

JIAYE (JAY) ZHANG, Ph.D.

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EDUCATION

Ph.D. in Coastal Engineering

Jun 2021 - Dec 2025

University of Delaware, USA

- Dissertation: “A Multi-scale Numerical Study on Coastal Hydrodynamics, Sediment Transport, and Morphodynamics”
- Committee: Dr. Tian-Jian Hsu (advisor), Dr. Jack A. Puleo, Dr. Nina Stark, Dr. Tobias Kukulka
- GPA: 3.9/4.0

M.S. in Coastal Engineering

Aug 2019 - Jun 2021

University of Delaware, USA

- Thesis: “Eulerian Two-Phase Modeling of Wave Orbital Ripples—A Sensitivity Study on Closure Models”
- Advisor: Dr. Tian-Jian Hsu

B.S. in Harbor, Waterway, and Coastal Engineering

Aug 2013 - Jun 2017

North China University of Water Resources and Electric Power, CHINA

PUBLICATIONS & PRESENTATIONS

Peer-Reviewed Publications:

- **Zhang, J.**, Hsu, T. J., Mathieu, A., Penaloza-Giraldo, J. A., & Chauchat, J. (2026). The significance of turbulent coherent structures on the initiation and evolution of sub-orbital ripples. *Scientific Reports*. <https://doi.org/10.1038/s41598-026-65502-8>
- **Zhang, J.**, Montellà, E. P., Nouri, M., Hsu, T. J., Chauchat, J., & Bonamy, C. (2026). On Key Mechanisms Driving the Onset Motion Behaviors of a Short Cylinder Driven by Accelerating Currents. *Coastal Engineering*, 212, 105120. <https://doi.org/10.1016/j.coastaleng.2026.105120>
- **Zhang, J.**, Tsai, B., Rafati, Y., Hsu, T. J., & Puleo, J. A. (2025). Cross-shore hydrodynamics and morphodynamics modeling of an erosive event in the inner surf zone. *Coastal Engineering*, 196, 104662. <https://doi.org/10.1016/j.coastaleng.2024.104662>
- Stark, N., Adusei, S., Hubler, J., El Ahmad, M., Mayer, T., Hsu, T. J., & **Zhang, J.** (2025). Relating Beach Groundwater-Surface Water Dynamics to In Situ Strength from Dynamic Penetrometers. In *Geotechnical Frontiers 2025* (pp. 75-82). <https://doi.org/10.1061/9780784486016.008>
- Hubler, J. F., Mayer, T., Stark, N., Hummel, E., **Zhang, J.**, & Hsu, T. J. (2025). Measurement of changes in beach sand soil stiffness due to fluctuating tides. *Journal of Waterway, Port, Coastal, and Ocean Engineering*, 151(1), 04024022. <https://doi.org/10.1061/JWPED5.WWENG-2139>
- **Zhang, J.**, Rafati, Y., Hsu, T. J., Calantoni, J., & Romaniello, S. (2024). Wave-driven vertical sorting of density-varying particles. *Journal of Geophysical Research: Earth Surface*, 129(3), e2023JF007320. <https://doi.org/10.1029/2023JF007320>
- Hummel, E., Stark, N., **Zhang, J.**, Hsu, T. J., & Hubler, J. (2024). A Field Observation Framework for Concurrent Measurement of Surf Zone Hydrodynamics, Morphodynamics, and Geotechnical Properties. In *Geo-Congress 2024* (pp. 491-500). <https://doi.org/10.1061/9780784485316.051>

Conference Presentations:

- “Large-Eddy Simulation of Wave-Driven Ripple Evolution and Benthic Flux” - *ICCE Conference 2026*.
- “Large-Eddy Simulation of Ripple Evolution Driven by Turbulent Coherent Structures in an Oscillatory Flow” - *CSDMS Meeting 2025*.
- “Large-Eddy Simulation of Bedform Evolution Driven by Turbulent Coherent Structures in an Oscillatory Flow” - *AGU Meeting 2024*.
- “Scour Burial of Small Object Driven by Currents and Waves—An Eulerian Two-phase Model Study” - *Ocean Sciences Meeting 2024*.

- “A joint field observation and numerical modeling study on cross-shore beach profile evolution in shallow surf zones” - *Ocean Sciences Meeting 2024*.
- “XBeach Modeling of Cross-shore Hydrodynamics and Morphodynamics in a Shallow Surf Zone” - *AGU Fall Meeting 2022*.
- “A numerical study on bottom-slope-induced sediment transport over wave orbital ripples and benthic flux” - *THESIS Conference 2022*.

HONORS & AWARDS

- Graduate Research Award — 2025 Graduate Research Award for Civil, Construction, and Environmental Engineering, University of Delaware.
- Funded Ph.D. Candidate — Supported through research projects funded by the National Science Foundation (NSF), Office of Naval Research (ONR), and Strategic Environmental Research and Development Program (SERDP).
- Travel Scholarships — 2025 CSDMS Annual Meeting Travel Scholarship; 2025 ASBPA Coastal Summit Students and New Professionals Travel Scholarship.

RESEARCH EXPERIENCE

Assistant Research Scientist Jun 2026 - Present

Horn Point Laboratory, University of Maryland Center for Environmental Science

- Physics-Based Modeling for Nature-Based Coastal Solutions
Develop and apply multiscale physics-based models to investigate coastal processes and assess nature-based solutions, with a focus on oyster reefs and wetland eco-morphodynamics.

Postdoctoral Researcher Jan 2026 - May 2026

Center for Applied Coastal Research, University of Delaware

- An Integrated Field-Lab-Modeling Study of Flocculation Dynamics in Estuarine Boundary Layers
Investigated coupled flocculation dynamics and sediment transport in estuarine boundary layers through integrated field observations, laboratory experiments, and modeling (COAWST/ROMS).

Graduate Research Assistant Aug 2019 - Dec 2025

Center for Applied Coastal Research, University of Delaware

- Cross-Shore Hydrodynamics and Morphodynamics Modeling of an Erosive Event
Investigated cross-shore hydrodynamics and morphodynamics across the surf zone using a process-based morphodynamic model (XBeach) and large-wave flume data, with a focus on storm-induced berm erosion, sediment transport, and subsequent sandbar formation.
- Field Observation and Modeling of Cross-Shore Beach Profile Evolution in the Surf Zone
Investigated the importance of incorporating geotechnical properties in coastal morphodynamic modeling through field experiments and numerical modeling. Actively participated in in situ data collection and measurements at the USACE Field Research Facility in Duck, NC (Spring & Fall 2023) and Crescent Beach near Matanzas Inlet, FL (July 2025).
- Numerical Study of Seabed Ripple Evolution Driven by Turbulent Coherent Structures
Investigated the role of turbulent coherent structures in seabed dynamics associated with ripple evolution using three-dimensional large-eddy simulations (LES) in a high-fidelity computational fluid dynamics (CFD) model (OpenFOAM).
- Numerical Study of Fluid-Sediment-Structure Interactions in Munition Mobility and Scour Burial
Investigated the mobility and scour-burial dynamics of underwater munitions on sandy seabeds by using a dynamic mesh approach within a high-fidelity CFD model (OpenFOAM).
- Numerical Study of Wave-Driven Vertical Sorting of Density-Varying Particles
Investigated wave-driven vertical sorting of polydispersed native sand and higher-density olivine particles (for coastal carbon removal) using a coupled CFD-DEM framework, with application to mixed-grain beach nourishment and coastal sediment management.

TEACHING EXPERIENCE

Instructor Fall 2026

Horn Point Laboratory, University of Maryland Center for Environmental Science

- Co-lead the graduate Issue Study Group *Bridging Physics and Ecology Through Eco-Geomorphic Modeling*, facilitating literature-based discussions and guiding students in critically evaluating modeling frameworks and synthesizing findings into a collaborative white paper.

Teaching Assistant

2022 - 2024

Civil, Construction, and Environmental Engineering, University of Delaware

- Supported upper-level undergraduate and graduate courses in *Fluid Dynamics* and *Turbulence and Transport Processes* by leading exam review sessions and holding regular office hours to strengthen students' understanding of fundamental physical concepts and analytical methods.

SELECTED PROJECTS

- Quantifying morphological changes driven by oyster reef breakwaters under different tidal and wave conditions to inform restoration strategies - *Funded by USCRP*.
- Collaborative Research: Flocculation Dynamics in Estuarine Boundary Layers - Advancing New Understanding Through an Integrated Field, Laboratory, and Computational Study - *Funded by NSF*.
- The Role of Turbulent Coherent Structures on the Evolving Seabed - *Funded by NSF*.
- Integration of Soil Mechanics in Numerical Models of Surf Zone Beach Processes via Joint Field Observation and Numerical Modeling - *Funded by ONR*.
- Novel Eulerian Two-phase Numerical Simulation Tool for Scour Burial of Munitions - *Funded by SERDP*.
- Physics of Dune Erosion during Extreme Wave and Storm-Surge Events - *Funded by NSF*.
- Vertical Sorting of Olivine Particles in Sands Driven by Waves - *Funded by Vesta*.

LICENSES & CERTIFICATIONS

- Engineer-in-Training (E.I.T.) — Maryland State Board for Professional Engineers

PROFESSIONAL AFFILIATIONS & SERVICE

- Peer Reviewer: Journal of Geophysical Research: Oceans; Geophysical Research Letters; Journal of Geophysical Research: Machine Learning and Computation; European Journal of Mechanics - B/Fluids; Journal of Waterway, Port, Coastal, and Ocean Engineering; Ocean Dynamics.
- Co-organizer: 2024 DARWIN Computing Symposium.
- Professional Memberships: American Society of Civil Engineers (ASCE), including the Coasts, Oceans, Ports and Rivers Institute (COPRI); American Shore & Beach Preservation Association (ASBPA); American Geophysical Union (AGU); Community Surface Dynamics Modeling System (CSDMS).

SKILLS

Research Expertise:

- Coastal Hydrodynamics and Morphodynamics
- Sediment Transport and Bedform Dynamics
- Fluid-Sediment-Structure Interactions
- Nature-Based Solutions for Coastal Resilience
- Multiscale Numerical Modeling of Coastal Processes
- Multiphase Computational Fluid Dynamics
- Coastal Field Data Collection and Analysis

Technical Expertise:

- Coastal Modeling: OpenFOAM (CFD), XBeach, Delft3D, COAWST (ROMS-SWAN), FUNWAVE
- Programming: MATLAB, Python, C++, Fortran
- Computational Skills: High-performance computing (HPC), machine learning, Linux