Shuyu Chang

NASA FINESST Graduate Research Fellow
Ph.D. Candidate in Geography
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RESEARCH

My research aims to quantify the interactions between hydrology and biogeochemistry and to better understand the impacts of climate change and human activities on water quality in the Anthropocene. I pursue these goals by producing datasets and developing models (process-based and machine learning models), with the ultimate objective of supporting decision-making for water resources management across various scales.

EDUCATION

2021-05/2025	Pennsylvania State University, University Park, PA Department of Geography Doctor of Philosophy in Geography (Water Resources) Advisor: Dr. Kimberly Van Meter
2019-2021	University of Illinois at Chicago, Chicago, IL Department of Earth and Environmental Science Doctor of Philosophy (transferred) Advisor: Dr. Kimberly Van Meter
2017-2018	Johns Hopkins University, Baltimore, MD Department of Environmental Health and Engineering Master of Science in Engineering in Water Resources Engineering Advisor: Dr. Ciaran J. Harman
2012-2015	China Agricultural University, Beijing, China College of Water Resources and Civil Engineering Bachelor of Science with Highest Honors in Hydraulic and Hydropower Engineering. Minor: Finance
2015-2016	University of Connecticut, Storrs, CT Department of Nature Resources and the Environment Undergraduate Exchange Student Advisor: Dr. Danial Civco

EMPLOYMENT

2024 summer	Science lead Chesapeake Water Summer Institute Pennsylvania State University
2022-present	NASA Future Investigators in NASA Earth and Space Science and Technology (FINESST) Graduate Research Fellow

	Pennsylvania State University
2023 Fall	Graduate Research Assistant Los Alamos National Laboratory
2023 summer	Applied Machine Learning Graduate Research Fellow Los Alamos National Laboratory
2022 summer	NOAA- Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI) National Water Center Graduate Research Fellow National Water Center, University of Alabama
2021-2022	Graduate Research Assistant Pennsylvania State University
2021 summer	NASA DEVELOP Summer Internship Science Systems and Applications, Inc.
2019-2021	Graduate Research Assistant and Teaching Assistant University of Illinois at Chicago

PUBLICATIONS

All papers are available upon request
**Indicates co-first authors*

Journal Articles (Published)

Chang, S. Y., Ghahremani, Z., Manuel, L., Erfani, M., Shen, C., Cohen, S., Van Meter, K. J., Pierce, J. L., Meselha, Ehab., Goharian, E. (2024) The geometry of flow: Advancing predictions of river geometry with multi-model machine learning. *Water Resources Research,* 60(10), 036733. DOI: 10.1029/2023WR036733

Chang, S. Y., Zhang, Q., Byrnes, D. K., Basu, N. B., & Van Meter, K. J. (2021). Chesapeake legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality. *Environmental Research Letters*, *16*(8), 085002. DOI: 10.1088/1748-9326/ac0d7b

Van Meter, K. J., Schultz, V. O., & **Chang, S. Y.** (2023). Data-driven approaches demonstrate legacy N accumulation in Upper Mississippi River Basin groundwater**.** *Environmental Research Letters*, *18*(9), 094016. DOI: 10.1088/1748-9326/acea34

Journal Articles (Under Review/Revision)

Chang, S. Y.*, Byrnes, D.K.*, Basu, N.B., Van Meter, K. J. (Submitted 08/2024). gTREND-Nitrogen - Long-term nitrogen mass balance data for the contiguous United States (1930-2017). *Scientific Data.*

Chang, S. Y., Schwenk, J., Solander, K. (Submitted 09/2024). Advancing Arctic River temperature predictions using a deep-learning approach. *Water Resources Research*. DOI: 10.22541/au.172745845.52823366/v1

Manuscripts (In prep)

Chang, S. Y., Zhang Q., Basu, N.B., Van Meter, K. J. Past Trajectories and Future Horizon: the Ecological functions of the Reservoirs Systems in Chesapeake Bay. Will be submitted to *Earth's Future.*

Chang, S.Y.*, Aboelyazeed, D.*, Sawadekar, K., Chavada, D., Shen C., Van Meter, K. J. Integrated Watershed Attributes, and Nutrient Database (IWAND): long-term, large-scale nutrient samples and paired inputs for water quality modeling for the Contiguous United States (1980-2023). Will be submitted to *Scientific Data.*

Byrnes, D.K., **Chang, S. Y.**, Basu, N.B., Van Meter, K. J., Sustainable Phosphorus: Balancing Food Security and Ecosystem Health. Will be submitted *Nature Food*

Dataset (Published)

Chang, S. Y., Ghahremani, Z., Manuel, L., Erfani, S. M. H., Shen, C., Cohen, S., et al. (2024). Stream Reach Evaluation and Metrics - Geometry (STREAM-geo) (Version 1). figshare. DOI: 10.6084/m9.figshare.24463240.v1

FUNDING (Total: $157,000)

Project Title: "Dams, nutrients, and water quality: The application of remote sensing and machine learning for detection and prediction of algal blooms in Chesapeake Bay Watershed reservoirs"
Role: PI (Future Investigator)
Funding Source: Future Investigators in NASA Earth and Space Science and Technology
Amount: $150,000

Project Title: "Using Automated Remote Sensing and Deep Learning to Small Reservoir Identification and Water Quality Modeling in Lake Michigan Watersheds"
Role: PI
Funding Source: Illinois-Indiana Sea Grant
Amount: $7,000

HONORS & AWARDS (Total: $39,810)

Fellowships

2023	Los Alamos National Laboratory Applied Machine Learning Graduate Research Fellowship	$18,000
2022	NOAA-CUAHSI National Water Center Innovators Program Summer Institute Fellowship	$2,500 +stipend
2016	ConnecticutView Remote Sensing Undergraduate Research Fellowship	$1,000

Awards

2023	Best Presentation in the Earth and Space Sciences Division, Los Alamos National Laboratory Student Symposium	
2022	Second Place, College of Earth and Mineral Sciences Graduate Student Research Showcase, Pennsylvania State University	$750
2022	First Place of Ph.D. Proposal, E. Willard Miller Award in Geography, Pennsylvania State University	$600
2022	Ann C. Wilson Graduate Fellowship, College of Earth and Mineral Sciences, Pennsylvania State University	
2022	Second Place, Association of American Geographers (AAG) Remote Sensing Specialty Group (RSSG) Student Illustrated Paper Competition	$200
2022	HydroML Symposium Student Travel Grant	$190
2022	Coastal & Estuarine Research Federation (CERF) Sponsored Jointed Aquatic Sciences Meeting Travel Grant	$350
2021	Grand prize, American Geographical Union (AGU) Michael H. Freilich Student Data Visualization Competition	$6,000
2021	Marilyn L. Fogel Student Research Fund in Biogeosciences, Earth and Environmental Systems Institute, Pennsylvania State University	$1,500
2021	Earth and Environmental Systems Institute Graduate Scholarship, Pennsylvania State University	$2000
2021	Coastal and Estuarine Research Student Participant Award, Coastal and Estuarine Research Foundation (CERF) Conference	$200
2021	Ruby S. Miller Endowment for Geographic Excellence, Department of Geography, Pennsylvania State University	$520
2019	Provost’s Graduate Research Award, University of Illinois at Chicago	$5,000
2019	College of Liberal Arts and Sciences Travel Grant, University of Illinois at Chicago	$500
2018	CUAHSI Student Travel Grant	$500
2016	Beijing Outstanding College Graduates	
2016	Outstanding Graduates of China Agricultural University	

2012-2015	Outstanding Student Scholarship, China Agricultural University

TEACHING

2024 Fall	Guest Lecturer ENE 350 Landscape Geochemistry Franklin & Marshall College
2022 Fall	Instructor GEOG 494 Research Project Pennsylvania State University
2022 Spring	Instructor GEOG 494 Research Project Pennsylvania State University
2019 Fall	Teaching Assistant EAES 101 Global Environmental Change University of Illinois at Chicago
2019 Spring	Teaching Assistant EAES 101 Global Environmental Change University of Illinois at Chicago
2018 Fall	Teaching Assistant EHE 570 Hydrology Johns Hopkins University

MENTORSHIP

Samrin Sumaiya (2024 summer)	PhD student, Geography at Pennsylvania State University
Elham Mahmod Por (2024 summer)	PhD student, Civil and environmental engineering at Pennsylvania State University
Safiya Alpheus (2024 summer)	PhD student, Geoscience at Pennsylvania State University
Dr. Meena Kumari Kolli (2024 summer)	Post doc, Geography at Pennsylvania State University
Fariha Ferdous (2024 summer)	Master student, Civil and environmental engineering at Pennsylvania State University
Sam Cohen (2024 Spring)	Master student, Geography at Pennsylvania State University
Ben Russell	Undergrad researcher, Civil and environmental

(2022 Spring)	engineering at Pennsylvania State University
Noah Rogers (2022 Fall)	Undergrad researcher, Geography at Pennsylvania State University
Ryan Armani (2022 Fall-2023 Spring)	Undergrad researcher, Geography at Pennsylvania State University
Matt Ziminski (2019 Fall-2020 Spring)	Undergrad researcher, Computer Science and Mathematics at University of Illinois at Chicago

PROFESSIONAL SERVICE

Journal Reviewer

Frontier in Earth Sciences, Advances in Water Resources, Annals of the American Association of Geographers

Grant Reviewer

2022 AGU Michael H. Freilich Student Data Visualization Competition

Scholarly Conference Committee

2022-2024 Chesapeake Community Research Symposium 2024

Session Coordinator/Panelist

2024 Plenary session lead and moderator
"Beyond 2025: Visionary Paths in the Chesapeake Bay Restoration by the Next Generation"
Chesapeake Community Research and Modeling Symposium, Annapolis, MD

2024 Special session convener
"Modern Research Innovations Harnessing Big Data, Machine Learning, and Remote Sensing for Advanced Estuarine Ecosystem Modeling and Monitoring"
Chesapeake Community Research and Modeling Symposium, Annapolis, MD

2024 Panelist
"Career development for the Research Experiences for Undergraduates (REU) in Climate Science program"
Penn State University, University Park PA

2023 Session convener
"Legacy Effects of Land Use on Water Quality, Watershed Processes, and Ecosystem Function"
American Geophysical Union Annual Meeting, San Francisco, CA

2022 Townhall convener

	"Building Your Network – Collaborating as an Early Career Hydrologist" American Geophysical Union Annual Meeting, Chicago, IL
2022	Session convener "Early Career Virtual Networking Event" American Geophysical Union, Online
2019	Panelist "Navigate Graduate School in Earth and Environmental Science Program" University of Illinois at Chicago, Chicago, IL

Committee

2022-2025	Chesapeake Community Modeling Program's Steering Committee (CCMP) First student committee member
2021-2022	AGU Hydrology Section Student Subcommittee (H3S) Student committee member
2021-2022	Department of Geography, Pennsylvania State University Graduate student committee member

FEATURED MEDIA

Shuyu's research was funded by the Illinois-Indiana Scholar program. ***IISG news***. Available at https://iiseagrant.org/meet-our-grad-student-scholars-shuyu-chang/

Shuyu's research was introduced by the AGU Ecohydrology post. ***AGU Ecohydrology Blog.*** Available at https://www.aguecohydrology.org/blog-adding-our-leaves/meet-a-leaf-shuyu-chang

Shuyu's research was awarded the NASA FINESST. ***Penn State news.*** Available at https://sc-cms.psu.edu/earth-and-mineral-sciences/story/geography-student-awarded-nasa-funding-study-harmful-algal-blooms

Shuyu's research was awarded the UIC Provost's Graduate Research Award. ***UIC news***. Available at https://eaes.uic.edu/news-stories/shuyu-chang-selected-for-a-uic-provosts-graduate-research-award/

Shuyu's proposal was funded by the EESI Marilyn L. Fogel Student Research Fund in Biogeosciences. ***PSU EESI news***. Available at https://www.eesi.psu.edu/news/news-archive-2021-institute-names-inaugural-recipients-marilyn-l-fogel-fund

Shuyu and her Chesapeake ELEMeNT-N work was featured at the Chesapeake Community Modelling Program. ***CCMP newsletter***. Available at https://mailchi.mp/77fbc6ce5631/ccmp-newsletter-december-6114474?e=926687c614#Modeler

PRESENTATIONS

Invited Presentations/Seminars

2023 A deep-learning approach to predict river temperature in Alaska, Interdisciplinary Research for Arctic Coastal Environments (InteRFACE) Permafrost Hydrology Monthly Meeting, online

2023 Dams, nutrients, and water quality in the Chesapeake Bay Watershed: past trajectories and future horizons, Earth and Environmental Sciences Lunch and Learn Seminar Series, Los Alamos, NM

2022 The Application of Remote Sensing and Machine Learning to Improve Early Warning Systems for Harmful Algal Events in the Highland Lake Chains, American Geographical Union Annual Meeting 2022, Chicago, IL

Professional Conference Presentations with Awards

2023 Chang, S. Y., Schwenk, J., Solander, K., Data-driven Approaches to Study Arctic River Temperatures, Los Alamos National Lab Student Research Symposium 2023, Los Alamos, NM (**LANL student presentation award**)

2022 Chang, S. Y., “Data Driven Approaches for Estimating River Channel Geometry over the Continental United States”. College of Earth and Mineral Sciences Graduate Student Research Showcase 2022, Pennsylvania State University. University Park, PA (**PSU student presentation award)**

2022 Chang, S.Y., Radwin, M., Hietpas, K., Pletcher, A., Hammock, R., Urquhart, E., The Application of Remote Sensing and Machine Learning to Improve Early Warning Systems for Harmful Algal Events in the Highland Lake Chains, American Association of Geographers Annual Meeting 2022, online (**AAG student presentation award**)

2021 Chang, S.Y., Radwin, M., Hietpas, K., Pletcher, A., Hammock, R., Urquhart, E., Van Meter, K. J., The Application of Remote Sensing and Machine Learning to Improve Early Warning Systems for Harmful Algal Events in the Highland Lake Chains, American Geographical Union Fall Meeting 2021, New Orleans, LA (**NASA Hyperwall Talk, AGU Michael H. Freilich Student Data Visualization award**)

Professional Conference Presentations (only list first-author presentations)

2024 Chang, S.Y., Aboelyazeed, D., Sawadekar, K., Chavada, D., Shen C., Van Meter, K. J. Large-scale predictions of water quality: dataset, models, and learning framework, Chesapeake Research Symposium 2024, Annapolis, MD (*Talk*)

2024	Chang, S.Y., Zhang, Q., Basu, N.B., Van Meter, K. J. Past trajectories and future horizons of water quality in the Chesapeake Bay reservoir system, Chesapeake Research Symposium 2024, Annapolis, MD (*Talk*)
2024	Chang, S.Y., Dams, nutrients, and water quality in the Chesapeake, Penn State Water Conference 2024, University Park, PA (*Talk*)
2023	Chang, S. Y., Schultz, V. O, Van Meter, K. J., Data-driven approaches demonstrate legacy N accumulation in Upper Mississippi River Basin groundwater, Geological Society of America Annual Meeting 2023, Pittsburgh, PA (*Talk*)
2023	Chang, S. Y., Ghahremani, Z., Manuel, L., Efani, M., Van Meter, K. J., Pierce, J., Meselhe, E., Goharian, E., Cohen, S., Shen, C., Unraveling patterns in river geometry: Multi-model machine learning for continental-scale predictions, Geological Society of America Annual Meeting 2023, Pittsburgh, PA (*Talk*)
2023	Chang, S. Y., Schwenk, J., Solander, K., Data-driven Approaches to Study Arctic River Temperatures, InteRFACE Virtual Poster Meeting 2023, online (*Poster*)
2022	Chang, S. Y., Ghahremani, Z., Manuel, L., Efani, M., Van Meter, K. J., Pierce, J., Meselhe, E., Goharian, E., Cohen, S., Shen, C., Data Driven Approaches for Estimating River Channel Geometry over the Continental United States. American Geographical Union Fall Meeting 2022, Chicago, IL (*Talk*)
2022	Chang, S.Y., Zhang, Q., Basu, N.B., Van Meter, K. J., Dams, nutrients, and water quality: A study of time-explicit reservoir ecological functions in the Chesapeake Bay Watershed, American Geographical Union Fall Meeting 2022, Chicago, IL (*Talk*)
2022	Chang, S. Y., Data Driven Approaches for Estimating River Channel Geometry over the Continental United States". The 17th River Symposium, Bucknell, PA (*Talk*)
2022	Chang, S.Y., Zhang, Q., Byrnes, D.K., Basu, N.B., Van Meter, K. J., "Chesapeake Legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality," Chesapeake Community Research and Modeling Symposium 2022, Annapolis, MD (*Talk*)
2022	Chang, S.Y., Zhang, Q., Byrnes, D.K., Basu, N.B., Van Meter, K. J., "Chesapeake Legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality," Jointed Aquatic Sciences Meeting 2022, Grand Rapids, MI (*Talk*)
2022	Chang, S. Y., "Data Driven Approaches for Estimating River

Channel Geometry over the Continental United States". ICDS Fall Symposium 2022: Data Science, AI, and a Sustainable, Resilient, and Equitable Future, University Park, PA (*Poster*)

2022 Chang, S.Y., "Chesapeake Legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality," HydroML Symposium 2022, University Park, PA (*Talk*)

2021 Chang, S.Y., Zhang, Q., Byrnes, D.K., Basu, N.B., Van Meter, K. J., Chesapeake Legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality, American Geographical Union Fall Meeting 2021, New Orleans, LA (*Poster*)

2021 Chang, S.Y., Chesapeake Legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality, Coastal & Estuarine Research Federation Biennial Conference 2021, Online (*Talk*)

2021 Chang, S.Y., Chesapeake Legacies: The importance of legacy nitrogen to improving Chesapeake Bay water quality, Society for Freshwater Science Conference 2021, Online (*Talk*)

2019 Chang, S.Y., Zhang, Q., Byrnes, D.K., Basu, N.B., Van Meter, K. J., Water Futures: Legacy Nitrogen and Chesapeake Bay Water Quality, American Geographical Union Fall Meeting 2019, San Francisco, CA (*Poster*)

2018 Chang, S.Y., Wilusz, D.C., Harman, C.J., Effects of seasonal and long-term climate variability on nitrate export in the Chesterville Branch catchment of the Eastern Shore, MD, American Geographical Union Fall Meeting 2018, DC (*Talk*)

2018 Chang, S.Y., Wilusz, D.C., Harman, C.J., Effects of seasonal and long-term climate variability on nitrate export in the Chesterville Branch catchment of the Eastern Shore, MD, Chesapeake Community Research and Modeling Symposium 2018, Annapolis, MD (*Talk*)

2018 Chang, S.Y., Wilusz, D.C., Harman, C.J., Effects of seasonal and long-term climate variability on nitrate export in the Chesterville Branch catchment of the Eastern Shore, MD, CUAHSI Biennial Colloquium 2018, Shepherdstown, WV (*Poster*)

2016 Chang, S.Y., MODIS Snow Cover Products Accuracy Assessment for Winters in Connecticut, ConnecticutView Student Fellowship Presentation 2016, Storrs, CT (*Poster*)

TRAININGS/CERTIFICATIONS

2024	Water Academy Workshop, University Park, PA
2023	GEOvista GIS-ML Workshop, University Park, PA
2019	Environmental Models and Bayesian Methods, Waterloo, ON, Canada
2018	Integrated Simulation of Watershed Systems Using ParFlow, Golden, CO

PROFESSIONAL MEMBERSHIPS

American Geophysical Union
Geological Society of America
Association of American Geographers