

Tianjia Liu

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EDUCATION

Harvard University, Cambridge, MA

Ph.D. Candidate, Earth and Planetary Sciences

May 2022 (expected)

S.M., Environmental Science and Engineering

November 2020

Thesis: Modeling the impact of human-driven fires on air quality from regional and global perspectives

Advisors: Dr. Loretta Mickley and Prof. Daniel Jacob

Columbia University, New York, NY

B.A., Environmental Science, *magna cum laude* and *departmental honors*

May 2017

Thesis: A new emissions inventory for post-monsoon agricultural fires in northwestern India

Advisors: Prof. Ruth DeFries, Drs. Miriam Marlier and Alexandra Karambelas

RESEARCH INTERESTS

My research interweaves the domains of atmospheric chemistry, remote sensing, statistical modeling, and public health in an effort to better understand the air quality and public health impacts of human-driven fires in India and Equatorial Asia.

RESEARCH EXPERIENCE

Harvard University, Cambridge, MA

Atmospheric Chemistry Modeling Group, Dept. of Earth and Planetary Sciences August 2017 – present
Graduate Research Assistant

Advisors: Dr. Loretta Mickley and Prof. Daniel Jacob

- Quantify trends in satellite and surface observations of agricultural fires, crop phenology, and air quality in north India
- Built an updated emissions inventory for agricultural fires in northwestern India and model fire-related smoke exposure in Delhi and other cities
- Created an online decision support tool that allows stakeholders to quantify the public health benefits from reducing fires in Indonesia according to various land management scenarios
- Presented research to over 100 stakeholders and press in a public dissemination forum in Jakarta, Indonesia in August 2019, as well as to scientists at WRI, WWF, and Greenpeace and government officials at the Indonesian Disaster Relief Agency (BNPB)

Woods Hole Oceanographic Institution, Woods Hole, MA

Dept. of Physical Oceanography

May – August 2016

Summer Student Fellow

Advisors: Drs. Raymond Schmitt, Laifang Li

- Developed a statistical method to model regional precipitation using sea surface salinity and temperature predictors

Columbia University, New York and Palisades, NY

Dept. of Ecology, Evolution, and Environmental Biology

September 2015 – August 2017

Undergraduate Research Assistant (Earth Institute)

Advisors: Dr. Miriam Marlier, Prof. Ruth DeFries

- Used ground and satellite observations to quantify the seasonal influence of agricultural fire on degraded air quality in three cities in India: Delhi, Pune, and Bengaluru

- Developed an algorithm to estimate burned area from agricultural fires at high spatial resolution in northwestern India

Lamont-Doherty Earth Observatory

October 2014 – June 2016

Undergraduate Research Assistant (Earth Institute)

Advisor: Prof. Jerry McManus

- Analyzed carbon and oxygen isotope signatures in benthic and planktonic foraminifera and organic carbon to reconstruct the North Pacific biological pump in relation to glacial-interglacial cycles in the past 600,000 years

Lamont-Doherty Earth Observatory

May 2014 – August 2015

Earth Intern, Undergraduate RA, Co-PI

Advisors: Dr. Jonathan Nichols, Prof. Dorothy Peteet

- Wrote a proposal as co-PI (funded by LDEO's Climate Center), collected surface samples from peat bogs in the Catskill Mountains, and conducted analysis of fatty alcohols and sterols
- Analyzed leaf wax *n*-alkanes distributions, carbon flux, inorganic flux, and hydrogen isotope ratios in order to reconstruct regional North Pacific paleoclimate, paleo-vegetation, and paleo-wind during the late Holocene

PEER-REVIEWED PUBLICATIONS

h-index: 7, total citations: 538 (as of July 2021, [Google Scholar](#)); as first author (8), as co-author (5)

- [13] Zhou, X., K. Josey, L. Kamareddine, M.C. Caine*, **T. Liu**, L. Mickley, M. Cooper, F. Dominici. Excess of COVID-19 Cases and Deaths due to Fine Particulate Matter Exposure During the 2020 Wildfires in the United States. (*accepted at Sci. Adv.*)
- [12] **Liu, T.**, L.J. Mickley, and J.L. McCarty (2021). Global search for temporal shifts in fire activity: potential human influence on southwest Russia and north Australia fire seasons. *Environ. Res. Lett.*, **16**(4), 044023.
<https://doi.org/10.1088/1748-9326/abe328>
- [11] **Liu, T.** and M.A. Crowley (2021). Detection and impacts of tiling artifacts in MODIS burned area classification. *IOP SciNotes*, **2**, 014003.
<https://doi.org/10.1088/2633-1357/abd8e2>
- [10] Gunthe, S.S., P. Liu, U. Panda, S.S. Raj, A. Sharma, E. Derbyshire, E. Reyes-Villegas, J. Allan, Y. Chen, X. Wang, S. Song, M.L. Pöhker, L. Shi, Y. Wang, S.M. Kommula, **T. Liu**, R. Ravikrishna, G. McFiggans, L.J. Mickley, S.T. Martin, U. Pöschl, M.O. Andreae, and H. Coe (2021). Enhanced aerosol particle growth sustained by high continental chlorine emission in India. *Nat. Geosci.*, **14**(2), 77–84.
<https://doi.org/10.1038/s41561-020-00677-x>
- [9] **Liu, T.**, L.J. Mickley, R. Gautam, M.K. Singh, R.S. DeFries, and M.E. Marlier (2021). Detection of delay in post-monsoon agricultural burning across Punjab, India: potential drivers and consequences for air quality. *Environ. Res. Lett.*, **16**(1), 014014.
<https://doi.org/10.1088/1748-9326/abcc28>
- [8] **Liu, T.**, L.J. Mickley, S. Singh, M. Jain, R.S. DeFries, and M.E. Marlier (2020). Crop residue burning practices across north India inferred from household survey data: bridging gaps in satellite observations. *Atmos. Environ. X*, **8**, 100091.
<https://doi.org/10.1016/j.aeaoa.2020.100091>
Dataverse: <https://doi.org/10.7910/DVN/JUMXOL> (SAGE-IGP agricultural fire emissions)
- [7] **Liu, T.**, L.J. Mickley, M.E. Marlier, R.S. DeFries, M.F. Khan, M.T. Latif, and A. Karambelas (2020). Diagnosing spatial biases and uncertainties in global fire emissions inventories: Indonesia as regional case study. *Remote Sens. Environ.*, **237**, 111557.
<https://doi.org/10.1016/j.rse.2019.111557>
- Special issue on “Remote Sensing of Land Change Science with Google Earth Engine”
- [6] Marlier, M.E., **T. Liu**, K. Yu, J.J. Buonocore, S.N. Koplitz, R.S. DeFries, L.J. Mickley, D.J. Jacob, J. Schwartz, B.S. Wardhana, and S.S. Myers (2019). Fires, smoke exposure, and public health: an

integrative framework to maximize health benefits from peatland restoration. *GeoHealth*, **3**(7), 178-189.
<https://doi.org/10.1029/2019GH000191>

- [5] **Liu, T.**, M.E. Marlier, A. Karambelas, M. Jain, S. Singh, M.K. Singh, R. Gautam, and R.S. DeFries (2019). Missing emissions from post-monsoon agricultural fires in northwestern India: regional limitations of MODIS burned area and active fire products. *Environ. Res. Commun.*, **1**(1), 011007.
<https://doi.org/10.1088/2515-7620/ab056c>
• Highlighted by Ladies of Landsat #ManuscriptMonday on December 23, 2019
- [4] **Liu, T.**, R.W. Schmitt, and L. Li (2018). Global search for autumn-lead sea surface salinity predictors of winter precipitation in southwestern United States. *Geophys. Res. Lett.*, **45**(16), 8445-8454.
<https://doi.org/10.1029/2018GL079293>
- [3] Cusworth, D.H., L.J. Mickley, M.P. Sulprizio, **T. Liu**, M.E. Marlier, R.S. DeFries, S.K. Guttikunda, and P. Gupta (2018). Quantifying the influence of agricultural fires in northwest India on urban air pollution in Delhi, India. *Environ. Res. Lett.*, **13**(4), 044018.
<https://doi.org/10.1088/1748-9326/aab303>
- [2] **Liu, T.**, M.E. Marlier, R.S. DeFries, D.M. Westervelt, K.R. Xia, A.M. Fiore, L.J. Mickley, D.H. Cusworth, and G. Milly (2018). Seasonal impact of regional outdoor biomass burning on air pollution in three Indian cities: Delhi, Bengaluru, and Pune. *Atmos. Environ.*, **173**, 83-92.
<https://doi.org/10.1016/j.atmosenv.2017.10.024>
- [1] Koplitz, S.N., L.J. Mickley, M.E. Marlier, J.J. Buonocore, P.S. Kim, **T. Liu**, M.P. Sulprizio, R.S. DeFries, D.J. Jacob, J. Schwartz, and S.S. Myers (2016). Public health impacts of the severe haze in Equatorial Asia in September–October 2015: demonstration of a new framework for informing fire management strategies to reduce downwind smoke exposure. *Environ. Res. Lett.*, **11**(9), 094023.
<https://doi.org/10.1088/1748-9326/11/9/094023>
• Editors' Highlights of 2016 in *Environmental Research Letters*, ESI 1% Highly Cited Paper

* Note: authors who are students I mentored are starred

In Revision, In Review, In Prep

- [14] Lan, R., S.D. Eastham, **T. Liu**, L.K. Norford, and S.R.H. Barrett. Spatial and temporal attribution of air quality and health impacts due to crop residue burning in India. (*in review at Nat. Commun.*)
- [15] **Liu, T.**, L.J. Mickley, et al. Cascading delays in monsoon rice phenology and post-monsoon fires may exacerbate poor air quality in north India. (*in prep.*)

PRESENTATIONS

[[Links to abstracts and posters](#)]

Invited Talks

- [3] **Liu, T.** Visualizing Fires and Smoke in Earth Engine Apps. Geo for Good Lightning Talk Series #1. Google, virtual. April 8, 2021.
- [2] **Liu, T.**, M.E. Marlier, K. Yu, J.J. Buonocore, S.N. Koplitz, R.S. DeFries, L.J. Mickley, D.J. Jacob, J. Schwartz, B.S. Wardhana, and S.S. Myers. Fires, smoke exposure, and public health: an integrative framework to maximize health benefits from peatland restoration.
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| Indonesian Disaster Relief Agency, BNPB (Jakarta, Indonesia) | August 15, 2019 |
| World Resources Institute, WRI (Jakarta, Indonesia) | August 14, 2019 |
| World Wildlife Fund, WWF (Jakarta, Indonesia) | August 14, 2019 |
| Greenpeace (Jakarta, Indonesia) | August 13, 2019 |
| Katadata Forum (Jakarta, Indonesia) | August 13, 2019 |

- [1] **Liu, T.**, R.W. Schmitt, and L. Li. Sea surface salinity and temperature-based predictive modeling of southwestern US winter precipitation: improvements, errors, and potential mechanisms. American Geophysical Union Fall Meeting, New Orleans, LA, December 12, 2017. (Union eLightning Talk)

Select Conference Presentations

- [12] **Liu, T.**, L.J. Mickley, and J.L. McCarty. Human-driven temporal shifts in fire activity: southwest Russia and north Australia as case study regions. American Geophysical Union Fall Meeting, December 8, 2020. (Talk)
- [11] Marlier, M.E., **T. Liu**, K. Yu, J.J. Buonocore, S.N. Koplitz, R.S. DeFries, L.J. Mickley, D.J. Jacob, J.Schwartz, B.S. Wardhana, and S. S. Myers. Connecting land use management, fires, and public health: Demonstration of an online decision support tool for Equatorial Asia. American Geophysical Union Fall Meeting, San Francisco, CA, December 9, 2019. (Invited Talk)
- [10] **Liu, T.**, L.J. Mickley, S. Singh, M. Jain, R.S. DeFries, and M.E. Marlier. Revised estimates of agricultural fire emissions for Punjab, India: bridging gaps in satellite observations using household survey data. American Geophysical Union Fall Meeting, San Francisco, CA, December 10, 2019.
- [9] **Liu, T.**, L.J. Mickley, M.E. Marlier, R.S. DeFries, M.F. Khan, M.T. Latif, and A. Karambelas. Diagnosing spatial biases and uncertainties in global fire emissions inventories: Indonesia as regional case study. 9th International GEOS-Chem Meeting (IGC9), Harvard University, Cambridge, MA, May 6, 2019.
- [8] **Liu, T.**, M. Lin, L.J. Mickley, P.J. Huybers, R. Gautam, M.K. Singh, DeFries R.S., and M.E. Marlier. Consequences for regional air quality from temporal shifts in post-monsoon agricultural burning associated with the double-crop cycle of Punjab, India. American Geophysical Union Fall Meeting, Washington D.C., December 12, 2018. (Talk)
- [7] Schmitt, R., L. Li, C. Ummenhofer, **T. Liu**, L. Zeng, J. Schanze, S. Levang, E. Schmitt, and S. Schmitt. From Ocean Observations to Societal Applications: The Surprising Skill of Sea Surface Salinity in Seasonal to Sub-Seasonal Prediction of Precipitation on Land. OceanObs'19.
- [6] **Liu, T.**, M.E. Marlier, Karambelas A.N., Jain M., and DeFries R.S. A multi-sensor burned area algorithm for crop residue burning in northwestern India: validation and sources of error. American Geophysical Union Fall Meeting, New Orleans, LA, December 12, 2017. (Talk)
- [5] **Liu, T.**, M.E. Marlier, R.S. DeFries, A. Karambelas, D.M. Westervelt, K.R. Xia, A.M. Fiore, L.J. Mickley, and D.H. Cusworth. Contributions of winter outdoor biomass burning to air quality in Delhi and reevaluation of agricultural burned area in northwest India. Planetary Health/GeoHealth Inaugural Meeting, Boston, MA, April 29, 2017.
- [4] **Liu, T.**, R.W. Schmitt, and L. Li. Global salinity predictors of western United States precipitation. American Geophysical Union Fall Meeting, San Francisco, CA, December 16, 2016; Woods Hole Oceanographic Institution, Department of Physical Oceanography, August 18, 2016. (Talk)
- [3] Schmitt, R.W., L. Li, and **T. Liu**. Rainfall predictions from global salinity anomalies. American Geophysical Union Fall Meeting, San Francisco, CA, December 16, 2016.
- [2] **Liu, T.**, J.F. McManus, K. Costa, and T. Liu. A glacial-interglacial record of the North Pacific biological pump for the past 600,000 years. Ocean Sciences Meeting, New Orleans, LA, February 23, 2016.
- [1] **Liu, T.**, J.E. Nichols, D.M. Peteet, C.M. Moy, J. Crusius, and A.W. Schroth. Leaf wax *n*-alkane distributions, stable isotope ratios, paleovegetation, and dust flux to reconstruct North Pacific climate during the last 2,000 years. American Geophysical Union Fall Meeting, San Francisco, CA, December 18, 2014.

OTHER ATTENDED CONFERENCES AND WORKSHOPS

Geo for Good Summit, (Google, virtual)	October 2020
13th Graduate Climate Conference (Woods Hole, MA)	November 2019
Geo for Good Summit, (Google, Sunnyvale, California)	September 2019
Demo Pod on “SMOKE Policy Tool for Indonesian Fires”	

Air Pollution Extremes Workshop, <i>invited</i> (Columbia University, New York, NY)	November 2018
Google Earth Engine User Summit (Google, Dublin, Ireland)	June 2018
Google Earth Engine Advanced Workshop (Google, Cambridge, MA)	March 2018
“Fire Prediction Across Scales” Conference (Columbia University, New York, NY)	October 2017

FUNDING

Liu, T., J.E. Nichols, and D.M. Peteet. Calibration of Fatty Alcohols as a Paleotemperature Proxy. LDEO Climate Center, April 2015, \$9,140

HONORS AND AWARDS

Graduate Student Associate, Mittal Institute, Harvard University	February 2021-
GSAS Professional Development Fund, Harvard University	September 2019
Bok Center Certificate of Distinction in Teaching, Harvard University	September 2019, April 2021
Runner-Up, 2018 Planetary Health Photography Contest	May 2018
Phi Beta Kappa , Columbia University	May 2017
Departmental Honors (Earth and Environmental Sciences), Columbia University	May 2017
NSF Graduate Research Fellowship (GRFP)	March 2017
AGU Outstanding Student Paper Award, Ocean Sciences	January 2017
Young Investigator Award, Columbia University	December 2016
WHOI Summer Student Fellow Travel Award	November 2016
Honorable Mention, ACTR National Post-Secondary Russian Essay Contest	May 2016
Core Scholar, Columbia University	April 2015

PROFESSIONAL SERVICE AND AFFILIATIONS

Primary Convener, Co-Session Chair at American Geophysical Union Fall Meeting (December 2020)
 “Aerosols and Air Pollution Extremes in South and Southeast Asia”
 - with Shraddha Dhungel and Ritesh Gautam

Co-Convener, Co-Session Chair at American Geophysical Union Fall Meeting (December 2019)
 “Air Pollution Extremes in South and Southeast Asia: Observations, Modeling, and Impact Studies”
 - with Shraddha Dhungel (primary convener) and Ritesh Gautam

Peer reviewer for *Water Resources Research*, *Scientific Reports*, *Remote Sensing*, *Environmental Pollution*, *Environmental Research Communications*, *Elementa*, *International Journal of Applied Earth Observations and Geoinformation*, and *International Journal of Digital Earth*.

Member of American Geophysical Union (2014 – present), Phi Beta Kappa (2017 – present), Sigma Xi (2017 – present)

MENTORING

Marie Panday, University of Maryland, Summer 2021

- Project: Trends in and Reconstruction of Smoke Days across the United States
- Harvard OEB REU (co-mentor with Makoto Kelp, Drew Pendergrass, and Loretta Mickley)

Miah Caine, Harvard University, Summer 2020 - Spring 2021

- Project: Agreement between the HMS Product and Ground-Level Smoke in the Pacific Northwest
- HUCE Summer Undergraduate Research Program (co-mentor with Makoto Kelp, Drew Pendergrass, and Loretta Mickley)

Kent Toshima, Harvard University, Summer 2020 - present

- Project: Application of Deep Learning to Detection of Wildfire Smoke in HMS over North America

- HUCE Summer Undergraduate Research Program (co-mentor with Makoto Kelp, Drew Pendergrass, and Loretta Mickley)

Caroline Liang, Harvard University, Summer 2020

- Project: Tracking Locust Outbreaks (EPS Short-Term Summer Student Program)

TEACHING EXPERIENCE

Teaching Fellow at Harvard University for SPU 12/GENED 1098: Natural Disasters
Spring 2019, Spring 2020, Fall 2020

- Lead weekly 2-hour lab sections (computer-based labs using ArcGIS + practical experiment labs), exam review/proctoring, office hours, and grading
- Develop GIS labs for open-source software: QGIS and Google Earth Engine
- Modify existing labs and create two new labs (on fires and COVID-19) for online learning
- Lead trainings on labs for TFs/TAs

LEADERSHIP AND OUTREACH

Articles

Liu, T. “A Bird’s-Eye View of Earth: Petabytes of Satellite Data at Our Fingertips.” *Science in the News*, Harvard University. April 14, 2020. [[Link](#)]

Liu, T. “Living in a World of Extreme Droughts, Floods, and Storms.” *Science in the News*, Harvard University. September 27, 2019. [[Link](#)]

Liu, T., M.E. Marlier, J.J. Buonocore, L.J. Mickley, and R.S. DeFries. “We built an app to detect areas most vulnerable to life-threatening haze.” *The Conversation Indonesia*. September 9, 2019. [[Link](#)]

Liu, T. “It’s Time to Value Disappearing Wetlands.” *Columbia Science Review*, Columbia University. Spring 2016. [[Link](#)]

Liu, T. “Finding Serenity Through Research.” *Columbia to the Core*, Columbia University. July 15, 2015. [[Link](#)]

Activities

EPS Day co-organizer, Harvard University	May 2019
Participant, Science-A-Thon	October 2018, 2019
Speaker ambassador, Inaugural Planetary Health/ GeoHealth Meeting	April 2017
Blog content manager, writer, and reviewer, Columbia Science Review	February 2014 – December 2016
Volunteer, Columbia Astronomy Public Outreach, Columbia University	February – July 2016
Volunteer, Discovery Science Center, Santa Ana, CA	2012 – 2013
Creator, writer, “The Cosmos”, astronomy blog	2012 – 2013

FIELD EXPERIENCE

Bog Sediment Coring and Sampling, Catskill Mountains, NY June – July 2015

Geologic Field Trips to Death Valley, CA (2014), Barbados (2016), Osservatorio Geologico di Coldigioco, Italy (2017), and One-Day At-Sea Practicum Cruise on the R/V Tioga (2016)

TECHNICAL SKILLS

Working level proficiency with computer languages: R, Python, MATLAB • GIS platforms: Google Earth Engine (in JavaScript, Python), QGIS, and ArcGIS • atmospheric models: STILT, HYSPLIT, GEOS-Chem
• other software/tools: HTML/CSS, Google Earth, L^AT_EX, GitHub/git, and Wordpress

Foreign Languages: Mandarin (native speaker), Russian (intermediate), French (beginning)