CURRICULUM VITAE

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IDENTIFYING INFORMATION

Academic Rank

Assistant Professor Southern University of Science and Technology 2019.12–Present

Education

Degree	Institution	Date Degree Granted
● PhD in Engineering Science	Harvard University	2016.12
● MS in Environmental Science	Peking University	2011.07
● BS in Environmental Science	Nankai University	2008.06 (graduate with honors)

Employment

- Research Scholar Harvard-Smithsonian Center for Astrophysics 2019.08–2019.12
- Post-doctoral Fellow Harvard University 2017.01–2019.07

Current Membership in Professional Organizations

- American Geophysical Union (AGU)
- Advanced Global Atmospheric Gases Experiment (AGAGE), Xichong (XCG) station PI
- Atmospheric Environmental Remote Sensing Society (AERSS)
- Environmental Information and Remote Sensing Committee of the Chinese Society for Environmental Sciences
- Pollution Source Emission and Control Committee of the Chinese Society for Environmental Sciences

Research Links

Google Scholar: https://scholar.google.com/citations?user=cJCsQjoAAAAJ&hl=en
ORCID: https://orcid.org/0000-0002-3919-3095
ResearchGate: https://www.researchgate.net/profile/Lei-Zhu-90

HONORS AND AWARDS FOR RESEARCH/CREATIVE WORK, TEACHING, PUBLIC ENGAGEMENT, AND SERVICE

External Sources

- Atmospheric Environmental Remote Sensing Society Best Oral Award, 2023
- American Meteorological Society special award for OMI, 2020

- William T. Pecora team award, NASA and DOI for OMI, 2018
- Outstanding reviewer for *Atmospheric Environment*, 2017
- Group achievement award for SEAC^{4}RS, NASA, 2015
- Harvard university certificate of distinction in teaching, 2013

RESEARCH

Grants and Contract

Summary:

2020–Present, at Southern University of Science and Technology, 17 grants. 6 completed and 11 currently active. 5 as PI, 12 as co-investigator. From 9 different funding agencies. Approximately ¥50.72 million in total, of which Lei Zhu directs ¥9520 k.

External Sources

Currently Active Projects:

1. High spatial and hourly monitoring of anthropogenic non-methane volatile organic compound emissions in China during the daytime with satellite remote sensing, *National Natural Science Foundation of China* (42375090), 2024.01-2027.12, PI, ¥500 k total, ¥500 k directed.
2. Sources, transformation, and environmental effects of active carbon components in the atmosphere, Sub-project 5: Simulation of environmental and radiative effects of active carbon components in the atmosphere, *National Key Research and Development Program of China* (2023YFC3706205), 2023.12-2027.11, Co-investigator, ¥2,880 k total, ¥720 k directed.
3. Research on carbon neutrality pathways for synergistic benefits in climate, environment, health, and socioeconomic sectors, Sub-project 1: Development of a global high-resolution accounting system for greenhouse gas and short-lived pollutant emissions, *Ministry of Science and Technology of the People's Republic of China* (2023YFE0112900), 2023.12-2027.11, Co-investigator, ¥2,141.6 k total, ¥476.9 k directed.
4. Shenzhen key laboratory of precision measurement and early warning technology for urban environmental health risks, *Shenzhen Science and Technology Program* (ZDSYS20220606100604008), 2023.03-2025.03, Co-investigator, ¥5,000 k total, ¥150 k directed.
5. Characteristics of air pollutant emissions from Shenzhen airport and their impact on air quality, *Guangzhou Hexin Instruments Co., Ltd.*, 2022.12-2024.12, Co-investigator, ¥700 k total, ¥300 k directed.
6. High spatiotemporal resolution monitoring and health early warning platform for urban atmospheric environment, *Shenzhen Science and Technology Program* (KQTD20210811090048025), 2022.10-2027.09, Co-investigator, ¥15,000 k total, ¥3,500 k directed.
7. Monitoring of fluorinated greenhouse gases and emission flux inversion in Shenzhen, *Shenzhen Science and Technology Program* (JCYJ20220530115404009), 2022.10-2025.10, PI, ¥300 k total, ¥300 k directed.
8. Improvement study on ozone simulation in the Guangdong-Hong Kong-Macao Greater Bay area based on multi-source stereoscopic data assimilation, *Shenzhen Science and Technology Program* (JCYJ20210324104604012), 2021.10-2025.10, PI, ¥600 k total, ¥600 k directed.

9. Research and application demonstration of key technologies for controlling atmospheric pollutants emitted by ships, *Key-Area Research and Development Program of Guangdong Province* (2020B1111360001), 2021.01-2025.01, Co-investigator, ¥5,000 k total, ¥85.5 k directed.

Completed Projects:

1. High-resolution monitoring, forecasting, and early warning of ground-level ozone pollution in the Guangdong-Hong Kong-Macao Greater Bay Area based on satellite remote sensing, *Guangdong Basic and Applied Basic Research Foundation* (2021A1515110713), 2021.10-2024.09, PI, ¥100 k total, ¥100 k directed.
2. Innovative team for synergistic management of air pollution and population health risks in the context of carbon neutrality, *Guangdong University Research Project Science Team* (2021KCXTD004), 2021.09-2024.09, Co-investigator, ¥800 k total, ¥160 k directed.
3. Guangdong provincial observation and research station for coastal atmosphere and climate of the Greater Bay Area, *Key-Area Research and Development Program of Guangdong Province*, 2021.07-2024.06, Co-investigator, ¥3,000 k total, ¥500 k directed.
4. Study on the interactions of atmospheric physicochemical processes between sea and land and their impact on air quality in the Guangdong-Hong Kong-Macao Greater Bay Area, *Guangdong Basic and Applied Basic Research Fund* (2020B1515130003), 2020.10-2024.09, Co-investigator, ¥2,000 k total, ¥150 k directed.
5. High-resolution air quality monitoring in the Guangdong-Hong Kong-Macao Greater Bay Area based on satellite remote sensing, *Guangdong University Youth Innovation Talent Project* (2020KQNCX066), 2020.09-2022.09, PI, ¥40 k total, ¥40 k directed.

University Sources

1. Research on the habitability of Earth and other planets, 2024.01-2024.12, Co-investigator, ¥6,660 k total, ¥188 k directed.
2. Innovative research platform for ecological environment and sustainable development, 2024.01-2024.12, Co-investigator, ¥3,000 k total, ¥250 k directed.
3. Special funding for greenhouse gases monitoring, 2022.01-2023.12, Co-investigator, ¥3,000 k total, ¥1500 k directed.

Publications

Summary:

Refereed journal articles: 80; Google scholar citations: 3,724; H-index: 30.

Refereed Journal Articles

(***** Lei Zhu as the corresponding author)

Papers Submitted:

1. Ayazpour, Z., González Abad, G., Nowlan, C. R., Sun, K., Kwon, H.-A., Miller, C. C., Chong, H., Wang, H., Liu, X., Chance, K., O'Sullivan, E., **Zhu, L.**, Vigouroux, C., De Smedt, I., Stremme, W., Hannigan, I. W., Notholt, J., Sun, X., Palm, M., Petri, C., Strong, K., Röhling, A. N., Mahieu, E., Smale, D., Té, Y., Morino, I., Murata, I., Nagahama, T., Kivi, R., Makarova, M., Jones, N., Sussmann, R., Zhou, M. (2024). Aura ozone monitoring instrument (OMI) collection 4 formaldehyde product. Submitted to *Earth and Space Science*, in press.

2. Chen, Y., Yao, B., An, M., Ding, A., Liu, S., Li, X., Li, Y., Yang, H., Yu, H., Chen, L., Yang, X., Fu, T.-M., Shen, H., Ye, J., Wang, C., **Zhu, L. *** (2024). Inverse modeling of high global warming potential perfluorinated greenhouse gases in southeastern China. Submitted to *Geophysical Research Letters*, under review.
3. Li, Y., **Zhu, L. ***, Li, J., Chen, Y., Yao, B., Western, L. M., O'Doherty, S., Krummel, P. B., Weiss, R. F., Mühle, J., Young, D., Lunder, C. R., Liu, S., Li, X., Fu, W., Yan, Z., Zhang, P., Zhang, X., Zhang, J., Wu, X., Yang, X., Fu, T.-M., Shen, H., Ye, J., Wang, C. (2024). Developing the fluorinated greenhouse gases (F-gases) chemistry module: reactions, emissions, and implementation in GEOS-Chem. Submitted to *Journal of Geophysical Research-Atmospheres*, under review.
4. Li, J., Chen, Y., Li, Y., Liu, S., An, M., Yao, B., Sheng, J., Western, L. M., Rigby, M., Ganesan, A. L., O'Doherty, S., Yang, H., Yu, H., Chen, L., Krummel, P. B., Shen, H., Ye, J., Wang, C., Yang, X., Fu, T.-M., **Zhu, L. *** (2024). Hydrofluorocarbons (HFCs) in southern China: High-frequency observations and emission estimates. Submitted to *Environmental Science & Technology Letters*, under review.

Papers Published:

1. Fu, W., **Zhu, L. ***, Kwon, H.-A., Park, R. J., Lee, G. T., De Smedt, I., Liu, S., Li, X., Chen, Y., Pu, D., Li, J., Zuo, X., Zhang, P., Li, Y., Yan, Z., Zhang, X., Zhang, J., Wu, X., Shen, H., Ye, J., Wang, C., Fu, T.-M., Yang, X. (2024). Evaluating GEMS HCHO retrievals with TROPOMI product, Pandora observations, and GEOS-Chem simulations. *Earth and Space Science*, 12, e2024EA003894. https://doi.org/10.1029/2024EA003894.
2. Fang, L., Jin, J., Segers, A., Li, K., Xia, J., Han, W., Li, B., Lin, H., **Zhu, L.**, Liu, S., Liao, H. (2024). Observational operator for fair model calibration with ground NO_2 measurements. *Geoscientific Model Development*, 17(22), 8267–8282. https://doi.org/10.5194/gmd-17-8267-2024.
3. Xing, C., Zeng, Y., Zhang, A., Zhai, J., Cai, B., Shi, S., Zhang, Y., Zhang, Y., Fu, T.-M., **Zhu, L.**, Shen, H., Ye, J., Wang, C. (2024). Molecular characterization of major oxidative potential active species in ambient $PM_{2.5}$: Emissions from biomass burning and ship exhaust. *Environmental Pollution*, 363(2). https://doi.org/10.1016/j.envpol.2024.125291.
4. Liu, S., Wei, J., Li, X., Shu, L., Zhang, J., Fu, T.-M., Yang, X., **Zhu, L. *** (2024). Underappreciated roles of soil nitrogen oxide emissions on global acute health burden. *Environment International*, 193, 109087. https://doi.org/10.1016/j.envint.2024.109087.
5. Li, X., **Zhu, L. ***, De Smedt, I., Sun, W., Chen, Y., Shu, L., Wang, D., Liu, S., Pu, D., Li, J., Zuo, X., Fu, W., Li, Y., Zhang, P., Yan, Z., Fu, T.-M., Shen, H., Wang, C., Ye, J., Yang, X. (2024). Global temperature dependency of biogenic HCHO columns observed from space: Interpretation of TROPOMI results using GEOS-Chem model. *Journal of Geophysical Research-Atmospheres*, 129, e2024JD041784. https://doi.org/10.1029/2024JD041784
6. Jiang, S., Wang, Y., Huang, X., Liu, B., Nie, D., Ge, Y., Ma, L., Wang, Q., Wang, J., Ma, Y., Jiang, S., Shu, Z., Zhang, Y., Sun, J., Wu, C., Ge, X., **Zhu, L.**, Shen, H., Wang, C., Zheng, Y., Fu, T.-M., Yang, X., Li, Y. J., Chen, Q., Ye, J. (2024). Characteristics of nocturnal boundary layer over a subtropical forest: Implications for the dispersion and fate of atmospheric species. *Environmental Science & Technology*, 58(52), 23075–23087. https://doi.org/10.1021/acs.est.4c05051.

7. Zhang, L., Yuan, W., Zhao, W., Yang, B., Jiao, X., Zhou, L., Long, S., Xu, J., Huang, W., Liu, C., Zheng, G., Shen, H., Ye, J., **Zhu, L.**, Fu, T.-M., Yang, X., Wang, C. (2024). Formation of nitrosamines from the heterogeneous reaction of nitrous acid and organic amines in indoor environments. *Environmental Science & Technology*, 58(42), 18881–18891. https://doi.org/10.1021/acs.est.4c05636.
8. Guo, P., Shen, H., Chen, Y., Dai, H., Mai, Z., Xu, R., Zhang, R., Wang, Z., He, J., Zheng, L., Zhe Sun, H., Ke, K., Meng, J., Liu, M., Li, J., Adalibieke, W., Wang, C., Ye, J., **Zhu, L.**, Shen, G., Fu, T.-M., Tsang, A., Yang, X., Russell, R. G., Driscoll, C. T., Tao, S. (2024). Carbon dioxide emissions from global overseas coal-fired power plants. *Nature Climate Change*, https://doi.org/10.1038/s41558-024-02114-y.
9. Xia, H., Wang, D., González Abad, G., Yang, X., **Zhu, L.**, Pu, D., Feng, X., Zhang, A., Song, Z., Mo, Y., Wang, J. (2024). Multi-scale correlation reveals the evolution of socio-natural contributions to tropospheric HCHO over China from 2005 to 2022. *Science of The Total Environment*, 954, 176197. https://doi.org/10.1016/j.scitotenv.2024.176197.
10. Cai, B., Wang, Y., Yang, X., Li, Y., Zhai, J., Zeng, Y., Ye, J., **Zhu, L.**, Fu, T.-M., Zhang, Q. (2024). Rapid aqueous-phase dark reaction of phenols with nitrosonium ions: Novel mechanism for atmospheric nitrosation and nitration at low pH. *PNAS Nexus*, 3(9), pgae385. https://doi.org/10.1093/pnasnexus/pgae385.
11. Zhai, J., Shao, S., Yang, X., Zeng, Y., Fu, T.-M., **Zhu, L.**, Shen, H., Ye, J., Wang, C., Tao, S. (2024). Chemically resolved respiratory deposition of ultrafine particles characterized by number concentration in the urban atmosphere. *Environmental Science & Technology*, 58(37), 16507–16516. https://doi.org/10.1021/acs.est.4c03279.
12. Chang, D., Li, Q., Wang, Z., Dai, J., Fu, X., Guo, J., **Zhu, L.**, Pu, D., Cuevas, C. A., Fernandez, R. P., Wang, W., Ge, M., Fund, J. C. H., Lau, A. K. H., Granier, C., Brasseur, G., Pozzer, A., Saiz-Lopez, A., Song, Y., Wang, T. (2024). Significant chlorine emissions from biomass burning affect the long-term atmospheric chemistry in Asia. *National Science Review*, 11(9), nwae285. https://doi.org/10.1093/nsr/nwae285.
13. Wang, D., Pu, D., De Smedt, I., **Zhu, L. ***, Yang, X. *, Sun, W., Xia, H., Song, Z., Li, X., Li, J., Zhang, A., Feng, X., Chen, Y., Yang, X., Fu, T.-M., Wang, J. (2024). Evolution of global O_3-NO_x-VOCs sensitivity before and after the COVID-19 from the ratio of formaldehyde to NO_2 from satellites observations. Journ*al of Environmental Sciences*, https://doi.org/10.1016/j.jes.2024.07.029.
14. Li, J., Sheng, J., **Zhu, L. ***, Yao, B., Wu, J., Pu, D., Shu, L., Liu, S., Li, X., Chen, Y., Zuo, X., Li, Y., Zhang, P., Yan, Z., Shen, H., Ye, J., Wang, C., Yang, X., Fu, T.-M. (2024). Bayesian inversion of HFC-134a emissions in southern China from a new AGAGE site: results from an observing system simulation experiment. *Atmospheric Environment*, 334, 120715. https://doi.org/10.1016/j.atmosenv.2024.120715.
15. Shi, S., Zhai, J., Yang, X., Ruan, Y., Huang, Y., Chen, X., Zhang, A., Ye, J., Zheng, G., Cai, B., Zeng, Y., Wang, Y., Xing, C., Zhang, Y., Fu, T.-M., **Zhu, L.**, Shen, H., Wang, C. (2024). Technical note: Determining chemical composition of atmospheric single particles by a standard-free mass calibration algorithm. *Atmospheric Chemistry and Physics*, 24(12), 7001–7012. https://doi.org/10.5194/acp-24-7001-2024.
16. Liu, S., Li, X., Wei, J., Shu, L., Fu, T.-M., Yang, X., **Zhu, L. *** (2024). Short-term exposure to fine particulate matter and ozone: source impacts and attributable mortalities.

Environmental Science & Technology, 58(26), 11256–11267. https://doi.org/10.1021/acs.est.4c00339.

17. Chen, Y., Yao, B., Wu, J., Yang, H., Ding, A., Liu, S., Li, X., O'Doherty, S., Li, J., Li, Y., Yu, H., Wang, W., Chen, L., Yang, X., Fu, T.-M., Shen, H., Ye, J., Wang, C., **Zhu, L. *** (2024). Observations and emission constraints of trichlorofluoromethane (CFC-11) in southern China: First-year results from a new AGAGE station. *Environmental Research Letters*, 19(7), 074043. https://doi.org/10.1088/1748-9326/ad5857.
18. Pu, D., **Zhu, L. ***, Shen, H., De Smedt, I., Ye, J., Li, J., Shu, L., Wang, D., Li, X., Zuo, X., Yang, X., Fu, T.-M. (2024). Integrated satellite observations unravel the relationship between urbanization and anthropogenic non-methane volatile organic compound emissions globally. *npj Climate and Atmospheric Science*, 7, 125. https://doi.org/10.1038/s41612-024-00683-5.
19. Pu, D., Wang, D., **Zhu, L.**, Yand, X., Wang, J. (2024). Study on ozone precursors in Beijing based on OLI and TROPOMI satellite data. *China Environmental Science*, 44(7), 3592-3600. https://www.webofscience.com/wos/cscd/full-record/CSCD:7758188. (in Chinese).
20. Li, M., Huang, X., Yan, D., Lai, S., Zhang, Z., **Zhu, L.**, Lu, Y., Jiang, X., Wang, N., Wang, T., Song, Yu, Ding, A. (2024). Coping with the concurrent heatwaves and ozone extremes in China under a warming climate. *Science Bulletin*, 69(18), 2938–2947. https://doi.org/10.1016/j.scib.2024.05.034.
21. Liu, S., Valks, P., Curci, G., Chen, Y., Shu, L., Jin, J., Sun, S., Pu, D., Li, X., Li, J., Zuo, X., Fu, W., Li, Y., Zhang, P., Yang, X., Fu, T.-M, **Zhu, L. *** (2024). Satellite NO_2 retrieval complicated by aerosol composition over global urban agglomerations: Seasonal variations and long-term trends (2001-2018). *Environmental Science & Technology*, 58(18), 7891–7903. https://doi.org/10.1021/acs.est.3c02111. (Journal Supplemental Cover)
22. Mai, Z., Shen, H., Zhang, Z., Zhe Sun, H., Zheng, L., Guo, J., Liu, C., Chen, Y., Wang, C., Ye, J., **Zhu, L.**, Fu, T.-M., Yang, X., Tao, S. (2024). Convolutional neural networks facilitate process understanding of megacity ozone temporal variability. *Environmental Science & Technology*, 58(35), 15691–15701. https://doi.org/10.1021/acs.est.3c07907.
23. Zheng, L., Adalibieke, W., Zhou, F., He, P., Chen, Y., Guo, P., He, J., Zhang, Y., Xu, P., Wang, C., Ye, J., **Zhu, L.**, Shen, G., Fu, T.-M., Yang, X., Zhao, S., Hakami, A., Russell, A. G., Tao, S., Meng, J., Shen, H. (2024). Health burden from food systems is highly unequal across income groups. *Nature Food*, 5, 251–261. https://doi.org/10.1038/s43016-024-00946-7.
24. Wu, W., Fu, T.-M., Arnold, S. R., Spracklen, D. V., Zhang, A., Tao, W., Wang, X., Hou, Y., Mo, J., Chen, J., Li, Y., Feng, X., Lin, H., Huang, Z., Zheng, J., Shen, H., **Zhu, L.**, Wang, C., Ye, J., Yang, X. (2024). Temperature-dependent evaporative anthropogenic VOC emissions significantly exacerbate regional ozone pollution. *Environmental Science & Technology*, 58(12), 5430–5441. https://doi.org/10.1021/acs.est.3c09122.
25. Zeng, Y., Zhang, A., Yang, X., Xing, C., Zhai, J., Wang, Y., Cai, B., Shi, S., Zhang, Y., Shen, Z., Fu, T.-M., **Zhu, L.**, Shen, H., Ye., J., Wang, C. (2024). Internal exposure potential of water-soluble organic molecules in urban $PM_{2.5}$ evaluated by non-covalent adductome of human serum albumin. *Science of The Total Environment*, 912, 169555. https://doi.org/10.1016/j.scitotenv.2023.169555.
26. Liu, S., Shu, L., **Zhu, L. ***, Song, Y., Sun, W., Chen, Y., Wang, D., Pu, D., Li, X., Sun, S., Li, J., Zuo, X., Fu, W., Yang, X., Fu, T.-M. (2024). Underappreciated emission spikes from power plants during heatwaves observed from space: Case studies in India and China. *Earth's*

Future, 12(12), e2023EF003937. https://doi.org/10.1029/2023EF003937. (Journal Cover)

27. Wang, Y., Xing, C., Cai, B., Qiu, W., Zhai, J., Zeng, Y., Zhang, A., Shi, S., Zhang, Y., Yang, X., Fu, T.-M., Shen, H., Wang, C., **Zhu, L.**, Ye, J. (2024). Impact of antioxidants on $PM_{2.5}$ oxidative potential, radical level, and cytotoxicity. *Science of the Total Environment*, 912, 169555. https://doi.org/10.1016/j.scitotenv.2023.169555.
28. Zuo, X., Sun, W., De Smedt, I., Li, X., Liu, S., Pu, D., Sun, S., Li, J., Chen, Y., Fu, W., Zhang, P., Li, Y., Yang, X., Fu, T.-M., Shen, H., Ye, J., Wang, C., **Zhu, L. *** (2023). Observing downwind structures of urban HCHO plumes from space: Implications to non-methane volatile organic compound emissions. *Geophysical Research Letters*, 50(24), e2023GL106062. https://doi.org/10.1029/2023GL106062.
29. Chen, Y., Liu, S.*, **Zhu, L. ***, Seo S., Richter, A., Li, X., Ding, A., Sun, W., Shu, L., Wang, X., Valks, P., Hendrick, F., Koenig, T. K., Volkamer, R., Bai, B., Wang, D., Pu, D., Sun, S., Li, J., Zuo, X., Fu, W., Li, Y., Zhang, P., Yang, X., Fu, T.-M. (2023). Global observations of tropospheric bromine monoxide (BrO) columns from TROPOMI. *Journal of Geophysical Research-Atmospheres*, 128 (24), e2023JD039091. https://doi.org/10.1029/2023JD039091.
30. Zhang, A., Zeng, Y., Yang, X., Zhai, J., Wang, Y., Xing, C., Cai, B., Shi, S., Zhang, Y., Shen, Z., Fu, T.-M., **Zhu, L.**, Shen, H., Ye, J., Wang, C. (2023). Organic matrix effect on the molecular light absorption of brown Carbon. *Geophysical Research Letters*, 50(24), e2023GL106541. https://doi.org/10.1029/2023GL106541.
31. He, J., Shen, H., Lei, T., Chen, Y., Meng, J., Sun, H., Li, M., Wang, C., Ye, J., **Zhu, L.**, Zhou, Z., Shen, G, Guan, D., Fu, T.-M., Yang, X., Tao, S. (2023). Investigation of plant-level volatile organic compound emissions from chemical industry highlights the importance of differentiated control in China. *Environmental Science & Technology*, 57(50), 21295–21305, https://doi.org/10.1021/acs.est.3c08570.
32. Liu, S., Li, X., Li, J., Shu, L., Fu, T.-M., Yang, X., **Zhu, L. *** (2023). Observing network effect of shipping emissions from space: A natural experiment in the world's busiest port. *PNAS Nexus*, 2(11), pgad391. https://doi.org/10.1093/pnasnexus/pgad391.
33. Zhang, J., Shen, H., Chen, Y., Meng, J., Li, J., He, J., Guo, P., Dai, R., Zhang, Y., Xu, R., Wang, J., Zheng, S., Lei, T., Shen, G., Wang, C., Ye, J., **Zhu, L.**, Zhe Sun, H., Fu, T.-M., Yang, X., Guan, D., Tao, S. (2023). Iron and steel industry emissions: A global analysis of trends and drivers. *Environmental Science & Technology*, 57(43), 16477–16488. https://doi.org/10.1021/acs.est.3c05474.
34. Feng, X., Ma, Y., Lin, H., Fu, T.-M., Zhang, Y., Wang, X., Zhang, A., Yuan, Y., Han, Z., Mao, J., Wang, D., **Zhu, L.**, Wu, Y., Li, Y., Yang, X. (2023). Impacts of ship emissions on air quality in southern China: Opportunistic insights from the abrupt emission changes in early 2020. *Environmental Science & Technology*, 57(44), 16999–17010. https://doi.org/10.1021/acs.est.3c04155.
35. Zhai, J., Yu, G., Zhang, J., Shi, S., Yuan, Y., Jiang, S., Xing, C., Cai, B., Zeng, Y., Wang, Y., Zhang, A., Zhang, Y., Fu, T.-M., **Zhu, L.**, Shen, H., Ye, J., Wang, C., Tao, S., Li, M., Zhang, Y., Yang, X. (2023). Impact of ship emissions on air quality in the Greater Bay Area in China under the latest global marine fuel regulation. *Environmental Science & Technology*, 57(33), 12341–12350. https://doi.org/10.1021/acs.est.3c03950.
36. Shu, L., **Zhu, L. ***, Bak, J., Zoogman, P., Han, H., Liu, S., Li, X., Sun, S., Li, J., Chen, Y., Pu, D., Zuo, X., Fu, W., Yang, X., Fu, T.-M. (2023). Improving ozone simulations in Asia via

multisource data assimilation: results from an observing system simulation experiment with GEMS geostationary satellite observations. *Atmospheric Chemistry and Physics*, 23(6), 3731–3748. https://doi.org/10.5194/acp-23-3731-2023.

37. Nowlan, C. R., González Abad, G., Kwon, H.-A., Ayazpour, Z., Chan Miller, C., Chance, K., Chong, H., Liu, X., O'Sullivan, E., Wang, H., **Zhu, L.**, De Smedt, I., Jaross, G., Seftor, C., Sun, K. (2023). Global formaldehyde products from the Ozone Mapping and Profiler Suite (OMPS) Nadir Mappers on Suomi NPP and NOAA-20. *Earth and Space Science*, 10(5), e2022EA002643, https://doi.org/10.1029/2022EA002643.
38. Souri, A. H., Johnson, M. S., Wolfe, G. M., Crawford, J. H., Fried, A., Wisthaler, A., Brune, W. H., Blake, D. R., Weinheimer, A. J., Verhoelst, T., Compernolle, S., Pinardi, G., Vigouroux, C., Langerock, B., Choi, S., Lamsal, L., **Zhu, L.**, Sun, S., Cohen, R. C., Min, K.-E., Cho, C., Philip, S., Liu, X., Chance, K. (2023). Characterization of errors in satellite-based HCHO/NO_2 tropospheric column ratios with respect to chemistry, column-to-PBL translation, spatial representation, and retrieval uncertainties. *Atmospheric Chemistry and Physics*, 23(3), 1963–1986. https://doi.org/10.5194/acp-23-1963-2023.
39. Xing, C., Wang, Y., Yang, X., Zeng, Y., Zhai, J., Cai, B., Zhang, A., Fu, T.-M., **Zhu, L.**, Li, Y., Wang, X., Zhang, Y. (2023). Seasonal variation of driving factors of ambient $PM_{2.5}$ oxidative potential in Shenzhen, China. *Science of the Total Environment*, 862, 160771. https://doi.org/10.1016/j.scitotenv.2022.160771.
40. Howlett, C., González Abad, G., Chan Miller, C., Nowlan, C. R., Ayazpour, Z., **Zhu, L.** (2023). The influence of snow cover on Ozone Monitor Instrument formaldehyde observations. *Atmósfera,* 37, 159–174. https://doi.org/10.20937/ATM.53134.
41. Zhai, J., Yang, X., Li, L., Ye, X., Chen, J., Fu, T.-M., Zhu, L., Shen, H., Ye, J., Wang, C., Tao, S. (2022). Direct observation of the transitional stage of mixing-state-related absorption enhancement for atmospheric black carbon. *Geophysical Research Letters*, 49(23), e2022GL101368. https://doi.org/10.1029/2022GL101368.
42. Wang, X., Fu, T.-M., Zhang, L., Lu, X., Liu, X., Amnuaylojaroen, T., Latif, M. T., Ma, Y., Zhang, L., Feng, X., **Zhu, L.**, Shen, H., Yang, X. (2022). Rapidly changing emissions drove substantial surface and tropospheric ozone increases over southeast Asia. *Geophysical Research Letters*, 49(19), e2022GL100223. https://doi.org/10.1029/2022GL100223.
43. Pu, D., **Zhu, L. ***, De Smedt, I., Li, X., Sun, W., Wang, D., Liu, S., Li, J., Shu, L., Chen, Y., Sun, S., Zuo, X., Fu, W., Xu, P., Yang, X., Fu, T.-M. (2022). Response of anthropogenic volatile organic compound emissions to urbanization in Asia probed with TROPOMI and VIIRS Satellite observations. *Geophysical Research Letters,* 49(18), e2022GL099470. https://doi.org/10.1029/2022GL099470.
44. Long, X., Fu, T.-M., Yang, X., Tang, Y., Zheng, Y., **Zhu, L.**, Shen, H., Ye, J., Wang, C., Wang, T., Li, B. (2022) Efficient atmospheric transport of microplastics over Asia and adjacent oceans. *Environmental Science & Technology,* 56(10), 6243–6252. https://doi.org/10.1021/acs.est.1c07825.
45. Zhao, T., Mao, J., Simpson, W. R., De Smedt, I., **Zhu, L.**, Hanisco, T. F., Wolfe, G. M., St. Clair, J. M., González Abad, G., Nowlan, C. R., Barletta, B., Meinardi, S., Blake, D. R. (2022). Source and variability of formaldehyde (HCHO) at northern high latitudes: an integrated satellite, aircraft, and model study. *Atmospheric Chemistry and Physics*, 22(11), 7163–7178. https://doi.org/10.5194/acp-22-7163-2022.

46. Shu, L., **Zhu, L. ***, Bak, J., Zoogman, P., Han, H., Long, X., Bai, B., Liu, S., Wang, D., Sun, W., Pu, D., Chen, Y., Li, X., Sun, S., Li, J., Yang, X., Fu, T.-M. (2022). Improved ozone simulation in east Asia via assimilating observations from the first geostationary air-quality monitoring satellite: Insights from an Observing System Simulation Experiment. *Atmospheric Environment*, 274, 119003. https://doi.org/10.1016/j.atmosenv.2022.119003.
47. Xu, P., Li, G., Houlton, B. Z., Ma, L., Ai, D., **Zhu, L.**, Luan, B., Zhai, S., Hu, S., Chen, A., Zheng, Y. (2022). Role of organic and conservation agriculture in ammonia emissions and crop productivity in China. *Environmental Science & Technology*, 56(5), 2977–2989. https://doi.org/10.1021/acs.est.1c07518.
48. Zhai, J., Yang, X., Li, L., Bai, B., Liu, P., Huang, Y., Fu, T. M., **Zhu, L.**, Zeng, Z., Tao, S., Lu, X., Ye, X., Wang, X., Wang, L., Chen, J. (2022). Absorption enhancement of black carbon aerosols constrained by mixing-state heterogeneity. *Environmental Science & Technology*, 56(3), 1586–1593. https://doi.org/10.1021/acs.est.1c06180.
49. Huang, G., Ponder, R., Bond, A., Brim, H., Temeng, A., Naeger, A., **Zhu, L.** (2021). Unexpected impact of COVID-19 lockdown on the air quality in the metro Atlanta, USA using ground-based and satellite observations. *Aerosol and Air Quality Research,* 21(11), 210153. https://doi.org/10.4209/aaqr.210153.
50. Marais, E., Pandey, A., Van Damme, M., Clarisse, L., Coheur, P.-F., Shephard, M., Cady-Pereira, K., Misselbrook, T., **Zhu, L.** (2021). UK ammonia emissions estimated with satellite observations and GEOS-Chem. *Journal of Geophysical Research-Atmospheres*, 126(18), e2021JD035237. https://doi.org/10.1029/2021GL093808.
51. Zhai, S., Wang, X., McConnell, J. R., Geng, L., Cole-Dai, J., Sigl, M., Chellman, N., Sherwen, T., Pound, R., Fujita, K., Hattori, S., Moch, J., M., **Zhu, L.**, Evans, M., Legrand, M., Liu, P., Pasteris, D., Chan, Y.-C., Murray, L. T., Alexander, B. (2021). Anthropogenic impacts on tropospheric reactive chlorine since the preindustrial. *Geophysical Research Letters*, 48(14), e2021GL093808. https://doi.org/10.1029/2021JD035237.
52. Wang, X., Jacob, D. J., Downs, W., Zhai, S., **Zhu, L.**, Shah, V., Holmes, C. D., Sherwen, T., Alexander, B., Evans, M. J., Eastham, S. D., Neuman, J. A., Veres, P., Koenig, T. K., Volkamer, R., Huey, L. G., Bannan, T. J., Percival, C. J., Lee, B. H., Thornton, J. A. (2021). Global tropospheric halogen (Cl, Br, I) chemistry and its impact on oxidants. *Atmospheric Chemistry and Physics,* 21(18), 13973–13996. https://doi.org/10.5194/acp-21-13973-2021.
53. Wang, X., Fu, T.-M., Zhang, L., Cao, H., Zhang, Q., Ma, H., Shen, L., Evans, M. J., Ivatt, P. D., Lu, X., Chen, Y., Zhang, L., Feng, X., Yang, X., **Zhu, L.** (2021). Sensitivities of ozone air pollution in the Beijing-Tianjin-Hebei area to local and upwind precursor emissions using adjoint modeling. *Environmental Science & Technology*, 55(9), 5752–5762. https://doi.org/10.1021/acs.est.1c00131.
54. Li, Y., Fu, T.-M., Yu, J., Feng, X., Zhang, L., Chen, J., Boreddy, S., Kawamura, K., Fu, P., Yang, X., **Zhu, L.**, Zeng, Z. (2021). Impacts of chemical degradation on the global budget of atmospheric levoglucosan and its use as a biomass burning tracer. *Environmental Science & Technology*, 55(8), 5525–5536. https://doi.org/10.1021/acs.est.0c07313.
55. Sun, W., **Zhu, L. ***, De Smedt, I., Bai, B., Pu, D., Chen, Y., Shu, L., Wang, D., Fu, T.-M., Wang, X., Yang, Y. (2021). Global significant changes in formaldehyde (HCHO) columns observed from space at the early stage of the COVID-19 pandemic. *Geophysical Research Letters*, 48(4), 2e020GL091265. https://doi.org/10.1029/2020GL091265.

56. Wang, X., Ye, X., Chen, J., Wang, X., Yang, X., Fu, T.-M., **Zhu, L.**, Liu, C. (2020). Direct links between hygroscopicity and mixing state of ambient aerosols: estimating particle hygroscopicity from their single-particle mass spectra. *Atmospheric Chemistry and Physics*, 20(11), 6273–6290. https://doi.org/10.5194/acp-20-6273-2020.
57. Souri, A. H., Nowlan, C. R., González Abad, G., **Zhu, L.**, Blake, D. R., Fried, A., Weinheimer, A. J., Wisthaler, A., Woo, J.-H., Zhang, Q., Chan Miller, C. E., Liu, X., Chance, K. (2020). An inversion of NO_x and non-methane volatile organic compound (NMVOC) emissions using satellite observations during the KORUS-AQ campaign and implications for surface ozone over East Asia. *Atmospheric Chemistry and Physics*, 20(16), 9837–9854. https://doi.org/10.5194/acp-20-9837-2020.
58. **Zhu, L. ***, González Abad, G., Nowlan, C. R., Chan Miller, C., Chance, K., Apel, E. C., DiGangi, J. P., Fried, A., Hanisco, T. F., Hornbrook, R. S., Hu, L., Kaiser, J., Keutsch, F. N., Permar, W., St. Clair, J. M., Wolfe, G. M. (2020). Validation of satellite formaldehyde (HCHO) retrievals using observations from 12 aircraft campaigns. *Atmospheric Chemistry and Physics*, 20(20), 12329–12345. https://doi.org/10.5194/acp-20-12329-2020.
59. Lu, X., Zhang, L., Wu, T., Long, M. S., Wang, J., Jacob, D. J., Zhang, F., Zhang, J., Eastham, S. D., Hu, L., **Zhu, L.**, Liu, X., Wei, M. (2020). Development of the global atmospheric chemistry general circulation model BCC-GEOS-Chem v1.0: Model description and evaluation. *Geoscientific Model Development*, 13(9), 3817–3838. https://doi.org/10.5194/gmd-13-3817-2020.
60. Chance, K., Liu, X., Chan Miller, C., González Abad, G., Huang, G., Nowlan, C., Souri, A., Suleiman, R., Sun, K., Wang, H., **Zhu, L.**, Zoogman, P., Al-Saadi, J., Antuña-Marrero, J.-C., Carr, J., Chatfield, R., Chin, M., Cohen, R., Edwards, D., Fishman, J., Flittner, D., Geddes, J., Grutter, M., Herman, J. R., Jacob, D. J., Janz J. Joiner, S., Kim, J., Krotkov, N. A., Lefer, B., Martin, R. V., Mayol-Bracero, O. L., Naeger, A., Newchurch, M., Pfister, G. G., Pickering, K., Pierce, R. B., Rivera Cárdenas, C., Saiz-Lopez, A., Simpson, W., Spinei, E., Spurr, R. J. D., Szykman, J. J., Torres, O., Wang, J. (2019). TEMPO Green Paper; Chemistry, physics, and meteorology experiments with the Tropospheric Emissions: Monitoring of Pollution instrument, *Proc. SPIE 11151, Sensors, Systems, and Next-Generation Satellites XXIII, 111510B (10 October 2019)*.
61. **Zhu, L. ***, Jacob, D. J., Eastham, S. D., Sulprizio, M. P., Wang, X., Sherwen, T., Evans, M. J., Chen, Q., Alexander, B., Koenig, T. K., Volkamer, R., Huey, L. G., Le Breton, M., Bannan, T. J., Percival, C. J. (2019). Effect of sea salt aerosol on tropospheric bromine chemistry. *Atmospheric Chemistry and Physics*, 19(9), 6497–6507. https://doi.org/10.5194/acp-19-6497-2019.
62. Shen, L., Jacob, D. J., **Zhu, L.**, Zhang, Q., Zheng, B., Sulprizio, M. P., Li, K., Smedt, I. D., Abad, G. G., Cao, H., Fu, T.-M., Liao, H. (2019). The 2005-2016 trends of formaldehyde columns over China observed by satellites: Increasing anthropogenic emissions of volatile organic compounds and decreasing agricultural fire emissions. *Geophysical Research Letters*, 46(8), 4468–4475. https://doi.org/10.1029/2019GL082172.
63. Zhang, Y., Gautam, R., Zavala-Araiza, D., Jacob, D. J., Zhang, R., **Zhu, L.**, Sheng, J.-X., Scarpelli, T. (2019). Satellite-observed changes in Mexico's offshore gas flaring activity linked to oil/gas regulations. *Geophysical Research Letters*, 46(3), 1879–1888. https://doi.org/10.1029/2018GL081145.

64. Wang, X., Jacob, D. J., Eastham, S. D., Sulprizio, M. P., **Zhu, L.**, Chen, Q., Alexander, B., Sherwen, T., Evans, M. J., Lee, B. H., Haskins, J. D., Lopez-Hilfiker, F. D., Thornton, J. A., Huey, G. L., Liao, H. (2019). The role of chlorine in global tropospheric chemistry. *Atmospheric Chemistry and Physics*, 19(6), 3981-4003. https://doi.org/10.5194/acp-19-3981-2019.
65. Song, S., Gao, M., Xu, W., Sun, Y., Worsnop, D. R., Jayne, J. T., Zhang, Y., **Zhu, L.**, Li, M., Zhou, Z., Cheng, C., Lv, Y., Wang, Y., Peng, W., Xu, X., Lin, N., Wang, Y., Wang, S., Munger, J. W., Jacob, D. J., McElroy, M. B. (2019). Possible heterogeneous chemistry of hydroxymethanesulfonate (HMS) in northern China winter haze. *Atmospheric Chemistry and Physics*, 19(2), 1357–1371. https://doi.org/10.5194/acp-19-1357-2019.
66. Sun, K., **Zhu, L.**, Cady-Pereira, K., Chan Miller, C., Chance, K., Clarisse, L., Coheur, P.-F., González Abad, G., Huang, G., Liu, X., Van Damme, M., Yang, K., Zondlo, M. (2018). A physics-based approach to oversample multi-satellite, multispecies observations to a common grid. *Atmospheric Measurement Techniques*, 11(12), 6679–6701. https://doi.org/10.5194/amt-11-6679-2018.
67. Kaiser, J., Jacob, D. J., **Zhu, L.**, Travis, K. R., Fisher, J. A., González Abad, G., Zhang, L., Zhang, X., Fried, A., Crounse, J. D., St. Clair, J. M., Wisthaler, A. (2018). High-resolution inversion of OMI formaldehyde columns to quantify isoprene emission on ecosystem-relevant scales: Application to the southeast US. *Atmospheric Chemistry and Physics*, 18(8), 5483–5497. https://doi.org/10.5194/acp-18-5483-2018.
68. **Zhu, L. ***, Mickley, L., J., Jacob, D. J., Marais, E. A., Sheng, J., Hu, L., González Abad, G., Chance, K. (2017). Long-term (2005–2014) trends in formaldehyde (HCHO) columns across North America as seen by the OMI satellite instrument: Evidence of changing emissions of volatile organic compounds. *Geophysical Research Letters*, 44(13), 7079–7086. https://doi.org/10.1002/2017GL073859.
69. **Zhu, L. ***, Jacob, D. J., Keutsch, F. N., Mickley, L. J., Scheffe, R., Strum, M., Abad, G. G., Chance, K., Yang, K., Rappengluck, B., Millet, D. B., Baasandorj, M., Jaegle, L., Shah, V. (2017). Formaldehyde (HCHO) as a hazardous air pollutant: Mapping surface air concentrations from satellite and inferring cancer risks in the United States. *Environmental Science & Technology*, 51(10), 5650–5657. https://doi.org/10.1021/acs.est.7b01356.
70. Chan Miller, C., Jacob, D. J., Marais, E. A., Yu, K., Travis, K. R., Kim, P. S., Fisher, J. A., **Zhu, L.**, Wolfe, G. M., Hanisco, T. F., Keutsch, F. N., Kaiser, J., Min, K.-E., Brown, S. S., Washenfelder, R. A., González Abad, G., Chance, K. (2017). Glyoxal yield from isoprene oxidation and relation to formaldehyde: Chemical mechanism, constraints from SENEX aircraft observations, and interpretation of OMI satellite data. *Atmospheric Chemistry and Physics*, 17 (14), 8725–8738. https://doi.org/10.5194/acp-17-8725-2017.
71. Travis, K. R., Jacob, D. J., Fisher, J. A., Kim, P. S., Marais, E. A., **Zhu, L.**, Yu, K., Miller, C. C., Yantosca, R. M., Sulprizio, M. P., Thompson, A. M., Wennberg, P. O., Crounse, J. D., St. Clair, J. M., Cohen, R. C., Laughner, J. L., Dibb, J. E., Hall, S. R., Ullmann, K., Wolfe, G. M., Pollack, I. B., Peischl, J., Neuman, J. A., Zhou, X. (2016). Why do models overestimate surface ozone in the Southeast United States? *Atmospheric Chemistry and Physics*, 16 (21), 13561–13577. https://doi.org/10.5194/acp-16-13561-2016.
72. **Zhu, L. ***, Jacob, D. J., Kim, P. S., Fisher, J. A., Yu, K., Travis, K. R., Mickley, L. J., Yantosca, R. M., Sulprizio, M. P., De Smedt, I., González Abad, G., Chance, K., Li, C.,

Ferrare, R., Fried, A., Hair, J. W., Hanisco, T. F., Richter, D., Jo Scarino, A., Walega, J., Weibring, P., Wolfe, G. M. (2016). Observing atmospheric formaldehyde (HCHO) from space: Validation and intercomparison of six retrievals from four satellites (OMI, GOME2A, GOME2B, OMPS) with SEAC^{4}RS aircraft observations over the southeast US. *Atmospheric Chemistry and Physics*, 16 (21), 13477–13490. https://doi.org/10.5194/acp-16-13477-2016.

73. Fisher, J. A., Jacob, D. J., Travis, K. R., Kim, P. S., Marais, E. A., Chan Miller, C., Yu, K., **Zhu, L.**, Yantosca, R. M., Sulprizio, M. P., Mao, J., Wennberg, P. O., Crounse, J. D., Teng, A. P., Nguyen, T. B., St. Clair, J. M., Cohen, R. C., Romer, P., Nault, B. A., Wooldridge, P. J., Jimenez, J. L., Campuzano-Jost, P., Day, D. A., Hu, W., Shepson, P. B., Xiong, F., Blake, D. R., Goldstein, A. H., Misztal, P. K., Hanisco, T. F., Wolfe, G. M., Ryerson, T. B., Wisthaler, A., Mikoviny, T. (2016). Organic nitrate chemistry and its implications for nitrogen budgets in an isoprene- and monoterpene-rich atmosphere: Constraints from aircraft (SEAC^{4}RS) and ground-based (SOAS) observations in the southeast US. *Atmospheric Chemistry and Physics*, 16(9), 5969–5991. https://doi.org/10.5194/acp-16-5969-2016.
74. Yu, K., Jacob, D. J., Fisher, J. A., Kim, P. S., Marais, E. A., Miller, C. C., Travis, K. R., **Zhu, L.**, Yantosca, R. M., Sulprizio, M. P., Cohen, R. C., Dibb, J. E., Fried, A., Mikoviny, T., Ryerson, T. B., Wennberg, P. O., Wisthaler, A. (2016). Sensitivity to grid resolution in the ability of a chemical transport model to simulate observed oxidant chemistry under high-isoprene conditions. *Atmospheric Chemistry and Physics*, 16(7), 4369–4378. https://doi.org/10.5194/acp-16-4369-2016.
75. Marais, E. A., Jacob, D. J., Jimenez, J. L., Campuzano-Jost, P., Day, D. A., Hu, W., Krechmer, J., **Zhu, L.**, Kim, P. S., Miller, C. C., Fisher, J. A., Travis, K., Yu, K., Hanisco, T. F., Wolfe, G. M., Arkinson, H. L., Pye, H. O. T., Froyd, K. D., Liao, J., McNeill, V. F. (2016). Aqueous-phase mechanism for secondary organic aerosol formation from isoprene: Application to the southeast United States and co-benefit of SO_2 emission controls. *Atmospheric Chemistry and Physics*, 16(3), 1603-1618. https://doi.org/10.5194/acp-16-1603-2016.
76. Kim, P. S., Jacob, D. J., Fisher, J. A., Travis, K., Yu, K., **Zhu, L.**, Yantosca, R. M., Sulprizio, M. P., Jimenez, J. L., Campuzano-Jost, P., Froyd, K. D., Liao, J., Hair, J. W., Fenn, M. A., Butler, C. F., Wagner, N. L., Gordon, T. D., Welti, A., Wennberg, P. O., Crounse, J. D., St. Clair, J. M., Teng, A. P., Millet, D. B., Schwarz, J. P., Markovic, M. Z., Perring, A. E.(2015). Sources, seasonality, and trends of southeast US aerosol: An integrated analysis of surface, aircraft, and satellite observations with the GEOS-Chem chemical transport model. *Atmospheric Chemistry and Physics*, 15(18), 10411–10433. https://doi.org/10.5194/acp-15-10411-2015.
77. **Zhu, L. ***, Jacob, D. J., Mickley, L. J., Marais, E. A., Cohan, D. S., Yoshida, Y., Duncan, B. N., González Abad, G., Chance, K. V. (2014). Anthropogenic emissions of highly reactive volatile organic compounds in eastern Texas inferred from oversampling of satellite (OMI) measurements of HCHO columns. *Environmental Research Letters*, 9(11), 114004. https://doi.org/10.1088/1748-9326/9/11/114004.
78. Li, M., Huang, X., **Zhu, L.**, Li, J., Song, Y., Cai, X., Xie S. (2012). Analysis of the transport pathways and potential sources of PM_{10} in Shanghai based on three methods. *Science of the Total Environment*, 414, 525–534, https://doi.org/10.1016/j.scitotenv.2011.10.054.
79. Huang, X., Li, M., Friedli, H. R. Song, Y., Chang, D., **Zhu, L.** (2011). Mercury emissions

from biomass burning in China. *Environmental Science & Technology*, 45(21), 9442–9448. https://doi.org/10.1021/es202224e.

80. **Zhu, L.**, Huang, X., Shi, H., Cai, X. H., Song, Y. (2011). Transport pathways and potential sources of PM_{10} in Beijing. *Atmospheric Environment*, 45(3), 594–604. https://doi.org/10.1016/j.atmosenv.2010.10.040.
81. Song, Y., Chang, D., Liu, B., Miao, W., **Zhu, L.**, Zhang, Y. (2010). A new emission inventory for nonagricultural open fires in Asia from 2000 to 2009. *Environmental Research Letters*, 5(1), 014014. https://doi.org/10.1088/1748-9326/5/1/014014.
82. Wang, B., **Zhu, L.**, Gong, Z., Wang, R., Tao, S. (2009). Introduction to the methods of parameter estimation for environmental monitoring data set with truncated data below a detection limit. *Acta Science Circumstantiae,* 29(7), 1345–1350. https://www.webofscience.com/wos/cscd/full-record/CSCD:3522537. (in Chinese).

Presentations

Invited Presentations at Professional Meetings, Conferences, Universities and Industries, etc.

Invited international talks:

1. Underappreciated emission spikes and impacts on air quality during heatwaves, ABaCAS 2024, September 22, 2024, Shanghai, China.
2. Underappreciated emission spikes and impacts on air quality during heatwaves, The 7th International Workshop on Regional Air Quality Management in Rapidly Developing Economic Regions (7RAQM), May 30, 2024, Guangzhou, Guangdong.
3. Observing downwind structures of urban HCHO from space: applications to non-methane volatile organic compound emissions, The second ISSI workshop on geostationary satellites for atmospheric composition, May 28, 2024, Beijing, Beijing.
4. Observing downwind structures of urban HCHO plumes from space: Implications to non-methane volatile organic compound emissions, The International Expert Workshop on Volatile Organic Compounds 2023, November 29, 2023, Hong Kong.
5. Satellite remote sensing of trace gases and applications for air quality studies, Atmospheric Environmental Remote Sensing Society (AERSS) Webinar Series, June 25, 2022, Online.
6. Satellite remote sensing of trace gases: principles, methods, and applications for air quality studies, Nankai University, October 07, 2020, Tianjin, China.
7. Satellite remote sensing of trace gases: principles, methods, and applications for air quality studies, Atmospheric Chemistry Forum, November 30, 2019, Online.
8. Satellite remote sensing for air quality applications, with a focus on formaldehyde (HCHO), University of Illinois at Urbana–Champaign, March 28, 2019, Champaign, IL, USA.
9. Satellite remote sensing for air quality applications, with a focus on formaldehyde (HCHO), Institute of Atmospheric Physics Chinese Academy of Sciences, March 19, 2019, Beijing, China.
10. Satellite remote sensing for air quality applications, with a focus on formaldehyde (HCHO), Peking University, March 16, 2019, Beijing, China.
11. Satellite remote sensing for air quality applications, with a focus on formaldehyde (HCHO), Southern University of Science and Technology, January 05, 2019, Shenzhen, China.
12. Mapping surface air concentrations from OMI and inferring cancer risks: implications for TEMPO, TEMPO Science Meeting, June 01, 2017, Cambridge, MA, USA.

13. Math in Nature: finding order in chaos, Science in News, November 13, 2013, Boston, MA, USA.

Invited talks presented in Chinese:

1. 深圳西涌站含氟温室气体观测介绍, 含氟温室气体监测联盟启动暨第一次研讨会, December 28, 2024, 上海, 上海.
2. 臭氧及其前体物卫星遥感与应用, 第三届“大气化学、大气环境与健康气象”青年学者论坛, November 23, 2024, 北京, 北京.
3. 臭氧及其前体物卫星遥感与应用, 第二届地球与海洋大气科学学术沙龙, November 16, 2024, 广州, 广东.
4. 含氟温室气体浓度监测、模型模拟与排放反演, 第 30 届大气环境科学与技术会议暨大气污染防治技术研讨会, October 21, 2024, 合肥, 安徽.
5. 气溶胶组分演变对城市区域卫星 NO_2 反演的影响研究, 第 30 届大气环境科学与技术会议暨大气污染防治技术研讨会, October 21, 2024, 合肥, 安徽.
6. 基于西涌站点的含氟温室气体浓度监测与排放反演, 第三届含氟温室气体论坛, September 14, 2024, 杭州, 江苏.
7. 臭氧及其前体物卫星遥感与应用, 2024 年粤港澳高校环境生态工程联盟学术研讨会, July 13, 2024, 广州, 广东.
8. 人为源挥发性有机物的遥感观测与排放约束, 第 15 次生态环境监测学术交流会, June 18, 2024, 合肥, 安徽.
9. 气溶胶组分演变对城市区域卫星 NO_2 反演的影响研究, 第九届青年地学论坛, May 19, 2024, 厦门, 福建.
10. 热浪期间电厂激增排放的遥感约束及空气质量影响, 第四届大气环境遥感与协同分析学术会议, May 09, 2024, 上海, 上海.
11. 城市甲醛烟羽遥感识别与挥发性有机物排放约束, 第 29 届中国大气环境科学与技术大会, April 27, 2024, 青岛, 山东.
12. 基于多源数据同化的臭氧模拟改进研究, 第 29 届中国大气环境科学与技术大会, December 14, 2023, Online.
13. 基于甲醛卫星遥感的挥发性有机物排放研究, 挥发性有机物污染防治专业委员会第十届学术年会, December 14, 2023, 重庆, 重庆.
14. 臭氧及其前体物卫星遥感与应用, 华南理工大学, December 11, 2023, 广州, 广东.
15. 臭氧及其前体物卫星遥感与应用, 清华大学, December 8, 2023, 深圳, 广东.
16. 深圳市背景大气含氟温室气体在线监测及来源分析, 第二届含氟温室气体论坛, September 19, 2023, 北京, 北京.
17. 长大气寿命气体浓度模拟与排放反演, 中国环境监测总站讲座, September 8, 2023, 北京, 北京.
18. 基于 TROPOMI 卫星的对流层 BrO 反演与应用, 污染源排放与管控专业委员会 2023 年学术年会, August 26, 2023, 哈尔滨, 黑龙江.
19. 人为源挥发性有机物排放的卫星约束, 第 22 届中国遥感大会, August 21, 2023, 常州, 江苏.
20. 城市尺度人为源挥发性有机物排放的卫星约束, GEIA-CWG 委员会议, July 28, 2023, 兰州, 甘肃.
21. 臭氧及其前体物卫星遥感与应用, 南京信息工程大学, July 18, 2023, 南京, 江苏.
22. 臭氧及其前体物卫星遥感与应用, 南京大学, July 17, 2023, 南京, 江苏.
23. 基于多源数据同化的臭氧模拟改进研究, 第 27 届大气污染防治技术研讨会, July 15,

2023，南京，江苏.

24. 基于多源数据同化的臭氧模拟改进研究，第3届大气环境遥感与协同分析学术论坛, May 12, 2023，兰州，甘肃.
25. 基于甲醛卫星遥感的挥发性有机物排放研究，第 8 届青年地学论坛, May 6, 2023，武汉，湖北.
26. 基于HCHO卫星遥感的挥发性有机物排放研究，中国环境科学学会污染源排放与管控专业委员会会议, November 29, 2022, Online.
27. 基于甲醛卫星遥感的挥发性有机物排放研究，第 28 届中国大气环境科学与技术大会, November 24, 2022, Online.
28. 海洋源排放对卤素化学及大气氧化性的模拟研究，第 27 届中国大气环境科学与技术大会, November 27, 2021, Online.
29. 卫星遥感在空气质量监测中的应用，中国环境监测总站培训班, July 6, 2021, online.
30. 甲醛卫星监测及其在空气质量研究中的应用，暨南大学, April 20, 2021，广州，广东.
31. 甲醛的卫星遥感监测及其应用，第 25 届大气污染防治技术研讨会, April 10, 2021，西安，陕西.
32. 全球地表甲醛的估算，第26届中国大气环境科学与技术大会, December 08, 2020, Online.
33. Global Significant Changes in Formaldehyde (HCHO) Columns Observed from Space at the Early Stage of the COVID-19 Pandemic，首届大气环境遥感与协同分析青年学者论坛, November 29, 2020，珠海，广东.

Selected Talks at Professional Meetings, Conferences, etc.

1. Evaluating GEMS HCHO retrievals with TROPOMI product, Pandora observations, and GEOS-Chem simulations, AERSS Annual Meeting 2024, December 2, 2024, Hong Kong.
2. Observing downwind structures of urban HCHO and CHOCHO plumes with TROPOMI and GEMS: Implications to non-methane volatile organic compound emissions, TEMPO/GEMS Joint Science Team Workshop, August 30, 2024, Kailua-Kona, Hawaii, USA.
3. Observing the network effect of shipping emissions from space: a natural experiment in the world's busiest port, International Conference Chemical Weather and Chemical Climate, October 17, 2023, Shanghai, Shanghai.
4. Improved Ozone Simulation in East Asia via Assimilating Observations from the First Geostationary Air-quality Monitoring Satellite, AERSS Annual Meeting 2023, September 18, 2023, Wuhan, Hubei.
5. Improved Ozone Simulation in Asia via Assimilating Observations from the First Geostationary Air quality Monitoring Satellite, Insights from an Observing System Simulation Experiment, presented by Lei Shu at AGU Fall Meeting 2021, December 14, 2021, Online.
6. Validation of satellite formaldehyde (HCHO) retrievals using observations from 12 aircraft campaigns, AGU Fall Meeting, December 11, 2019, San Francisco, CA, USA.
7. Modeling of tropospheric halogen (Cl-Br-I) chemistry: cycling, debromination, and impact, The 1st Regional GEOS-Chem Asia Meeting, May 21, 2018, Nanjing, China.
8. Observing atmospheric formaldehyde from space: validation, intercomparison, trend analysis and public health implications, AGU Fall Meeting, December 14, 2016, San Francisco, CA, USA.
9. Observing atmospheric formaldehyde from space: Validation, intercomparison, trend analysis and public health implications, Aura Science Meeting, August 30, 2016, Rotterdam, The

Netherlands.

10. Mapping of surface formaldehyde (HCHO) from space for air quality management, The 9th NASA Air Quality Applied Sciences Team Meeting, June 02, 2015, St. Louis, MO, USA.
11. Indirect validation of new OMI, GOME-2B and OMPS formaldehyde retrievals using SEAC^{4}RS data, The 7th International GEOS-Chem Meeting, May 05, 2015, Cambridge, MA, USA.
12. Validation of satellite HCHO observations (OMI, GOME-2B, OMPS) using SEAC4RS data, SEAC^{4}RS Science Meeting, April 30, 2015, Pasadena, CA, USA.
13. Anthropogenic emissions of highly reactive volatile organic compounds inferred from oversampling of OMI HCHO columns, EOS Aura Science Team Meeting 10th year anniversary celebration, September 16, 2014, College Park, MD, USA.
14. Anthropogenic emissions of highly reactive VOCs (HRVOCs) inferred from oversampling of OMI formaldehyde columns, The 6th NASA Air Quality Applied Sciences Team Meeting, January 15, 2014, Houston, TX, USA.
15. Variability of HCHO over the United States: Implications for VOCs Emissions, The 5th NASA Air Quality Applied Sciences Team Meeting, June 04, 2013, College Park, MD, USA.
16. A spike in electricity demand due to severe summer heatwaves: Increase of SO2 emissions detected from space, The 18th Seminar of JSPS-MOE Core University Program, December 22, 2010, Beijing, China.
17. Estimating of fire emissions in Boreal Siberia by satellite data sets, The 6th Seminar of Environment Modeling and Pollution Controlling, November 13, 2009, Beijing, China.

Selected Posters at Professional Meetings, Conferences, etc.

1. Validation of satellite formaldehyde (HCHO) retrievals using aircraft observations and implication for TEMPO, TEMPO Science Meeting, June 05, 2019, Madison, WI, USA.
2. Effect of sea-salt aerosol on tropospheric bromine chemistry, The 9th International GEOS-Chem Meeting, May 07, 2019, Cambridge, MA, USA.
3. Effect of sea-salt aerosol on tropospheric bromine chemistry, AGU Fall Meeting, December 13, 2018, Washington, D.C., USA.
4. Observing atmospheric formaldehyde from space: trend analysis and public health implications, The 8th International GEOS-Chem Meeting, May 01, 2017, Cambridge, MA, USA.
5. Validation of satellite HCHO retrievals with aircraft (SEAC^{4}RS) observations, Atmospheric Radiation Workshop, March 08, 2016, Boulder, CO, USA.
6. Anthropogenic emissions of highly reactive volatile organic compounds inferred from oversampling of OMI HCHO columns, AGU Fall Meeting, December 19, 2014, San Francisco, CA, USA.
7. Indirect validation of GOME-2/MetOp-A and B formaldehyde retrievals using SEAC^{4}RS data: Preliminary results, The 7th NASA Air Quality Applied Sciences Team Meeting, June 17, 2014, Cambridge, MA, USA.
8. Indirect Validation of GOME-2/MetOp-A and B and New OMI formaldehyde (HCHO) retrievals using SEAC^{4}RS data: Preliminary results, SEAC^{4}RS Science Meeting, April 17, 2014, Boulder, CO, USA.
9. Variability of HCHO over the Southeastern United States observed from space: Implications

for VOC emissions, AGU Fall Meeting, December 04, 2012, San Francisco, CA, USA.

10. Spikes in electricity demand during severe summer heat waves: Increased SO_2 emissions detected from space, AGU Fall Meeting, December 15, 2010, San Francisco, CA, USA.

TEACHING AND CURRICULUM DEVELOPMENT

Teaching Courses at Southern University of Science and Technology

- Computing and Programming for Environmental Research, Graduate course, 35 students 2023 Fall, 24 students 2022 Fall, 42 students 2021 Fall, 26 students 2020 Fall.
- Environmental Data Analysis, Undergraduate course, 15 students 2024 Spring, 6 students 2023 Spring, 6 students 2022 Spring, 15 students 2021 Spring.

Curriculum Development at Southern University of Science and Technology

- Computing and Programming for Environmental Research, Graduate course
- Environmental Data Analysis, Undergraduate course

Teaching Assistant at Harvard University

Lab demonstrations/tutoring, grading, exam grading, offering weekly sections

- Atmospheric Chemistry and Physics, Graduate course, 12 students, 2017 Fall.
- The Fluid Earth: Oceans, Atmosphere, and Climate, Undergraduate course, 50 students, 2013 Fall.

ADVISING AND MENTORING

Undergraduate Student Activities

1. Xiangyu Luan, 2024–Present
2. Liqian Tan, 2020–2021, China Merchants Bank, China
3. Yuyang Chen, 2019–2020, PhD student, Southern University of Science and Technology

Graduate Student Activities

Master Dissertations Directed:

1. Xiaoxing Zuo, 2021–2024, PhD student, Royal Netherlands Meteorological Institute (KNMI), The Netherlands.
2. Shuai Sun, 2021–2023, PhD student, Westlake University, China.
3. Xicheng Li, 2020–2022, PhD student, Southern University of Science and Technology

Master Students Advised (Current):

1. Yuchen Huang, 2025–Present
2. Jiaming Zhang, 2024–Present
3. Xingyi Wu, 2024–Present
4. Yali Li, 2023–Present
5. Peng Zhang, 2023–Present
6. Zhuoxian Yan, 2023–Present
7. Weitao Fu, 2022–Present

Doctoral Dissertations Directed:

1. Dongchuan Pu 2020–2024, Post-doctoral fellow, Shenzhen University, China

Doctoral Students Advised (Current)

1. Xue Zhang, 2024–Present

2. Xicheng Li, 2022–Present
3. Juan Li, 2021–Present
4. Yuyang Chen, 2020–Present

Post-doctoral Fellows Supervised:

1. Song Liu, 2021–2023, Research Assistant Professor, Southern University of Science and Technology
2. Lei Shu, 2020–2022, Associate professor, Fujian Normal University, China.
3. Dakang Wang, 2020–2022, Associate professor, Guangzhou University, China.

Graduate Mentoring Program at Harvard:

1. Tianjia Liu 2017–2019
2. Natasha Goss 2014–2015

Research Assistants Advised

1. Bin Bai, Research Assistant, 2020–2021, PhD student, Georgia Institute of Technology, USA.
2. Wenxu Liao, Research Assistant, 2023–2023, PhD student, University of Notre Dame, USA.
3. Wenfu Sun, Research Assistant, 2020–2021, PhD student, The Royal Belgian Institute for Space Aeronomy (BIRA-IASB), Belgium.

SERVICE AND PUBLIC OUTREACH

Editorships/Journal Reviewer Experience

Youth Editor:

Journal of Remote Sensing

Guest Editor:

Remote Sensing

Reviewer:

ACS ES&T Air, Atmosphere, Atmospheric Environment, Atmospheric Chemistry and Physics, Atmospheric Measurement Techniques, Atmospheric Pollution Research, Environmental Science & Technology, Environmental Science & Technology Letter, Environmental Modelling and Software, Geophysical Research Letters, Journal of Environmental Science & Technology, Journal of Geophysical Research, Nature Climate Change, Remote Sensing

Committee memberships

- China Working Group of Global Emissions InitiAtive (GEIA-CWG), 2023–Present
- China Compliance Expert Group on the Montreal Protocol on Substances that Deplete the Ozone Layer, Ministry of Ecology and Environment of China, 2022–Present
- Gaofen Series Satellite Science Team, 2021–Present
- GEMS Science Team, 2019–Present
- OMPS (NPP and NOAA-20) Science Team, 2018–Present
- TEMPO Science Team, 2017–Present
- NASA Aura Science Team, 2016–Present
- Chair of weekly Harvard Atmospheric Sciences seminar series, 2016–2017
- NASA SEAC^{4}RS Flight Campaign Science Team, 2012–2015

- NASA Air Quality Applied Sciences Team, 2011–2015

Review panels for external funding agencies, foundations, etc.

- NASA proposal review panels
- NSFC proposal review panels

Organization of conferences, workshops, panels, symposia

Session Chairs at Conferences:

- AS14 - Emissions of air pollutants and greenhouse gases and interactions with the earth system, The 21st Annual Meeting of the Asia Oceania Geosciences Society (AOGS2024), 2024

Service to the University/Faculty/Department

University-wide service

- Advisor, Zhiren House, 11 students monitored
- Outstanding individual in student recruitment, 2022
- Excellence in science outreach for student recruitment award, 2022

Department Service

- School of the Environment Education Committee, 2024–Present
- Operation and maintenance of the department data storage platform, 2022–Present
- Student recruitment in Shanxi province, 2020–Present