Jiangchao QIU

54-1823, Ames St, Cambridge, MA 02139, USA +1 (617) 230-1103 qiujch24@mit.edu
X @JiangchaoQiu MainPage Scholar

SHORT BIO

I am a Postdoctoral Associate at MIT/EAPS (since April 2023), advised by Dr. Sai Ravela, in collaboration with Prof. Kerry Emanuel and Prof. Miho Mazereeuw, and funded by two MIT Climate Grand Challenge Flagship Projects. My research spans physical oceanography, atmospheric science, and terrestrial hydrology, with a focus on ocean–atmosphere–land interactions, climate adaptation solutions, and the application of emerging AI methods in Earth sciences.

My current work at MIT focuses on developing probabilistic, hyper-resolution flood-inundation risk maps for vulnerable regions worldwide, such as Bangladesh, Southeast Florida, Puerto Rico, and Boston, under various climate scenarios, using a multidisciplinary downscaling–hydrodynamic modeling framework accelerated by machine learning. This research addresses the impacts of climate extremes—particularly tropical cyclones, seasonal extreme rainfall, and sea-level rise—and aims to empower frontline communities by enhancing disaster resilience, strengthening coastal strategies, and advancing climate adaptation.

EDUCATION

Ph.D. *in Physical Geography* — *Sun Yat-sen University*
Sep 2018 – Dec 2022, Guangzhou, China

Advisor: Prof. Bingjun Liu

Dissertation: Driving mechanisms and projections of compound floods in the complicated river network.

Ph.D. (CSC joint-educated, 1 year) — *National University of Singapore*
May 2021 – Jun 2022, Singapore

Advisor: Prof. Xiaogang He

M.Eng. *in Hydraulic Engineering* — *Sun Yat-sen University*
Sep 2016 – Jun 2018, Guangzhou, China

Advisor: Prof. Bingjun Liu

Thesis: Impacts of hydropower cascade development on ecohydrological processes in the middle and lower reaches of the Lancang (upper Mekong) River.

B.Eng. *in Hydraulic & Hydropower Engineering* — *China Three Gorges University*
Sep 2012 – Jun 2016, Yichang, China

Advisor: Prof. Yu Wang

Thesis: Design of plant layout and generating-unit selection for the CJY hydropower complex.

PROFESSIONAL EXPERIENCE

Postdoctoral Associate — *Massachusetts Institute of Technology*
Apr 2023 – Present, Cambridge, MA, USA

Advisor: Dr. Sai Ravela

- Tropical-cyclone downscaling and hydrodynamic inundation modeling for Bangladesh and the U.S. coastline
- Core contributor in compound/cascading flooding, active learning for searching extremes, and coastal risk mapping

PUBLICATIONS

Manuscripts under Review

Huang, Z., **Qiu, J.**, et al. Anthropogenic warming quadruples recent unprecedented snow droughts in the Asian Water Tower. *under review, Weather and Climate Extremes*.

Wang, X., Duan, K., Sun, G., Liu, H., **Qiu, J.**, Wang, X., Huang, Z., Peng, H. A modeling framework for disentangling the impacts of changing climate and land uses on terrestrial water–carbon balance under SSP–RCP scenarios. *under review, Journal of Hydrology*.

Jiang, Q., Wang, H., Long, B., Li, S., **Qiu, J.**, Zhang S., Li C., He X,. Complex networks reveal climate models' capability in simulating global synchronized extreme precipitation. *under review, Geophysical Research Letters*.

Peer-reviewed Journal Articles

Qiu, J.†, Ravela, S†., & Emanuel, K. (2025). From decades to years: Rising seas and cyclones amplify Bangladesh's storm-tide hazards in a warming climate. *One Earth*, 8(4). Media coverage: MIT News; The Independent; Yahoo News; Business Today; TV9 Bharatvarsh; Down To Earth; Prothom Alo; The Business Standard

Jiang, G., **Qiu, J.**, & Ravela, S. (2024). LASSE: Learning Active Sampling for Storm Tide Extremes in Non-Stationary Climate Regimes. *arXiv*:2501.00149.

Qiu, J., Liu, B., Yang, F., Wang, X., & He, X. (2022). Quantitative stress test of compound coastal–fluvial floods in China's Pearl River Delta. *Earth's Future*, 10(5), e2021EF002638.

Qiu, J., Liu, B., Yu, X., & Yang, Z. (2021). Combining a segmentation procedure and the BaRatin stationary model to estimate nonstationary rating curves and associated uncertainties. *Journal of Hydrology*, 597, 126168.

Qiu, J., Liu, B., Yang, Z., Peng, W. (2020). Uncertainty analysis of estimated discharge based on stage-discharge rating curves. *Advances in Water Science*, 31(2), 214–223.

Hu, S., Liu, B., **Qiu, J.**, Zeng, H., Zhang, M., Li, D. (2023). Nonlinear effects of a storm surge in the Pearl River estuary. *Marine Sciences*, 47(1):1–12. (in Chinese)

Peng, W., Liu, B., **Qiu, J.**, Zeng, H., Zhang, M., Li, D. (2020). The ecological flow of the middle and lower reaches of the Lancang River based on priority protection fishes identification. *Acta Scientiarum Naturalium Universitatis Sunyatseni*, 59(3): 43-50. (in Chinese)

Peng, W., Liu, B., Liao Y., **Qiu, J.** (2018). The ecological flow of the middle and lower reaches of the Lancang River based on priority protection fishes identification. *Journal of China Hydrology*, 38(6):7-11. (in Chinese)

Note: † Corresponding author.

PATENTS AND SOFTWARE

Liu, B., **Qiu, J.**, Tan, X., et al. (2019). A method for determining the rating curve in natural rivers based on Bayesian theory. China Patent. Zl201811518558.3.

Liu, B., Yang, Z., **Qiu, J.**, et al. (2019). A method for analyzing the stage series error based on stage–discharge rating curves. China Patent. Zl201910779160.3.

Qiu, J., Liu, B., Zhou, F. (2020). Rating curve calibration system based on Bayesian theory in natural river channels v1.0. 2020SR1207020.

Qiu, J., Liu, B., Zhou, F. (2021). Automated unstructured mesh generating system for hydrodynamic models in the Pearl River Estuary based on OceanMesh2D v1.0. Computer Software Copyright Registration No.2021SR0251878.

Qiu, J., Liu, B., Zhou, F. (2021). Stage–discharge rating-curve series denoising and segmentation toolkit. Computer Software Copyright Registration No. 2021SR0393317.

Zhou, F., Liu, B., **Qiu, J.** (2021). Saltwater intrusion prediction system based on error correction–online sequential extreme learning machine (EC-OSELM). Computer Software Copyright Registration No. 2021SR0339316.

Zhou, F., Liu, B., **Qiu, J.** (2021). Short-, medium-, and long-term nested real-time rolling prediction system for saltwater intrusion based on the OSELM model. Computer Software Copyright Registration No. 2021SR0339317.

PROJECTS EXPERIENCE (SELECTED)

During Postdoc / Massachusetts Institute of Technology

MIT Climate Grand Challenge Flagship Project (April 2023–Present) – *Preparing for a New World of Weather and Climate Extremes*. Role: Core contributor — TC downscaling, ocean circulation model development and validation (ADCIRC), hydrological-hydrodynamic model development (SFINCS), compound flood inundation, hazards and risks mapping, decision-support tools.

MIT Climate Grand Challenge Flagship Project (April 2023–Present) – *Reinventing climate change adaptation with the Climate Resilience Early Warning System (CREWSnet)*. Role: Core contributor - TC downscaling, ocean circulation model development and validation (ADCIRC), hydrological-hydrodynamic model development (VIC, CaMa-Flood, SFINCS), cascading flood inundation, hazards and risks mapping, climate attribution.

During Ph.D. (Sun Yat-sen University)

National Natural Science Foundation of China - 52179029 (2022-2025). - *Mechanism and Risk Assessment of Storm Surge in the Complex Estuary under the Additive Effect of Multiple Environmental Loads on the Sea and Land*. Core contributor - hydrodynamic model development (ADCIRC).

National Natural Science Foundation of China - 51879289 (2019-2022). - *Driving Effect of Sea–Land Interaction on*

the Saltwater Intrusion in the Estuary. Core contributor - hydrodynamic model development (FVCOM).

Guangzhou Water and Technology Project - GZSWKJ-2020-2 (2020-2021). - *Effect of Storm Surge and Reconstruction of the Design Value of Flood in Guangzhou Section of Pearl River*. Core contributor - hydrodynamic model development (ADCIRC).

During Ph.D. (National University of Singapore)

National University of Singapore Faculty Research Committee (FRC) Start-up Grant - R-302-000-265-133 (2018-2022). - *Risks and Impacts of Hydrological Extremes under Climate Change*. Role: Core contributor - hydrological model development (VIC, CWatM).

Lloyd's Register Foundation Institute for the Public Understanding of Risk (IPUR) Seed Grant - R-302-000-277-133 (2018-2022). - *Flood Risks and Climate Change Beliefs*. Role: Core contributor - hydrodynamic model development (CaMa-Flood, ADCIRC, TCWiSE).

During Master (Sun Yat-sen University)

National Natural Science Foundation of China - 91547108 (2016- 2018) - *Mode of Coordinated Regulation for Streamflow Adaptive Utilization in Lancang River Basin under Changing Environments*. Role: Core contributor - hydrodynamic model development (CE-QUAL-W2, MIKE3).

National Key Research and Development Program of China - 2017YFC0405905 (2017-2019). - *Multi-objective Coupling and Synergistic Mechanism of Multilateral and Multi-dimensional Water Resources in the Watershed*. Role: Core contributor - nonstationary rating curve development (pyBaRatin).

National Key Research and Development Program of China - 2016YFC0401305 (2016-2018) - *Dynamic Prediction and Regulation of Water Resources Carrying Capacity in Pearl River Delta*. Role: Core contributor - non-stationary time series analysis (Time Varying Moment (TVM) framework).

MENTORING

Provided mentoring in literature curation, writing guidance, and model development support for the following students.

Massachusetts Institute of Technology

Grace Jiang — B.S. (graduated); Jul 2023 – Dec 2024.
Research: Active learning for searching extremes (available on *arXiv*, to be submitted to *JGR: Machine Learning and Computation*).

Madeline Loui — Ph.D. student; Dec 2023 – Jun 2024.
Research: Machine learning & remote sensing for flood inundation mapping (provided to two CGC projects for model validation).

National University of Singapore

Yifan Lu — Incoming Ph.D. (mentored since junior year); May 2023 – Present.
Research: Tropical cyclone migration and associated changing flood patterns in East Asia (to be submitted to *Nature Communications*).

Ling Jing — M.S. (graduated); Aug 2021 – May 2022.
Research: Probabilistic changes and attribution analysis of regional sea-level rise (completed her Master's Thesis).

Sun Yat-sen University

Shikun Hu — Ph.D. student (graduated); Sep 2019 – Jun 2024.
Research: Investigation of extreme water level rise and inundation mechanisms in the Pearl River Estuary (published three first-author papers, completed his Ph.D. Dissertation).

Zewen Zhu — M.S. student; Sep 2020 – Jun 2022.
Research: Modeling saltwater intrusion in the Pearl River Estuary with FVCOM (published one first-author paper, completed her M.S. Thesis).

Wei Peng — M.S. student; Sep 2017 – Jun 2020.
Research: Ecohydrological effects and ecological flow assessment under cascade river development (published two first-author papers, completed his M.S. Thesis).

Zibo Yang — M.S. student; Sep 2018 – Jun 2020.
Research: Bayesian approach to stage–discharge rating curve fitting: A case study of the Beijiang River Basin (published two patents, completed his M.S. Thesis).

China Three Gorges University

Yi Huang — M.S. student; Oct 2023 – Present.

Research: Nowcasting tropical cyclone rainfall (published one first-author paper in *Journal of Hohai University (Natural Sciences)*).

China Institute of Water Resources and Hydropower Research

Xiaola Wang — Ph.D. student; Since starting her M.S. at SYSU in 2018 until present.

Research: Disentangling the impacts of changing climate and land uses on the terrestrial water–carbon balance (completed her M.S. Thesis; one first-author paper currently under review in *Journal of Hydrology*).

TEACHING

- Teaching Assistant for multiple undergraduate and graduate hydrology and systems courses at SYSU, NUS, and MIT, collaborating with leading faculty members:

  Engineering Hydrology, undergraduate course, Teaching Assistant (under Prof. Bingjun Liu), SYSU, Spring 2017. Organized and led a class field practicum to the China Three Gorges Project, Yichang, Hubei, in 2017 summer.

  Hydrologic Forecasting, undergraduate course, Teaching Assistant (under Prof. Kairong Lin), SYSU, Fall 2017.

  Principles of Hydrology, undergraduate course, Teaching Assistant (under Prof. Bingjun Liu), SYSU, Fall 2018, Fall 2019.

  Hydrologic and Hydraulic Calculations, undergraduate course, Teaching Assistant (under Prof. Bingjun Liu), SYSU, Spring 2019, Spring 2020. Organized and led a class field practicum to the China Three Gorges Project, Yichang, Hubei, in 2019 summer.

  Statistical Hydrology, undergraduate course, Teaching Assistant (under Prof. Xiaogang He), NUS, Spring 2022.

  Dynamics Optimization and Learning Systems (12.S592), graduate course (research, teaching, and discussion), Teaching Assistant (under Dr. Sai Ravela, in collaboration with the entire ESSG), MIT, Spring 2024, Fall 2024, Spring 2025, Fall 2025.

- With strong expertise in hydrologic and hydrodynamic model development and debugging, I have provided extensive free consulting services to numerous domestic and international researchers and students, assisting them in generating meshes, building models, and resolving operational issues, given the substantial entry barrier of dynamic model construction.

- Leveraging experience in information retrieval, literature tracking (RSS), classification, and storage (EndNote, Zotero), I have shared practical management skills with students during mentoring and in both formal and informal settings at MIT, NUS, SYSU, and CTGU. I consider this one of the most essential first steps in academic research and have consistently emphasized its importance to my mentees, which have been highly valued by the recipients.

PRESENTATIONS (SELECTED)

Visit to Broward Emergency Center and SFWMD Center (July 2025) *Fort Lauderdale, Florida, USA*

Oral (Invited) - Title: Cyclone- and seasonal extreme-induced flood risk in Broward County.

Compound Climate Extremes Workshop (Feb 2025) *NUS, Singapore (online)*

Oral (Invited) - Title: Cascading hazards from tropical cyclone and monsoon extreme rainfall in a warming climate.

AGU Fall Meeting (Dec 2024) *Washington, DC, USA*

Poster - Title: Assessing cascading flood hazards in a warming climate.

Flood Hazard and Climate Resilience Workshop (Aug 2024) *MIT, Cambridge, USA*

Poster - Title: Coastal flood risk in Bangladesh under a warming climate.

Compound Climate Extremes Workshop (Jun 2024) *NUS, Singapore (online)*

Oral (Invited) - Title: Tropical cyclone–induced compound flooding in a warming climate.

AGU Fall Meeting (Dec 2023) *San Francisco, USA*

Poster - Title: Coastal flood risk in Bangladesh.

Carlson Lecture (Nov 2023) *New England Aquarium, Boston, USA*

Poster - Title: Coastal flooding in Bangladesh in a changing climate.

The 3rd International Workshop on Waves, Storm Surges, & Coastal Hazards (Oct 2023) *Notre Dame, USA*

Oral - Title: Machine learning–accelerated search for storm surge extremes: Application to Bangladesh.

Personal visit to the China Three Gorges University (Mar 2023) *Yichang, China*

Oral (Invited) - Title: Academic Writing and Literature Management: Methods and Practices.

AGU Fall Meeting (Dec 2021) *Chicago, USA (online)*

Poster - Title: Compound fluvial-pluvial-coastal flood risk over Southeast Asia in current and future climates.

Chinese Academy of Sciences Annual Meeting (Sep 2019) *Hubei, China*

Oral (Invited) Title: Stage–discharge rating-curve information and uncertainty. (Best Conference Paper Award)

TECHNICAL SKILLS

Programming Languages: Python, MATLAB, R, Julia, FORTRAN

Tropical Cyclone Modeling: MIT-Open-Source Physics-Based Model (TC-intensity), TCWiSE (TC-intensity), STORM (TC-intensity), pyTCR (TC-rainfall), FHLO (Forecasting Hurricanes Using Large-Ensemble Outputs), Probabilistic Precipitation Nowcasting (pySTEPS)

Hydrologic & Hydrodynamic Modeling:
Inland Hydrologic Models – Wflow (basin scale), CWatM (local&global scale), WaSSI (basin scale);
Ocean Circulation Models – ADCIRC, FVCOM, Delft3D, SMS, SWAN (wave), OceanMesh2D (mesh design);
Compound Inundation Models – CaMa-Flood (global & regional scale), LISFLOOD-FP (local), SFINCS (local);
Lake/Reservoir Models – CE-QUAL-W2, MIKE3;
Ecohydrology Models – SOTE (soil–vegetation–atmosphere; soil salinization impacts)

Machine Learning & Statistical Analysis: Deep generative AI models (diffusion models), Bayesian analysis (Rating Curve Estimation – pyBaRatin, developed independently); non-stationary time series analysis, copula, extreme-value analysis, complex network

ACADEMIC SERVICES

Journal Reviewer: Geophysical Research Letters (6 times), Weather and Climate Extremes (2 times)

ACADEMIC REFERENCES

Sai Ravela — Principal Research Scientist, MIT/EAPS. *Email:* ravela@mit.edu

Miho Mazereeuw — Associate Professor, MIT/Architecture and Urbanism. *Email:* mmaz@mit.edu

Xiaogang He — Assistant Professor, NUS/CEE. *Email:* hexg@nus.edu.sg

Bingjun Liu — Professor, SYSU/CE. *Email:* liubj@mail.sysu.edu.cn

Kerry A. Emanuel — Professor Emeritus, MIT/EAPS. *Email:* emanuel@mit.edu