Benjamin Tsai

Research Oceanographer · U.S. Geological Survey

St. Petersburg Coastal and Marine Science Center

benjamintsai@usgs.gov | btsai.space | 0000-0002-2176-9295

Research Interests

Hydrodynamics
- Nearshore processes
- Turbulence modeling
- Wave breaking

Fluid-Soil Interaction
- Sediment transport
- Scour around structures/objects
- Dune erosion/slump

Geotechnics
- Fast granular flow
- Scour burial
- Pore water pressure

Education

University of Delaware — *Newark, DE, USA*

PhD, Civil and Environmental Engineering (Concentration: Coastal Engineering) — *2017 - 2023*
- Advisor: Dr. Tian-Jian Hsu
- Dissertation: *Coastal Hydrodynamics and its Interaction with Structure and Sediment*

National Cheng Kung University — *Tainan, Taiwan*

MS, Hydraulic and Ocean Engineering (Concentration: Ocean Engineering) — *2012 - 2014*
- Advisor: Dr.-Ing. Yu-Shu Kuo
- Thesis: *Wave-Induced Pore Pressure Changes in Sandy Seabed*

National Cheng Kung University — *Tainan, Taiwan*

BS, Hydraulic and Ocean Engineering — *2008 - 2012*
- Undergrad research advisor: Dr.-Ing. Yu-Shu Kuo

Professional Experience

U.S. Geological Survey, St. Petersburg Coastal and Marine Science Center — *St. Petersburg, FL, USA*

Research Oceanographer · Mendenhall Postdoctoral Fellow — *2023 - Present*

University of Delaware, Department of Civil and Environmental Engineering — *Newark, DE, USA*

Graduate Research Assistant — *2017 - 2023*

National Yunlin University of Science and Technology, Research Center for Soil and Water Resources and Natural Disaster Prevention — *Yunlin, Taiwan*

Research Assistant — *2016-2017*

National Cheng Kung University, Department of Hydraulic and Ocean Engineering — *Tainan, Taiwan*

Research Assistant — *2015-2016*

National Cheng Kung University, Department of Hydraulic and Ocean Engineering — *Tainan, Taiwan*

Graduate Research Assistant — *2012-2014*

Publications

** corresponding author*

Published

Zhang, J.*, **Tsai, B.**, Rafati, Y., Hsu, T.-J., Puleo, J. A (2025). Cross-shore Hydrodynamics and Morphodynamics Modeling of an Erosive Event using XBeach. *Coastal Engineering*, 196, 104662. https://doi.org/10.1016/j.coastaleng.2024.104662

Tsai, B.*, Hsu, T.-J., Lee, S.-B., Pontiki, M., Puleo, J. A., and Wengrove, M. E. (2024). Large Eddy Simulation of Cross-Shore Hydrodynamics Under Random Waves in the Inner Surf and Swash Zones. *Journal of Geophysical Research: Oceans*, 129(9), e2024JC021194. https://doi.org/10.1029/2024JC021194

Tsai, B.*, Mathieu, A., Hsu, T.-J., and Chauchat, J. (2023). An Eulerian two-phase model investigation on wave-induced scour around a vertical circular cylinder. *Proceedings of the 11th International Conference on Scour and Erosion*. https://www.issmge.org/publications/publication/an-eulerian-two-phase-model-investigation-on-wave-induced-scour-around-a-vertical-circular-cylinder

Feagin, R. A.*, Innocenti, R. A., Bond, B., Wengrove, M., Huff, T. P., Lomonaco, P., **Tsai, B.**, Puleo, J., Pontiki, M., Figlus, J., Chavez, V., and Silva, R. (2023). Does vegetation accelerate coastal dune erosion during extreme events? *Science Advances*, 9(24), eadg7135. https://doi.org/10.1126/sciadv.adg7135

Tsai, B.*, Mathieu, A., Montellà, E. P., Hsu, T.-J., and Chauchat, J. (2022). An Eulerian two-phase flow model investigation on scour onset and backfill of a 2D pipeline. *European Journal of Mechanics - B/Fluids*, 91, 10–26. https://doi.org/10.1126/10.1016/j.euromechflu.2021.09.004

Innocenti, R. A.*, Feagin, R. A., Charbonneau, B. R., Figlus, J., Lomonaco, P., Wengrove, M., Puleo, J., Huff, T. P., Rafati, Y., Hsu, T.-J., Moragues, M. V., **Tsai, B.**, Boutton, T., Pontiki, M., and Smith, J. (2021). The effects of plant structure and flow properties on the physical response of coastal dune plants to wind and wave run-up. *Estuarine, Coastal and Shelf Science*, 261, 107556. https://doi.org/10.1126/10.1016/j.ecss.2021.107556

Awards, Fellowships, & Grants

2023 **USGS Mendenhall Research Fellowship**, United States Geological Survey, USA.
Civil Engineering Graduate Research Award, University of Delaware, USA.

2022 **Government Scholarship to Study Abroad**, Ministry of Education, Taiwan.

2013 **Da-Yu Scholarship**, National Cheng Kung University, Taiwan. (Top 5% academic performance among all graduate students in the department)

Presentations

Invited Talks

October 2024. *High-Fidelity Modeling for Coastal and Marine Applications*. Seminar, School of Civil and Construction Engineering, Oregon State University, Corvallis, OR, USA.

July 2024. *Computational Fluid Dynamics (CFD) Modeling for Coastal and Marine Applications*. Seminar, Stantec Inc., Laurel, MD, USA.

September 2023. *Numerical Investigation on Coastal Hydrodynamics and Its Interaction with Structure and Sediment*. Seminar, Department of Hydraulic and Ocean Engineering, National Cheng Kung University, Tainan, Taiwan.

June 2023. *Coastal Hydrodynamics and Its Interaction with Structure and Sediment*. Seminar, St. Petersburg Coastal and Marine Science Center, U.S. Geological Survey, St. Petersburg, FL, USA.

May 2023. *Large-Eddy Simulations for Two Nearshore Applications*. Seminar, US Naval Research Laboratory, John C. Stennis Space Center, MS, USA.

May 2023. *A Numerical Investigation on Wave-induced Scour around a Cylinder*. The Second Hydraulic Modeling Collaboration Workshop at the Turner-Fairbank Highway Research Center, Federal Highway Administration, McLean, VA, USA.

October 2022. *RANS vs LES: an Eulerian Two-Phase Model Investigation on Wave-induced Scour*. Hydraulic Modeling Collaboration Workshop at the Turner-Fairbank Highway Research Center, Federal Highway Administration, McLean, VA, USA.

Contributed Presentations

** presenting author*

Tsai, B.*, Buckley, M., Palmsten, M. L. (2024, December). *Numerical simulations of wave-induced currents using a multilayer non-hydrostatic model.* Oral presentation presented at the American Geophysical Union Annual Meeting 2024, Washington, DC, USA.

Kumar, N.*, Mathieu, A., **Tsai, B.**, Hsu, T.-J., Puleo, J. A., Chauchat, J. (2024, December). *Cross-shore Beach Profile Evolution Driven by Successive Wave Breaking in Swash Zone.* Poster presented at the American Geophysical Union Annual Meeting 2024, Washington, DC, USA.

Chen, J.*, Raubenheimer, B., Elgar, S., **Tsai, B.** (2024, December). *Simulations of Depth Resolved Cross-shore Momentum Transfer in the Surfzone.* Poster presented at the American Geophysical Union Annual Meeting 2024, Washington, DC, USA.

Kumar, N.*, Mathieu, A., **Tsai, B.**, Hsu, T.-J., Puleo, J. A., Chauchat, J. (2024, December). *SedInterFoam: a multi-phase numerical model for sediment transport and its application to swash zones.* Oral presentation presented at the 38th International Conference on Coastal Engineering, Rome, Italy.

Tsai, B.*, Buckley, M., Palmsten, M. L., and Hsu, T.-J. (2024, February). *Numerical Investigation on Coastal Hydrodynamics under Irregular Waves.* Oral presentation presented at the Ocean Sciences Meeting 2024, New Orleans, LA, USA.

Tsai, B.*, Mathieu, A., Hsu, T.-J., and Chauchat, J. (2023, September). *An Eulerian two-phase model investigation on wave-induced scour around a vertical circular cylinder.* Oral presentation presented at the 11th International Conference on Scour and Erosion, Copenhagen, Denmark.

Tsai, B.*, Mathieu, A., Hsu, T.-J., Puleo, J. A., Wengrove, M. E., and Chauchat, J. (2022, December). *Large-Eddy Simulations for Two Nearshore Applications.* Oral presentation presented at the American Geophysical Union Fall Meeting 2022, Chicago, IL, USA.

Zhang, J.*, **Tsai, B.**, Hsu, T.-J., Stark, N., Puleo, J. A., and Wengrove, M. E. (2022, December). *XBeach Modeling of Cross-shore Hydrodynamics and Morphodynamics in a Shallow Surf Zone.* Oral presentation presented at the American Geophysical Union Fall Meeting 2022, Chicago, IL, USA.

Chauchat, J.*, Bonamy, C., Mathieu, A., Montellà, E. P., Chassagne, R., Nagel, T., Salimi-Tarazouj, A., **Tsai, B.**, Gilletta, A., Divel, H., Cheng, Z., and Hsu, T.-J. (2022, July). *Sedfoam: a Two-Fluid Model for Particulate Flows in Geophysics.* Oral presentation presented at the 17th OpenFOAM Workshop (OFW17), Cambridge, UK.

Tsai, B.*, Mathieu, A., Hsu, T.-J., and Chauchat, J. (2022, June). *An Eulerian two-phase model investigation on wave-induced scour around a vertical circular cylinder.* Oral presentation presented at the 5th symposium on two-phase modeling for sediment dynamics (THESIS-2022), Les Houches, France.

Feagin, R. A.*, Innocenti, R. A., Bond, H., Wengrove, M., Huff, T. P., Lomonaco, P., Chávez, V., Silva, R., **Tsai, B.**, Figlus, J., Pontiki, M., Puleo, J.A., and Hsu, T.-J. (2022, March). *Does coastal dune vegetation accelerate wave erosion during extreme events?* Oral presentation presented at the Ocean Sciences Meeting 2022, Honolulu, HI, USA.

Hsu, C.-J.*, Hsu, T.-J., Salimi-Tarazouj, A., and **Tsai, B.** (2022, February). *Nonlinear wave-induced momentary pressure gradient on sediments*. Oral presentation presented at the Ocean Sciences Meeting 2022, Honolulu, HI, USA.

Tsai, B.*, Rafati, Y., Hsu, T.-J., Pontiki, M., Puleo, J. A., Lee, S.-B., Wengrove, M., and Cox, D. T. (2021, July). *Large-Eddy Simulation of Cross-Shore Hydrodynamics under Random Wave in the Surf and Swash Zones.* Oral presentation presented at the Coastal Dynamics 2021, Delft, Netherlands.

Rafati, Y.*, **Tsai, B**., Hsu, T.-J., Pontiki, M., Puleo, J. A., Lee, S.-B., Wengrove, M., and Cox, D. T. (2021, July). *Phase-resolving Simulation of Waves, Currents, and Sediment Fluxes in a Large Wave Flume Under Storm Wave Scenarios.* Oral presentation presented at the Coastal Dynamics 2021, Delft, Netherlands.

Tsai, B.*, Kim, Y., and Hsu, T.-J. (2020, February). *A Large-Eddy Simulation Study on the Flow Structure of a Solitary Wave Breaking in the Inner-Surf and Swash Zones.* Oral presentation presented at the Ocean Sciences Meeting 2020, San Diego, CA, USA.

Tsai, B.*, Kim, Y., Hsu, T.-J., Chauchat, J., and Calantoni, J. (2019, September). *Toward linking fluid mechanics with soil mechanics - Extension of SedFoam model for simulating underwater slumping and sliding processes.* Poster presented at the 4th symposium on two-phase modeling for sediment dynamics (THESIS-2019), Newark, DE, USA.

Tsai, B.*, Kim, Y., and Hsu, T.-J. (2018, December). *Large Eddy Simulation of Solitary Wave Breaking and Flow Structures in the Inner-Surf and Swash Zones.* Poster presented at the American Geophysical Union Fall Meeting 2018, Washington, D.C., USA.

Teaching Experience

Fall 2021 **Soil Mechanics**, Teaching Assistant
Fall 2014 **Structural Theory**, Teaching Assistant
Spring 2014 **Soil Mechanics Laboratory**, Teaching Assistant
Spring 2013 **Soil Mechanics Laboratory**, Teaching Assistant

Outreach & Professional Development

Service and Outreach

2018-2020 **Taiwanese Student Association at University of Delaware**, Vice President *Newark, DE, USA*

Peer Review

Advances in Water Resources
Journal of Geophysical Research: Oceans
Journal of Waterway, Port, Coastal, and Ocean Engineering
Ocean Engineering

Professional Memberships

American Geophysical Union (AGU)
American Society of Civil Engineers (ASCE)