

Donghui Li, Ph.D.

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RESEARCH SUMMARY

My research advances large-scale hydrological and water resources modeling by integrating machine learning and process-based approaches, emphasizing applications in flood risk assessment, with an emerging focus on AI-driven decision support for risk communication.

RESEARCH INTERESTS

- Large-scale Hydrological and Water Resources Modeling
- Machine Learning and AI for Hydrology
- Extreme Events and Risk Analysis

EDUCATION

2020.08 – 2024.08	Ph.D. in Civil and Environmental Engineering with a minor in Statistics <i>University of Illinois Urbana-Champaign, USA</i>
2018.08 – 2020.08	M.S. in Civil and Environmental Engineering <i>University of Illinois Urbana-Champaign, USA</i>
2014.09 – 2018.09	B.E. in Hydraulic Engineering <i>Tsinghua University, China</i>

PROFESSIONAL EXPERIENCE

2024.09 – present	Postdoctoral Research Associate <i>Princeton University, USA</i>
2025.01 – 2025.05	Lecturer <i>Princeton University, USA</i>
2018.08 – 2024.08	Graduate Research Assistant <i>University of Illinois Urbana-Champaign, USA</i>

PUBLICATIONS

Published

- Li, D., & Villarini, G. (2026). Parsimonious and transferrable parameterization of reservoir operations: A modular approach for large-scale modeling. *Journal of Advances in Modeling Earth Systems*, 18(2). <https://doi.org/10.1029/2025MS005180>.
- Shi, H., Cai, X., Hu, X., Jamal, A., Li, D., Sun, C., & Liang, X. Z. (2025). A sub-seasonal to seasonal climate forecast informed irrigation scheduling tool for the Contiguous United States. *Environmental Modelling & Software*, 106819. <https://doi.org/10.1016/j.envsoft.2025.106819>.

- **Li, D.**^{*}, Vora, A.^{*}, & Cai, X. (2025). Streamflow simulation improvements enabled by a state-of-the-art algorithm for reservoir routing in the US National Water Model. *JAWRA Journal of the American Water Resources Association*. <https://doi.org/10.1111/1752-1688.13244>.
- **Li, D.**^{*}, Chen, Y.^{*}, Lyu, L., & Cai, X. (2024). Uncovering historical reservoir operation rules and patterns: Insights from 452 large reservoirs in the contiguous United States. *Water Resources Research*. <https://doi.org/10.1029/2023WR036686>.
- Vora, A., Cai, X., Chen, Y., & **Li, D.** (2024). Coupling reservoir operation and rainfall-runoff processes for streamflow simulation in watersheds. *Water Resources Research*. <https://doi.org/10.1029/2023WR035703>.
- Chen, Y.^{*}, **Li, D.**^{*}, Zhao, Q., & Cai, X. (2022). Developing a generic data-driven reservoir operation model. *Advances in Water Resources*. <https://doi.org/10.1016/j.advwatres.2022.104274>.
- Zhao, Q.^{*}, **Li, D.**^{*}, & Cai, X. (2021). Online generic diagnostic reservoir operation tools. *Environmental Modelling & Software*. <https://doi.org/10.1016/j.envsoft.2020.104918>.

Under Review

- **Li, D.**, Michalek, A., & Villarini, G. (Revised & Resubmitted). Assessing the Global Performance of a Parsimonious Soil Temperature Model for Frozen Ground Prediction. *Journal of Hydrology*.
- Pu, T., Villarini, G., Amorim, R., **Li D.**, Gangrade, S., Durr, M., Janssen B. (under review) High-Resolution Modeling of Nonlinear Flood Risk in the Santee Sioux Nation. *Geophysical Research Letter*.
- Cai, X., Chen, Y., Vora, A., **Li, D.**, Zheng, Z., Houtven, G., & Delaney, C. (Revised & Resubmitted). Forecast-Informed Reservoir Operation and Forecast Improvement with Reservoir Modification: A Perspective from Research to Practice in the United States. *Journal of Water Resources Planning and Management*.
- Michalek, A., **Li, D.**, Pu, T., and Villarini, G. (Revised & Resubmitted) Machine learning-based estimation of velocity-discharge power law parameters for ungauged locations. *Journal of Advances in Modeling Earth Systems*.

In Preparation

- **Li, D.**, Michalek, A., Binjolkar, M., Villarini, G., Cai, X. (2026) Tiger-HLM-WM: A Coupled large-scale hydrological and water management model.
- Michalek, A., Amorim, R., **Li, D.**, Binjolkar, M., Pu, T., Villarini, G., Done, J.M., and Gangrade, S. (2026) High-resolution flood inundation maps across the contiguous United States under historical and pseudo-global warming scenarios.
- Michalek, A., Binjolkar, M., Villarini, G., Amorim, R., **Li, D.**, Pu, T. (2026) Towards a calibration-free and hillslope-level conceptual hydrologic model.
- Binjolkar, M., Michalek, A., Amorim, R., **Li, D.**, Maebius, S., Pu T., Biswas, A., Ethier, S., Villarini G. (2026) Tiger-HLM: A GPU-Accelerated Distributed Hydrologic Model.

* Senior authorship shared.

SOFTWARE AND DATA

- **GDRM | Co-Developer | [Link](#)**:
 - Machine-learning-based reservoir operation rules for 450+ CONUS reservoirs.
 - Co-developed the machine learning algorithm and data pipeline.

- **Tiger-HLM | Contributor | [[Link](#)]:**
 - A high-performance, process-based hydrological model (rainfall-runoff-routing) accelerated via GPU (CUDA) and OpenMP.
 - Implemented the snow and soil temperature modules for better cold-region representation.
 - Implemented I/O module to support large-scale simulations.
- **Tiger-HLM-WM | Developer | [Forthcoming]**
 - A version of Tiger-HLM framework to include coupled water management for regulated streamflow.

CONFERENCE PRESENTATIONS

- **Li, D. & Villarini, G. (2025 Dec.).** Parsimonious and Transferrable Parameterization of Reservoir Operations: A Modular Approach for Large-Scale Modeling. *AGU 2025 [poster]*.
- **Li, D., Michalek, A., & Villarini, G. (2025 Dec.).** Global Products for Cold-Region Hydrological Modeling: Precipitation Phase Partitioning and Frozen Ground Status Prediction. *AGU 2025 [poster]*.
- **Pu, T., Villarini G., Amorim R., Li, D., Gangrade, S., Durr, M., & Janssen B. (2025 Dec.):** High-Resolution Flood Inundation Mapping of U.S. Tribal Nations Under Current and Future Conditions: The Case of the Santee Sioux Nation. *AGU 2025 [poster]*.
- **Li, D. & Cai, X. (2024 Dec.).** Water Supply Drought Under Reservoir Regulation: Understanding Impacts and Developing an Integrated Drought Index. *AGU 2024 [poster]*.
- **Barresi Armoa, O. L., Arnold, J., Li, D., Chen, Y., Cai, X., Sauvage, S., & Sánchez-Pérez, J. M. (2024 Jul.).** Development of reservoir operation functions in SWAT+ using a generic data-driven reservoir operation model. *2024 Strasbourg, France SWAT Conference [oral]*.
- **Vora, A., Li, D., Chen Y., & Cai, X. (2024 Jun.).** Changes in Regional Water Availability Resulting from Human Interferences in Hydrology. *CIROH 2024 [poster]*.
- **Vora, A., Cai, X., Chen Y., & Li, D. (2024 May).** Regional Water Availability Changes Resulting from Human Interferences in Hydrology. *EWRI 2024 [oral]*.
- **Li, D., Chen Y., & Cai, X. (2023 Dec.).** Understanding Real-world Reservoir Operation with a Data-driven Approach for Enhanced Hydrological and Water Resources Simulations. *AGU 2023 [poster]*.
- **Vora, A., Cai, X., Chen Y., & Li, D. (2023 Dec.).** Coupling Reservoir Operation with Rainfall-Runoff Processes to Simulate Streamflow in Watersheds. *AGU 2023 [poster]*.
- **Li, D., Chen Y., Zhao Q., & Cai, X. (2023 May).** Operation rules and patterns for 450+ large reservoirs in the Contiguous United States. *EWRI 2023 [oral]*.
- **Li, D., Chen Y., & Cai, X. (2023 Feb.).** Data-driven Operation Rules for Reservoirs Across the CONUS. *USACE R & D Day 2023 at UIUC [poster]*.
- **Li, D., Chen Y., Zhao Q., & Cai, X. (2022 May).** Improving the human dimension of hydrological simulation based on a data-driven reservoir operation model. *EWRI 2022 [oral]*.
- **Chen Y., Li, D., Zhao Q., & Cai, X. (2022 May).** Developing a generic data-driven reservoir operation model. *EWRI 2022 [oral]*.
- **Li, D., Zhao Q., & Cai, X. (2021 May).** DROT – A Diagnostic Reservoir Operation Tool. *EWRI 2021 [oral]*.
- **Li, D., Zhao Q., & Cai, X. (2019 May).** Decision support tool for reservoir operation based on derived rules. *EWRI 2019 [oral]*.

AWARDS & FELLOWSHIPS

- Mavis Future Faculty Fellowship 2023, University of Illinois Urbana-Champaign
“to facilitate the training of the next generation of great engineering faculty.”
- Conference Travel/Presentation Award 2021 & 2023, University of Illinois Urbana-Champaign
- Yen Fellowship 2018, University of Illinois Urbana-Champaign
- Academic Excellence Scholarship 2016 & 2017, Tsinghua University

TEACHING EXPERIENCE

Teaching Assistant, University of Illinois Urbana-Champaign

CEE434 Environmental Systems I 2021 Fall, 2022 Fall, 2023 Fall

- Lectured fundamentals of machine learning, and the applications to water resources engineering.
- Graded assignments and held office hours.

Computing Teaching Assistant, University of Illinois Urbana-Champaign

All computing-required courses within the CEE curriculum 2024 Spring

- Led weekly seminars and tutorials focused on scientific programming.
- Held regular office hours providing technical assistance to students with programming problems.

Wintersession Co-Facilitator, Princeton University

Introduction to Physical Hydrological Modeling 2025 Wintersession

- Lectured fundamentals of physically based hydrological modeling.
- Led a hands-on training workshop on the SWAT model.

Lecturer, High Meadows Environmental Institute, Princeton University

ENV423 Hydroclimatology 2025 Spring

- Co-developed and delivered course materials for CEE423 Hydroclimatology with Prof. Villarini.
- Lectured fundamentals of Python programming and the applications in hydroclimatology and statistical hydrology.

TECHNICAL SKILLS

- Programming & Tools: Python, R, C/C++, Fortran, Matlab, SQL, Git, Scikit-learn, PyTorch, LATEX
- Hydrologic & Hydraulic: VIC, WRF-Hydro, SWAT, TRITON, Tiger-HLM
- High-performance Computing: UNIX/Linux, Bash scripting, MP/MPI, Kokkos

ACADEMIC AND VOLUNTEER SERVICE

- Journal Reviewer: *Earth's Future*, *Ecological Indicators*, *Hydrology and Earth System Sciences*, *Journal of the American Water Resources Association*, *Water Resources Research*.
- Session Moderator for Environmental & Water Resources Institute (EWRI) Conference, 2022.
- Early Career Convener for AGU2025: “H004 - Advancements in Physics-based, Integrated Hydrologic Modeling to Support Water Resources Management”

PROFESSIONAL AFFILIATIONS

- Member, American Geophysical Union (AGU)
- Member, American Society of Civil Engineers (ASCE)