Tao Huang

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CURRENT POSITION

Assistant Professor in Water Resources Engineering   Aug. 2025 - Present

Department of Civil and Environmental Engineering, Idaho State University, Pocatello, ID

Courses Taught: CE4499/5599 Data Analysis Methods in Water Resources; CE3351 Engineering Hydrology

GRANTS

Idaho Water Resources Research Institute, "Developing Probabilistic Flood Maps for Idaho Under Precipitation Uncertainty Using a Computationally Efficient 2D Hydrodynamic Model", Nov. 2025-Nov. 2026 (PI, $46,784)

ACADEMIC EXPERIENCE & EDUCATION

Postdoctoral Research Associate, Pacific Northwest National Laboratory, Richland, WA   Jul. 2023-Aug. 2025

   Earth Systems Data Science

Ph.D.   Purdue University, West Lafayette, IN   Aug. 2019 - May 2023

   Civil Engineering

   Dissertation: Quantifying Uncertainty in Flood Modeling Using Bayesian Approaches

   Advisor: Dr. Venkatesh Merwade

M.S.   Tsinghua University, Beijing, China   Aug. 2012 - Jun. 2014

   Hydraulic Engineering

   Thesis: Concrete Autogenous Volume Deformation and the Influence on Stress States of High Arch Dams

B.S   Tsinghua University, Beijing, China   Aug. 2008- Jun. 2012

   Hydraulic and Hydropower Engineering

RESEARCH EXPERIENCE

Pacific Northwest National Laboratory, Richland, WA   Jul. 2023-Aug. 2025

Deep Learning for Fish Identification from Sonar Data

- Extracted and converted sonar data (ARIS and DIDSON) to 2D images using image conversion algorithms
- Preprocessed sonar images through background removal, wavelet denoising, and bounding box labeling
- Developed deep learning algorithms (YOLO) to detect multiple objects (eels and non-eel fish) in sonar images
- Explored the transferability of object detection algorithms (YOLO) for American eels to the detection of lampreys

Predicting Absolute Strike Injury Rates of Turbine Passed Fish Using Autonomous Sensor Fish

- Compiled Sensor Fish data and live fish data from various environmental conditions and hydraulic structure types
- Evaluated velocity- and pressure-based metrics for quantifying the absolute strike injury rates of turbine-passed fish
- Developed a joint metric that incorporates velocity- and pressure-based metrics based on Kaplan turbine datasets
- Integrated a framework of predicting absolute injury rates of fish passing through Kaplan turbines into software

Purdue University, West Lafayette, IN   Aug. 2019-May 2023

Evaluating Uncertainty in FEMA Flood Insurance Rate Maps (FIRMs) using Bayesian Model Averaging (BMA) and Hierarchical BMA

- Investigated various sources of uncertainty in the FEMA FIRMs flood modeling process systematically.
- Quantified the relative impact of individual uncertainty sources using BMA and HBMA approaches.
- Proposed uncertainty coefficients based on the reliability of prediction distributions and the accuracy of deterministic predictions to quantify uncertainty in FIRMs.
- Developed 100-year BMA probabilistic flood maps, offering improved reliability over existing deterministic FIRMs.

An Integrated Evaluation Framework based on Generalized Likelihood Uncertainty Estimation for Quantifying Uncertainty in Flood Modeling

- Explored the effect of different prior distributions of the uncertainty sources on the values of evaluation metrics
- Evaluated the effect of the scales of temporal data (different high-flow scenarios) on values of uncertainty metrics
- Measured the impact of the uncertainty of observed data on the values of uncertainty indicators
- Created an integrated statistical framework to demonstrate and quantify the overall uncertainty in flood models

Estimating Bayesian Model Averaging Parameters of Ensemble Flood Modeling Using Multiple Markov Chains Monte Carlo

- Applied the Metropolis-Hastings (M-H) algorithm to generate the posterior distribution of BMA parameters.
- Leveraged the M-H algorithm with various proposal distributions to estimate BMA weights.
- Compared the performance of Expectation-Maximization and M-H algorithms for estimating BMA parameters.
- Examined the effect of different posterior distributions of predictor variables on BMA parameters.

Developing Customized NRCS Unit Hydrographs (UHs) for Ungauged Watersheds in Indiana, USA

- Identified two key parameters (Peak Rate Factor and Lag Time) in the NRCS UH method through literature review
- Collected observed rainfall-runoff data and derived dimensionless UHs based on historical data.
- Developed statewide and regional regression models to relate UH parameters to watershed characteristics.
- Validated the customized UH for Indiana and designed a graphical user interface for its application in TR-20.

TEACHING & MENTORING EXPERIENCE

Idaho State University, Pocatello, ID

Instructor Fall 2025

Course: CE4499/5599 Data Analysis Methods in Water Resources

Purdue University, West Lafayette, IN

Lyles Teaching Fellow Spring 2023

Course: CE340 Hydraulics

- Delivered a series of six lectures focusing on hydrostatics, pipe flow, and open channel hydraulics
- Conducted interactive and engaging learning sessions through the implementation of creative quiz formats
- Collaborated with the Faculty Mentor in preparing homework, quizzes, and exams

Lyles Teaching Assistant Spring 2021 & Fall 2021

Course: CE340 Hydraulics

- Held daily office hours to support a class of 150 students in addressing coursework, assignments, and exams
- Assumed responsibility for grading assignments and quizzes, along with conducting pre-exam review sessions

Teaching Assistant Fall 2020

Course: CE343 Elementary Hydraulics Laboratory

- Instructed 20 students on fundamental concepts about experimental data and methods in hydraulic measurements
- Led experiments covering the measurement of fluid properties, hydrostatics, hydrodynamics, and more
- Held regular office hours to assist students with coursework, assignments, and exam preparation

Tsinghua University, Beijing, China

Student Counsellor Fall 2012 & Spring 2013

- Acted as a Student Counselor for 90 students, overseeing the Undergraduate Freshman Training Program
- Conducted regular meetings with students to address inquiries and provided positive counseling on academic and personal aspects of university life

INDUSTRY PROFESSIONAL EXPERIENCE

PowerChina Kunming Engineering Corporation Limited, Kunming, China. Jul. 2014 - Jun. 2019
Worked as a Civil Engineer for multiple international hydraulic and hydropower projects

Thalpitigala Reservoir Project, The Democratic Socialist Republic of Sri Lanka

- Served as the Chief Design Engineer and oversaw strategic communication with stakeholders, ensuring coordination of design objectives with project goals

- Led and motivated a team of six professionals to successfully deliver design projects in adherence to the schedule
- Executed a comprehensive three-dimensional design of the dam using tools such as Civil 3D, Inventor, and AutoCAD, meeting strict US Army Corps of Engineers (USACE) standards.

Integrated Landslide Mitigation Project, The Democratic Socialist Republic of Sri Lanka
- Served as the Chief Design Engineer and led a team of five people to develop the landslide mitigation proposal
- Conducted an extensive landslide site survey in Sri Lanka, fostering technical exchanges with engineers from the National Building Research Organization (NBRO) of Sri Lanka
- Evaluated the slope stability by using Google Earth and GeoStudio, ensuring robust engineering solutions

Nam Ou-4 & Nam Mang I & Nam Khan 3 Hydropower Projects, The Lao People's Democratic
- Worked as a Design Engineer to analyze and design dam spillways & piers using Ansys, Inventor, and AutoCAD
- Served as the design representative in Laos for one year in managing technical disclosures and addressing construction site technical challenges

Corumana Dam Project, The Republic of Mozambique
- Worked as a Design Engineer to analyze and design the structure of the pre-stress pier
- Conducted site survey in Mozambique and engaged in technical exchanges with consulting company, AECOM

SKILLS

Programming: Python, R, MATLAB, Visual Basic, Julia

Database: SQL (Azure SQL Server, Oracle SQL Developer)

Tools: High-Performance Computing, Azure, TensorFlow, PyTorch, Scikit-learn, Pandas, NumPy

Research Techniques: Bayesian Analysis, Uncertainty Quantification, Machine Learning, Deep Learning

PUBLICATIONS

Huang, T., Salalila, A., Mueller, R., Martinez, J., Titzler, S., Lu, J., Renholds, J., Anderson, K., Trumbo, B., & Deng, D. (2025). Characterizing Hydraulic and Biological Conditions of A New Adjustable-Blade Turbine Using Sensor Fish. *Energy*. Under Review.

Huang, T., Zang, X., Kondyukov, G., Hou, Z., Peng, G., Pander, J., Knott, J., Geist, J., Melesse, M.B., Jacobson, P. and Deng, D. (2025). Towards automated and real-time multi-object detection of anguilliform fishes from sonar data using YOLOv8 deep learning algorithm. *Ecological Informatics*, 103381. Doi: 10.1016/j.ecoinf.2025.103381

Huang, T., Salalila, A., Meyers, A., Fu, T., Martinez, J., Hou, H., & Deng, D. (2025). Velocity- and pressure-based metrics for estimating strike injuries during fish passage through hydro turbines, *Results in Engineering*, 104535. Doi: 10.1016/j.rineng.2025.104535

Huang, T., & Merwade, V. (2024). Developing customized NRCS unit hydrographs for ungauged watersheds in Indiana, *Journal of Hydrologic Engineering*, 29(4), 04024022. Doi: 10.1061/JHYEFF.HEENG-6089

Huang, T., & Merwade, V. (2024). Beyond a fixed number: Investigating uncertainty in popular evaluation metrics of ensemble flood modeling using bootstrapping analysis, *Journal of Flood Risk Management*, 17(2), e12982. Doi: 10.1111/jfr3.12982

Huang, T., & Merwade, V. (2023). Improving Bayesian model averaging for ensemble flood modeling using multiple Markov Chains Monte Carlo sampling. *Water Resources Research*, 59(10), e2023WR034947. Doi: 10.1029/2023WR034947

Huang, T., & Merwade, V. (2023). Uncertainty analysis and quantification in flood insurance rate maps using Bayesian model averaging and hierarchical BMA. *Journal of Hydrologic Engineering*, 28(2), 04022038. Doi: 10.1061/JHYEFF/HEENG-5851 (**Editor's Choice** and **Best Technical Paper**)

Huang, T., & Merwade, V. (2023). Developing customized NRCS unit hydrographs (Finley UHs) for ungauged watersheds in Indiana (Joint Transportation Research Program Publication No. FHWA/IN/JTRP-2023/10). West Lafayette, IN: Purdue University. Doi: 10.5703/1288284317644

Huang, T., & Zhan, C. (2019). 2D FEM calculation of pre-stressed pier with an anchor block reserved slot. *Journal of North China University of Water Resources and Electric Power (Natural Science Edition)*, 40(2): 84-89+96. Doi: 10.19760/j.ncwu.zk.2019027

Huang, T., & Cheng, P. (2018). Structure calculation of overflow sluice piers. *Water Resources Planning and Design*,

2018(12): 192-198. Doi: 10.3969/j.issn.1672-2469.2018.12.050

Zuo, Z., Hu, Y., Li, Q., Li, B., & **Huang, T**. (2015). Temperature monitoring during concrete setting through cooling pipe monitors. *Journal of Tsinghua University (Sci & Technol)*, 55(1): 21-26. Doi: 10.16511/j.cnki.qhdxxb.2015.01.004

Du, B., Du, G., **Huang, T.**, Liu, M., & Yue, Y. (2014). Temperature and stress analysis of concrete face plate in construction period. *Journal of China Three Gorges University (Natural Sciences)*, 36(3): 23-27. Doi: 10.13393/j.cnki.issn.1672-948X.2014.03.006

Huang, T., Chen, Q., Hu, Y., Zhong, Q., & Liu, T. (2013). Research of XYPEX on the property of concrete crack repair. *Concrete*, 2013 (11): 88-92. Doi: 10.3969/j.issn.1002-3550.2013.11.024

PRESENTATIONS

Huang, T., Daniel, B., & Li, X. (Dec. 2025). Probabilistic Flood Mapping for Idaho Under Precipitation Uncertainty Using a Computationally Efficient 2D Hydrodynamic Model. Poster presentation at American Geophysical Union (AGU) Fall Meeting in New Orleans, LA.

Huang, T., Hou, H., Salalila, A., Martinez, J., & Deng, D. (Aug. 2025). Estimating Strike Injuries During Fish Passage Using Enhanced Hydropower Biological Evaluation Toolset. Oral presentation at American Fisheries Society (AFS) Annual Meeting in San Antonio, TX.

Huang, T., Martinez, J., Fu, T., Salalila, A., & Deng, D. (Sep. 2024). Metrics for Estimating Strike Injuries During Fish Passage through Kaplan Turbines. Oral presentation at AFS Annual Meeting in Honolulu, HI.

Huang, T. (Dec. 2023). Investigating streamflow variability of HUC-2 regions in the Conterminous United States from 2003 to 2022 water years. Poster presentation at AGU Fall Meeting in San Francisco, CA.

Huang, T., & Merwade, V. (Dec. 2022). An integrated evaluation framework based on generalized likelihood uncertainty estimation for quantifying uncertainty in flood modeling. Oral presentation at AGU Fall Meeting in Chicago, IL.

Huang, T., & Merwade, V. (Dec. 2022). Estimating Bayesian model averaging weights and variances of ensemble flood modeling using multiple Markov chains Monte Carlo. Poster presentation at AGU Fall Meeting in Chicago, IL.

Huang, T., & Merwade, V. (Sep. 2022). Developing customized NRCS unit hydrographs for ungauged watersheds in Indiana. Oral presentation at the Indiana Association for Floodplain and Stormwater Management Annual Conference in South Bend, IN.

Huang, T., & Merwade, V. (May 2022). Evaluating uncertainty in FEMA flood insurance rate maps using Bayesian model averaging (BMA) and hierarchical BMA. Oral presentation at American Water Resources Association (AWRA) Geospatial Water Technology Conference in Austin, TX.

Huang, T., & Merwade, V. (May 2022). Developing customized NRCS unit hydrographs for ungauged watersheds in Indiana, USA. Oral presentation at AWRA Geospatial Water Technology Conference in Austin, TX.

Huang, T., & Merwade, V. (Dec. 2021). Evaluating uncertainty in modeling of FEMA flood insurance rate maps using Bayesian model averaging (BMA) and hierarchical BMA. Oral presentation at AGU Fall Meeting in New Orleans, LA.

Huang, T., & Merwade, V. (Dec. 2021). Developing customized NRCS unit hydrographs for ungauged watersheds in Indiana, USA. Poster presentation at AGU Fall Meeting in New Orleans, LA.

HONORS & AWARDS

Best Technical Paper (Feb. 2024), Environmental & Water Resources Institute award to the 2024 Best Technical Paper for "Uncertainty Analysis and Quantification in Flood Insurance Rate Maps Using Bayesian Model Averaging and Hierarchical BMA" published in *Journal of Hydrologic Engineering*, Environmental & Water Resources Institute

Editor's Choice (Feb, 2023), the Chief Editor of *Journal of Hydrologic Engineering* selected the paper entitled "Uncertainty Analysis and Quantification in Flood Insurance Rate Maps Using Bayesian Model Averaging and Hierarchical BMA" in Issue 28(2) to be featured on the journal homepage, ASCE Library

Lyles Teaching Fellowship (Jan. 2023), Lyles School of Civil Engineering fellowship presented to an outstanding graduate student who is working with a Faculty Mentor to teach an undergraduate course in civil engineering, Purdue University

Jacques Delleur Travel Award (Dec. 2022), Lyles School of Civil Engineering award to cover travel expenses for

graduate students to attend a scientific meeting that has strong relevance to the students' research, Purdue University

Dorothy Faye Dunn Fellowship (Oct. 2022), Lyles School of Civil Engineering award presented to an outstanding graduate student in the hydraulic and hydrologic engineering field, Purdue University

C4E Travel Grant (Apr. 2022), Purdue's Center for the Environment award to cover travel expenses for graduate students to attend a scientific meeting that has strong relevance to the students' research, Purdue University

Yeh Travel Fellowship (Nov. 2021), Lyles School of Civil Engineering award to cover travel expenses for graduate students to attend a scientific meeting that has strong relevance to the students' research, Purdue University

Zhang Guangdou Scholarship (July 2014), Department of Hydraulic Engineering award presented to an outstanding graduate student in the water resources engineering field, Tsinghua University

Undergraduate Mentor Certificate of Honor (July 2013), Tsinghua University award presented to an outstanding graduate student in undergraduate mentoring, Tsinghua University

Outstanding Undergraduate Thesis (June 2012), Tsinghua University award presented to an outstanding undergraduate thesis, Tsinghua University

PROFESSIONAL AFFILIATIONS

American Geophysical Union	2021-Present
American Society of Civil Engineers	2022-Present
American Water Resources Association	2022-Present