai, J.**, Chakraborty, T., Wang, Z. H., Li, M., Huang, F., and Lee, X.. 2022. Surface warming in global cities is substantially more rapid than in rural background areas. *Communications Earth & Environment*. 3(1), 219.
18. Zhan, W., Liu, Z. *, Bechtel, B., Li, J., **Lai, J.**, Fu, H., Li, L., Huang, F., Wang, C., and Chen, Y., 2022. Urban‐Rural Gradient in Urban Heat Island Variations Responsive to Large‐Scale Human Activity Changes During Chinese New Year Holiday. *Geophysical Research Letters*. 49(21), e2022GL100689.
19. Du, H., Zhan, W.*, Liu, Z., Li, J., Li, L., **Lai, J.**, Miao, S., Huang, F., Wang, C., Wang, C., Fu, H., Jiang, L., Hong, F., and Jiang, S., 2021. Simultaneous investigation of surface and canopy urban heat islands over global cities. *ISPRS Journal of Photogrammetry and Remote Sensing*. 181, 67-83.

20. Dong, P., Gao, L., Zhan, W.*, Liu, Z., Li, J., **Lai, J.**, Li, H., Huang, F., Tamang, S., and Zhao, L., 2020. Global comparison of diverse scaling factors and regression models for downscaling Landsat-8 thermal data. *ISPRS Journal of Photogrammetry and Remote Sensing*, 169, 44-56.
21. Jiang, S., Zhan, W.*, Yang, J., Liu, Z., Huang, F., **Lai, J.**, Li, J., Hong, F., Huang, Y., Chen, J., and Lee, X., 2020. Urban heat island studies based on local climate zones: A systematic overview. *Acta Geogr. Sin.* 75(9), 1860-78.
22. Jiang, L., Zhan, W.*, Hu, L., Huang, F., Hong, F., Liu, Z., **Lai, J.**, and Wang, C., 2021. Assessment of different kernel-driven models for daytime urban thermal radiation directionality simulation. *Remote Sensing of Environment*. 263, 112562.
23. Hong, F., Zhan, W.*, Göttsche, F.M., Liu, Z., Zhou, J., Huang, F., **Lai, J.**, and Li, M., 2018. Comprehensive assessment of four-parameter diurnal land surface temperature cycle models under clear-sky. *ISPRS Journal of Photogrammetry and Remote Sensing*, 142,190-204.
24. Huang, F., Zhan, W.*, Wang, Z., Wang, K., Chen, J.M., Liu, Y., **Lai, J.**, and Ju, W., 2017. Positive or negative? Urbanization‐induced variations in diurnal skin-surface temperature range detected using satellite data. *Journal of Geophysical Research: Atmospheres*, 122(24), 13-229.
25. Chen, J., Zhan, W., Jin, S.*, Han, W., Du, P., Xia, J., **Lai, J.**, Li, J., Liu, Z., Li, L., Huang, F., and Ding, H., 2021. Separate and combined impacts of building and tree on urban thermal environment from two-and three-dimensional perspectives. *Building and Environment*. 194, 107650.
26. Chen, J., Zhan, W.*, Du, P., Li, L., Li, J., Liu, Z., Huang, F., **Lai, J.**, and Xia, J., 2022. Seasonally disparate responses of surface thermal environment to 2D/3D urban morphology. *Building and Environment*. 15, 214:108928.
27. Wang, C., Zhan, W. *, Liu, Z., Li, J., Li, L., Fu, P., Huang, F., **Lai, J.**, Chen, J., Hong, F., and Jiang, S., 2020. Satellite-based mapping of the Universal Thermal Climate Index over the Yangtze River Delta urban agglomeration. *Journal of Cleaner Production*, 277, 123830.
28. Zou, Z., Zhan, W.*, Liu, Z., Bechtel, B., Gao, L., Hong, F., Huang, F., **Lai, J.**, 2018. Enhanced modeling of annual temperature cycles with temporally discrete remotely sensed thermal observations. *Remote Sensing*. 10(4), 650.
29. Huang, F., Zhan, W.*, Wang, Z., Voogt, J., Hu, L., Quan, J., Liu, C., Zhang, N., and **Lai, J.**, 2020. Satellite identification of atmospheric-surface-subsurface urban heat islands under clear sky. *Remote Sensing of Environment*, 250, 112039.
30. Li, L., Zhan, W. *, Ju, W., Peñuelas, J., Zhu, Z., Peng, S., Zhu, X., Liu, Z., Zhou, Y., Li, J., **Lai, J.**, Huang, F., Yin, G., Fu, Y., Li, M., and Yu, C., 2023. Competition between biogeochemical drivers and land-cover changes determines urban greening or browning. *Remote Sensing of Environment*. 287, 113481.
31. Huang, F., Jiang, S., Zhan, W. *, Bechtel, B., Liu, Z., Demuzere, M., Huang, Y., Xu, Y., Ma, L., Xia, W., Quan, J., Jiang, L., **Lai, J.**, Wang, C., Kong, F., Du, H., Miao, S., Chen, Y., and Chen, J., 2023. Mapping local climate zones for cities: A large review. *Remote Sensing of Environment*. 292, 113573.

Invited Talks

1. "Thermal remote sensing multi-scale temporal revolution of urban heat island and the associated controls". *Remote Sensing Discussion Group*, Cornell University, USA, 2022.
2. "Impact of mesophyll diffusion on carbonyl sulfide biosphere exchange". *Community Earth System Model (CESM) Discussion Group*, Cornell University, USA, 2022.
3. "Massive Crop Expansion Threatens Food and Water Sustainability in Arid Northwestern China". *Fall 2021 School of Integrative Plant Science (SIPS) Weekly Section Seminars*, Cornell University, USA, 2021.
4. "Multi-scale temporal revolution of urban heat island and the associated controls". *Yale-NUIST Center on Atmospheric Environment*, China, 2021.
5. * "Experience sharing in learning and conducting research". *Special Seminar of Ten-thousand Student Program of Academic Winter Camp in Jiangsu Province*, Nanjing University, China, 2019.
6. "Meteorological controls on daily variations of nighttime surface urban heat islands under clear-sky". *University of Electronic Science and Technology of China*, China, 2018.
7. "Experience sharing in writing scientific papers". *Nanjing University*, China, 2018.

* I was selected as the only student to give this speech on behalf of Nanjing University.

Conference/workshop presentations

1. **Lai, J.**, Keeling, R., Lombardozzi, D., Zuidema, P., Gu, L., Sun, Y., Mesophyll largely contributes to the historical increase in isotope discrimination of C3 plants and implications for water use efficiency. [oral] 4th *Annual Land Data Assimilation Community Virtual Workshop*, online, 2024.
2. **Lai, J.**, Keeling, R., Lombardozzi, D., Zuidema, P., Gu, L., Sun, Y., Mesophyll largely contributes to the historical increase in isotope discrimination of C3 plants and implications for water use efficiency. [poster] *European Geosciences Union*, Vienna, Austria, 2024.
3. **Lai, J.**, Keeling, R., Lombardozzi, D., Zuidema, P., Gu, L., Sun, Y., Impacts of mesophyll diffusion on the long-term increase in global Carbon-13 discrimination and water use efficiency. [oral & poster] *2nd Annual Dynamic Global Vegetation Modeling Conference*, USA, 2024.
4. **Lai, J.**, Keeling, R., Zuidema, P., Sun, Y., Impacts of mesophyll diffusion on the long-term increase in global Carbon-13 discrimination and water use efficiency. [oral] *American Geophysical Union*, San Francisco, USA, 2023.
5. **Lai, J.**, Kooijmans, L., Lombardozzi, D., Sun, W., Sun, Y., Impact of mesophyll diffusion on carbonyl sulfide (OCS) fluxes in global terrestrial ecosystems, [oral online], *iLEAPS – OzFlux Joint Conference*, Auckland, New Zealand, 2023.
6. **Lai, J.**, Kooijmans, L., Lombardozzi, D., Sun, W., Sun, Y., Impact of mesophyll diffusion on carbonyl sulfide (OCS) fluxes in global terrestrial ecosystems, [oral], *American Geophysical Union*, Chicago, USA, 2022.
7. **Lai, J.**, Li, Y., Chen, J., Niu, G.Y., Lin, P., Li, Q., Wang, L., Han, J., Luo, Z., Sun, Y., Massive Crop

Expansion Threatens Agriculture and Water Sustainability in Northwest China, [oral], *American Geophysical Union*, New Orleans, USA, 2021.

8. **Lai, J.**, Zhan, W., Reconciling debates in controls of urban heat islands: the effect of scaling and sampling. [oral online], *American Geophysical Union*, 2020.
9. **Lai, J.**, Zhan, W., Jiang, S., Forecasting of the nighttime surface urban heat islands under clear-sky. [oral & poster], *Joint Urban Remote Sensing Event*, Vannes, France, 2019.
10. **Lai, J.**, Zhan, W., Attribution and prediction of spatio-temporal evolution of surface urban heat islands. [oral], *3rd Seminar on Thermal Infrared Quantitative Remote Sensing*, Qingdao, China, 2019.
11. **Lai, J.**, Zhan, W., Systematic investigation of synoptic control of nighttime surface urban heat islands over Chinese cities. [poster], *American Geophysical Union*, Washington DC., USA, 2018.
12. **Lai, J.**, Zhan, W., Synoptic controls on daily variations of nighttime urban heat islands under clear-sky. [oral], *5th Youth Scientist Forum of Earth Science*, Nanjing, China, 2018.
13. **Lai, J.**, Zhan, W., Huang, F., Voogt, J., Bechtel, B., Allen, M., Peng, S., Hong, F., Liu, Y., Du, P. Identification of typical diurnal patterns for clear-sky climatology of surface urban heat islands. [oral], *1st International Conference on Urban Informatics*, Hong Kong, China, 2017.
14. **Lai, J.**, Zhan, W., Huang, F., Quan, J., Hu, L., Gao, L., Ju, W. Does quality control matter? Surface urban heat island intensity variations estimated by satellite-derived land surface temperature products. [oral], *ISPRS Geospatial week*, Wuhan, China, 2017.

Selected Awards

- Barbara McClintock Award, Cornell University 2024
- Saltonstall fellowship, Cornell University 2020
- National Scholarship, Nanjing University (Ranking: **1/300**) 2018
- First Prize of Graduate School Scholarship, Nanjing University (Ranking: **1/300**) 2018
- First Grade Award, 5th Youth Scientist Forum of Earth Science (**only 1** in Geography field) 2018
- Pacemaker to Excellent Postgraduate Student, Nanjing University (**1 out of 100**) 2018
- Excellent Student, Nanjing University (**3 out of 66)** 2015

Field work and workshops attended

- Field work, Musgrave research farm, NY, USA 2021-2023 summer
- Community Terrestrial Systems Model (CTSM) mini-tutorial, online 2022
- Community Earth System Model (CESM) tutorial, Boulder, CO, USA 2022
- Nature Research Academies Author Training, Nanjing, China 2018

Media Release and Peer Evaluation

- Media release on my research article “Urban Heat Islands Significantly Reduced by COVID-19 Lockdown”, https://t.co/HrIy21RWtp

- My research article "Identification of typical diurnal patterns for clear-sky climatology of surface urban heat islands" was commented as '*The temperature curves of Lai et al. (2018a)* ***exemplify a half-century of progress*** *toward time-continuous interpretations of SUHI magnitude at the diurnal scale*' in: Stewart, I. D., et al. 2021. Time evolution of the surface urban heat island. *Earth's Future*, 9(10), e2021EF002178.

Professional Services

- **Convener**, European Geosciences Union (EGU) BG 3.34 Trend and inter-annual variability of terrestrial photosynthesis, evapotranspiration, and water use efficiency: from theory and data to Earth system modeling [later merged with Session BG 3.39 Emerging constraints of photosynthesis (including chlorophyll fluorescence), respiration and transpiration at ecosystem to global scales, and my role became **co-convener**]
- **Membership**, American Geophysical Union (AGU), 2020-present

Journal Reviewer

- Remote Sensing of Environment
- Building and Environment
- Science of the Total Environment
- Journal of Urban Management
- Earth's Future
- Global Change Biology
- Sustainable Cities and Society
- International Journal of Digital Earth
- Urban Climate
- Frontiers in Plant Science

Mentoring

Yihang She, undergraduate student at Nanjing University 2019

Role: Helped supervise research on the meteorological controls of daily variations in surface urban heat island over global cities. A relevant paper was published on *Environmental Research Letters*.