

Chien-Yung Tseng, Ph.D.

RESEARCH EXPERTISE

- Fluid Mechanics: Turbulent Mixing, Interfacial Transfer, Fluid-structure Interaction
- Eco-hydraulics: Flow-vegetation Interactions, Fish Behaviors in Environmental Flows
- Environmental Hydraulics: Sediment Transport, Groundwater-Surface Water Interactions, Gravity Currents, Estuary and Coastal Processes
- Hydropower and Hydrokinetic Energy: Hydropower and In-stream Hydrokinetic Energy: Optimization, Sustainability, and Resilience

RESEARCH SKILLS

- Experimental Fluid Mechanics (PIV, PLIF, PTV, ADV)
- Image Analysis and Processing (MATLAB & Python)
- Numerical Modeling (SUNTANS, PROBE, CE-QUAL-W2)
- Stochastic Process, Uncertainty Quantification, and Machine Learning Application (Python & R)

EDUCATION

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN (UIUC) 2017 – 2022

Ph.D. in Civil Engineering - Water Resources Engineering and Science

Minor in Statistics

Graduate Concentration in Computational Science and Engineering

- *Dissertation Title*: “From Substrate to Surface: An Integrated Study on the Interfacial Transfer and Sediment Suspension Based on A Turbulence Prospective in Vegetated Flows”
- *Advisor*: Dr. Rafael Tinoco
- *Committee Members*: Dr. Gary Parker, Dr. Marcelo Garcia, Dr. Leonardo Chamorro, Dr. Maria Maza

NATIONAL TAIWAN UNIVERSITY (NTU) 2013 – 2015

M.S. in Applied Mechanics - Fluid Mechanics

- *Thesis Title*: “Non-hydrostatic Numerical Study of Hyperpycnal River Plumes on Sloping Continental Shelves”
- *Advisor*: Dr. Yi-Ju Chou
- *Committee Members*: Dr. Hsi-Heng Dai, Dr. Yueh-Jen Lai, Dr. Zhi-Cheng Huang

NATIONAL TSING HUA UNIVERSITY (NTHU) 2009 – 2013

B.S. in Physics

RESEARCH EMPLOYMENT/APPOINTMENT

Postdoctoral Research Associate, Oak Ridge National Laboratory

Jun. 2022 – Present

Mentor: Dr. Mirko Musa, Dr. Shih-Chieh Kao

In-stream Hydrokinetic Energy Deployment Optimization

- Develop theoretical framework to search for optimized siting locations for in-stream turbines within hydropower tailrace channels.

Sedimentation Data Exploration

- Propose an exploratory model to estimate the potential sedimentation problem in the U.S. at existing nonpower dams and hydropower assets, using existing dataset and geographical information.

Thermal Stratification by Long-term Climate Change

- Investigate thermal stratification effects in Tennessee reservoirs induced by long-term climate change using CE-QUAL-W2 hydrodynamic numerical model coupling with down-scaled data from climate models.

Ph.D. Research Fellow, Department of Civil and Environmental Engineering, UIUC

Aug. 2017 – May. 2022

Interfacial Gas Transfer and Sediment Dynamics in Flows with Aquatic Vegetation

Advisor: Dr. Rafael Tinoco

- Designed and conducted a series of multi-scale flume experiments with different density and submergence configurations of the array of simulated plants to study flow-vegetation interactions, vegetation effects on sediment transport, sediment-oxygen dynamics, and surface gas transfer mechanism.

Research Assistant, Illinois Water Resources Center, Prairie Research Institute, UIUC

Oct. 2019 – Mar. 2021

Uncertainty Quantification and Bayesian Experimental Design on Hydraulic Conductivity Mapping in a Watershed

Advisor: Dr. Maryam Ghadiri, Dr. Hadi Meidani

- Constructed a Gaussian Processes statistical model for the multi-fidelity source of data.
- Conducted uncertainty quantification on hydraulic conductivity via the developed multi-fidelity Gaussian Processes model with the multi-source field observation data in Sangamon Watershed, Illinois.
- Applied Bayesian Experimental Design to infer the future sampling locations to enhance the model/data capability.

Research Assistant, Illinois State Geological Survey, Prairie Research Institute, UIUC

Apr. 2018 – Aug. 2019

Development of the Portable Thermal Response Testing (TRT) Device

Advisor: Dr. Yu-Feng Forrest Lin

- Developed the portable Thermal Response Testing (TRT) device for Geothermal Energy Exchange and wrote a technical report for publication.
- Collected and analyzed the geothermal field data with TRT at Geothermal Research Station at the University of Illinois Energy Farm.

Research Associate, Department of Engineering Science and Ocean Engineering, NTU

Feb. 2017 – May. 2017

Poisson Pressure Solver Improvement of Curvilinear Mapped Hydrodynamics Numerical Model

Advisor: Dr. Wu-Ting Tsai

- Improved the iterative method of the Poisson pressure solver in wave-resolved curvilinear mapped DNS numerical model.

Research Assistant, Institute of Applied Mechanics, NTU**Sep. 2013 – Jan. 2016***Non-hydrostatic Numerical Modeling of Hyperpycnal River Plumes on Continental Slopes*

Advisor: Dr. Yi-Ju Chou

- Implemented the sediment component into SUNTANS coastal ocean model via the diffusive scalar approach.
- Performed non-hydrostatic pressure solver in SUNTANS to investigate the non-hydrostatic pressure effect and the plunging momentum transport of hyperpycnal plumes on riverine-coastal regions.

TEACHING/MENTORING EXPERIENCE

Teaching Assistant, Department of Civil and Environmental Engineering, UIUC**Jan. 2022 – May. 2022***CEE350 Water Resources Engineering (Spring 2022)*

- Graded students' assignments and hosted the TA office hour to solve students' problems.
- Co-designed the course and lectured three review sessions in hydrology, groundwater, hydraulics, and pipe flows.
- Won the teaching award "List of Teachers Ranked as Excellent by Their Student" offered by UIUC Center for Innovation in Teaching and Learning.

Student Research Mentor, Department of Civil and Environmental Engineering, UIUC*Graduate Student Summer Research Mentor**May. 2020 – Aug. 2020*

- Mentored an M.S. student to conduct experiments with flow tracking imaging techniques (PIV & PTV) in the lab for summer research.
- Research project: Sediment dynamics in random patch vegetated flows

*Undergraduate Student Research Mentor**Feb. 2019 – Jun. 2019*

- Mentored a 3+2 program student to conduct experiments with cutting-edge flow measurement techniques (PIV & ADV) in the lab for undergraduate research.
- Research project: Hydrodynamics of flexible vegetated flows

Guest Lecturer, Department of Civil and Environmental Engineering, UIUC**Oct. 2018***CEE555 Mixing in Environmental Flows (Fall 2018)*

- Guest-lectured the introduction of the theory and concept of the Particle Image Velocimetry (PIV) method.
- Guided students to work on PIV image processing via PIVlab, a MATLAB-based UI software.

Teaching Assistant, Earth System Science Program, NTU**Feb. 2015 – Jun. 2015***IPCS7001 Earth Environmental Problems and Resolutions (Spring 2015)*

- Guided the assigned discussions in the class.
- Guided students to finish their final project on the environmental issue with possible resolutions.

Teaching Assistant, Institute of Applied Mechanics, NTU**Sep. 2014 – Jun. 2015***AM7097 Fundamental of Fluid Dynamics (Fall 2014, Spring 2015)*

- Graded students' assignments and hosted the TA office hour to solve students' problems.
- Demonstrated the assignment solutions in TA class.

PUBLICATIONS

Peer-reviewed Journal

- **Tseng, C. Y.** and Tinoco, R. O. (In review). Canopy Randomness, Scale, and Stem Size Effects on the Interfacial Transfer Process in Vegetated Flows, *Water Resources Research*
- **Tseng, C. Y.**, Ghadiri, M., Kumar, P., Meidani, H. (2023). Estimation of hydraulic conductivity in a watershed using multi-source data via co-kriging and Bayesian experimental design, *Advances in Water Resources*, 178, 104489
- **Tseng, C. Y.** and Tinoco, R. O. (2022). From substrate to surface: A turbulence-based model for gas transfer across sediment-air-water interfaces in vegetated streams, *Water Resources Research*, 58(1), e2021WR030776
- **Tseng, C. Y.** and Tinoco, R. O. (2021). A two-layer turbulence-based model to predict suspended sediment concentration in flows with aquatic vegetation, *Geophysical Research Letters*, 48(3), e2020GL091255
- **Tseng, C. Y.** and Tinoco, R. O. (2020). A model to predict surface gas transfer rate in streams based on turbulence production by aquatic vegetation, *Advances in Water Resources*, 143, 103666
- **Tseng, C. Y.** and Chou, Y. J. (2018). Nonhydrostatic simulation of hyperpycnal river plumes on sloping continental shelves: flow structures and nonhydrostatic effect, *Ocean Modelling*, 124, 33-47

Technical Report

- Musa, M., Ghobrial, L., Heineman, J., Rencheck, M., Stewart, K., DeNeale, S., **Tseng, C. Y.**, White D., Davis, L., Nachman M., Rugani K. (2023). Advanced Manufacturing for Hydropower: Challenges and Opportunities, Oak Ridge National Laboratory, ORNL/TM-2023/2835, Oak Ridge, TN (United States)
- Lin, Y. F., **Tseng, C. Y.**, Sargent, S. L. (2020). User's manual for the portable thermal response test device, *Technical Report, Illinois State Geological Survey, Prairie Research Institute*, Circular no. 603

Manuscript in Preparation

- **Tseng, C. Y.** and Musa, M. (Ready to submit). Hydrokinetic Power Implications of In-stream Turbine Deployment within Hydropower Tailrace Channels, *Renewable Energy*
- **Tseng, C. Y.**, Sasthav, C., Basub, S., DeSomberb, K., Ham, K., Musa, M. (In prep). Challenges and Opportunities for Testing of Hydropower Technology Innovations, *Renewable and Sustainable Energy Reviews*
- **Tseng, C. Y.** and Tinoco, R. O. (In prep). Turbulent eddies-induced bedform undulation in vegetated flows, *Journal of Geophysical Research: Earth Surface*

PUBLIC DATASETS/CODE

- **Tseng, C. Y.**, Ghadiri, M., Larson, T. H., Kumar, P., Meidani, H. (2022). Bayesian experimental design coupling with multi fidelity Gaussian processes, GitHub. Repository. <https://doi.org/10.5281/zenodo.7098032>
- **Tseng, C. Y.** and Tinoco, R. O. (2021). From Substrate to Surface: A Turbulence-based Model for Gas Transfer across Sediment-water-air Interfaces in Vegetated Streams. figshare. Dataset. <https://doi.org/10.6084/m9.figshare.16862926>
- **Tseng, C. Y.** and Tinoco, R. O. (2020). A Two-Layer Turbulence-based Model to Predict Suspended Sediment Concentration in Flows with Aquatic Vegetation. figshare. Dataset. <https://doi.org/10.6084/m9.figshare.13333769>

- **Tseng, C. Y.** and Tinoco, R. O. (2020). A model to predict surface gas transfer rate in streams based on turbulence production by aquatic vegetation. figshare. Dataset. <https://doi.org/10.6084/m9.figshare.12486590>

INVITED TALKS

- From Substrate to Surface: An Experimental Study on the Interfacial Gas Transfer and Sediment Dynamics Based on a Turbulence Perspective in Vegetated River Flows, *Environmental and Water Resources Engineering Seminar, Department of Civil and Environmental Engineering at Virginia Tech*, Blacksburg, VA, USA, 02/10/2023
- From Substrate to Surface: An Experimental Study on the Interfacial Gas Transfer and Sediment Dynamics Based on a Turbulence Perspective in Vegetated River Flows, *Environmental Engineering and Water Resources Seminar, Department of Civil and Environmental Engineering at University of Tennessee*, Knoxville, TN, USA, 02/09/2023
- From Substrate to Surface: Dissolved Oxygen Transfer and Sediment Suspension in Environmental Vegetated Flows, *Invited Webinar Talk, Taiwanese Scholar Association in St. Louis*, 02/05/2022
- From Substrate to Surface: An Integrated Study on the Interfacial Transfer and Sediment Dynamics Based on a Turbulence Perspective in Vegetated Flows, *Water Resource Science and Engineering Group at Oak Ridge National Laboratory, Oak Ridge, TN, USA*, 01/10/2022
- From Substrate to Surface: An Integrated Study on the Interfacial Transfer and Sediment Dynamics Based on a Turbulence Perspective in Vegetated Flows, *Department of Civil Engineering at National Taiwan University*, Taipei, Taiwan, 12/08/2021
- Part 1: Non-hydrostatic Numerical Study of Hyperpycnal River Plumes on Sloping Continental Shelves / Part 2: Experimental Study of Vegetation Effects on the Sediment Suspension and Surficial Transfer in Rivers, *Theoretical Division at Los Alamos National Laboratory, Los Alamos, NM, USA*, 11/18/2021
- From substrate to surface: an integrated study on the interfacial transfer and sediment dynamics based on a turbulence perspective in environmental vegetated flows, *Department of Biological and Environmental Engineering at Cornell University, Ithaca, NY, USA*, 11/05/2021
- From substrate to surface: the interfacial transfer across air-water and sediment-water interface in vegetated flows, *Hydro-Geo Seminar at UIUC, Urbana, IL, USA*, 09/13/2021
- From substrate to surface: an integrated study on the interfacial transfer and sediment dynamics based on a turbulence perspective in environmental vegetated flows, *Rowland Institute at Harvard University, Boston, MA, USA*, 08/25/2021

CONFERENCE PRESENTATIONS

- **Tseng, C. Y.** and Tinoco, R. O. (2022). Canopy Randomness and Stem Size Effects on the Sediment-Water-Air Interfacial Transfer in Vegetated Flows, *AGU Fall Meeting*, Chicago, IL, USA
- **Tseng, C. Y.** and Musa, M. (2022). Siting Optimization of In-stream Hydrokinetic Turbines within Hydropower Tailrace Channels, *APS-DFD Annual Meeting*, Indianapolis, IN, USA
- **Tseng, C. Y.** and Tinoco, R. O. (2021). From substrate to surface: a turbulence-based model to predict interfacial gas transfer across sediment-air-water interfaces in vegetation streams with sediments, *AGU Fall Meeting*, New Orleans, LA, USA
- **Tseng, C. Y.**, Ghadiri, M., Meidani, H. (2021). Estimation of Hydraulic Conductivity in a Watershed Using Multi-source Data via Co-Kriging and Bayesian Experimental Design, *AGU Fall Meeting*, New Orleans, LA, USA

- **Tseng, C. Y.** and Tinoco, R. O. (2021). Laboratory Study on Sediment Suspension and Bed Morphodynamics in Vegetated Fluvial Systems, *12th Symposium on River, Coastal and Estuarine Morphodynamics – RCEM2021*, Virtual Webinar
- **Tseng, C. Y.** and Tinoco, R. O. (2021). Turbulence effects by the aquatic vegetation on interfacial transfer process with sediment, *5th International Symposium on Shallow Flows*, Nanjing, China
- **Tseng, C. Y.** and Tinoco, R. O. (2021). A turbulence-based, two-layer model to predict sediment suspension in vegetated flows, *9th International Symposium on Environmental Hydraulics*, Seoul, Korea
- **Tseng, C. Y.** and Tinoco, R. O. (2020). Effects of aquatic vegetation on gas exchange process across air-water and sediment-water interface, *AGU Fall Meeting*, San Francisco, CA, USA
- Ghadiri, M., **Tseng, C. Y.**, Meidani, H. (2020). Investigation of multi-fidelity co-kriging model for hydraulic conductivity in Sangamon Watershed, *AGU Fall Meeting*, San Francisco, CA, USA
- Tinoco, R. O. and **Tseng, C. Y.** (2020). From substrate to surface: the effect of vegetation-generated turbulence on surficial gas transfer, *River Flow 2020*, Delft, Netherlands
- **Tseng, C. Y.** and Tinoco, R. O. (2019). Quantifying the effect of aquatic vegetation on interfacial gas transfer in streams, *AGU Fall Meeting*, San Francisco, CA, USA
- **Tseng, C. Y.**, Kurtis H. D., Tinoco, R. O. (2019). Laboratory study of gravity currents over submerged vegetation canopies, *AGU Fall Meeting*, San Francisco, CA, USA
- **Tseng, C. Y.** and Chou, Y. J. (2016). Numerical investigation of plunging hyperpycnal plume on an idealized shelf slope, *The 38th Ocean Engineering Conference in Taiwan*, Taipei, Taiwan
- **Tseng, C. Y.** and Chou, Y. J. (2015). Nonhydrostatic numerical simulation of plunging hyperpycnal river plumes on continental shelves, *Gordon Research Conference on Coastal Ocean Modeling*, Biddeford, ME, USA

HONORS & AWARDS

- | | |
|--|-------------|
| • UIUC List of Teachers Ranked as Excellent by Their Student | Spring 2022 |
| • UIUC Grainger College of Engineering - Mavis Future Faculty Fellowship | 2021 – 2022 |
| • Best Young Professional Award - IAHR - The 9 th International Symposium on Environmental Hydraulics | 2021 |
| • UIUC Graduate College Conference Travel/Presentation Award | 2020, 2021 |
| • Taiwan MOE - UIUC Graduate Student Fellowship (4yrs Ph.D. Fellow Award) | 2017 |
| • Membership of the Phi Tau Phi Scholastic Honor Society (Summa Cum Laude), NTU | 2015 |
| • NTHU International Public Service Leader Scholarship | 2013 |
| • NTHU - University of Science and Technology of China Undergraduate Research Program Scholarship | 2011 |

PROFESSIONAL ACTIVITY/SERVICE

Professional Registration

- | | |
|---|----------------|
| • American Physical Society (APS) – Division of Fluid Dynamics | 2020 – present |
| • International Association for Hydro-Environment Engineering and Research (IAHR) | 2020 – present |
| • American Geophysical Union (AGU) | 2018 – present |
| • International Water Resources Association (IWRA) | 2017 – present |

Student Chapter Service

- Treasurer of the local IAHR Student Chapter at UIUC

2021 – 2022

Official Journal Reviewer

- Water Resources Research (AGU)
- Geophysical Research Letters (AGU)
- Journal of Hydrology (Elsevier)
- Ocean Engineering (Elsevier)
- Scientific Reports (Nature)
- Journal of Hydraulic Research (IAHR)
- Frontiers in Earth Science (Frontiers)