BIANCA CHAMPENOIS

MIT Graduate Student

bchamp@mit.edu ◇ biancach.github.io ◇ LinkedIn ◇ Google Scholar

EDUCATION

PhD, Mechanical Engineering and Computation, MIT 2022 - 2025
Major: Computational Science and Engineering, Minor: Geophysical Fluid Dynamics

Master of Science, Mechanical Engineering, MIT 4.9/5.0 2020 - 2022
Thesis: Reconstructing 3D ocean temperature fields from real-time satellite and buoy surface measurements

Bachelor of Science, Mechanical Engineering, UC Berkeley 3.9/4.0 2016 - 2020

RESEARCH SUMMARY

SAND Lab (Stochastic Analysis and Nonlinear Dynamics) - MIT September 2020 - Present
- Active learning for extreme weather event forecasting: I designed a likelihood-weighted active learning algorithm that selects optimal points that speed up training to correct low-resolution climate simulations. I used clustering to visualize and interpret the algorithm's outputs.
- Multi-fidelity modeling of ocean acidification: I trained a temporal convolutional network on historical reanalysis data to learn temperature and salinity over depth as a function of surface quantities. I then used the trained models to make predictions from real-time surface sensor measurements. Finally, I used these predictions to infer total alkalinity, dissolved inorganic carbon, and aragonite saturation state. All predictions included uncertainty quantification.
- Inferring ocean flows for tracking microplastics: I trained an autoencoder on historical reanalysis data to identify relevant latent variables. Then, I used Bayesian optimization to find the latent variables that correspond to real-time observations from drifter trajectories.

PUBLICATIONS

(In Progress) **B. Champenois** and T. P. Sapsis. Likelihood-Weighted Active Selection of Training Data for Improved Extreme Weather Event Prediction.

(In Progress) **B. Champenois**, C. Bastidas, B. LaBash, and T. P. Sapsis. Data-Driven Modeling of 4D Ocean and Coastal Acidification from Surface Measurements.

B. Champenois and T. P. Sapsis. Machine Learning Framework for the Real-Time Reconstruction of Regional 4D Ocean Temperature Fields from Historical Reanalysis Data and Real-Time Satellite and Buoy Surface Measurements. Physica D: Nonlinear Phenomena, December 2023.

S. Guth, **B. Champenois**, T. P. Sapsis, Application of Gaussian Process Multi-Fidelity Optimal Sampling to Ship Structural Modeling. 34th Symposium on Naval Hydrodynamics, June 2022.

AWARDS

2^{nd} Place in the MechE De Florez Competition in the Category of Graduate Science 2024
2^{nd} Place in the SIAM UQ Power of Diversity Poster Competition 2024
SIAM UQ Travel Award 2024
MIT MechE Graduate Travel Grant 2023
MIT Graduate Student Council Conference Grant 2023
Clement F. Burnap Award for Outstanding Master of Science in a Marine Field 2023
Meredith Kamm Award for Excellence in a Woman Graduate Student 2023
3^{rd} Place in the MechE De Florez Competition in the Category of Graduate Science 2023
MIT EnergyHack 2nd Place (1st place in the McKinsey & Co challenge) 2022
Mechanical Engineering Research Exhibition Poster Competition: Runner Up 2021
MIT MechE Harrington Fellowship 2020
National Science Foundation Graduate Research Fellowship (NSF-GRFP) 2020

MEDIA AND REPORTS

Radio Canada Moteur de Recherche *Les modèles météorologiques sont-ils désuets?* July 2024.

MIT News *The MIT Bike Lab: A place for community, hands-on learning.* May 2024.

SIAM News *MIT SIAM Student Chapter Hackathon Utilizes Open-access Energy Data* April 2024.

Spectrum Magazine *Bianca Champenois Helps Model the Future for Coastal Industries.* Spring 2023.

Global Energy Monitor *Scraping By 2023: Global Coal Miners and the Urgency of Just Transition.* Contributions: Development of machine learning model to estimate coal mine workforce size.

CONFERENCES

B. Champenois, T. P. Sapsis, Data-Driven Modeling of Indicators for Ocean Acidification in the US Northeast Coast with Physics-Enhanced Machine Learning. ENOC, 2024.

B. Champenois, T. P. Sapsis, Finding the Most Valuable Data Points for Predicting Extreme Event Statistics with Likelihood-Weighted Active Learning. ENOC, 2024.

B. Champenois, T. P. Sapsis, Overcoming Fear of Missing Out (FOMO): Active Selection of Training Data to Predict Extreme Event Statistics in Climate Datasets. SIAM UQ, 2024.

B. Champenois, A. Charalampopoulos, T. P. Sapsis, Quantifying the Value of Data in Scientific Machine Learning Models with Output-Weighted Active Learning. AGU, Fall 2023.

B. Champenois, T. P. Sapsis, A Multi-Fidelity Framework for Ocean Temperature Reconstruction Based on Model-Inferred Dynamics and Real Time Satellite and Buoy Measurements. AGU, Fall 2021.

K.T. Huynh, E. Variano, **B. Champenois**, M. Grehm, Correlating Gas Exchange Across the Air-Water Interface to Water-Side Velocity Statistics. AGU, Fall 2020.

SKILLS

Programming	Python, MATLAB, Java, High Performance Computing
Software Libraries	NumPy, Pandas, TensorFlow, PyTorch, ROS
Design Software	Adobe (Illustrator, Photoshop), AutoCAD, SolidWorks, Fusion, KiCad
Design Tools	3D Printing, Laser Cutter, Machine Shop Trained
Language	French (fluent), Spanish (proficient)

WORK, SERVICE, LEADERSHIP

MIT School of Engineering Communication Lab - Fellow June 2023 - Present
Communication coach for graduate and undergraduate students. Responsibilities include one-on-one sessions, content creation for the online CommKit resource, and technical communication workshops.

MIT MechE - 2.122 Stochastic Systems Teaching Assistant January 2022 - May 2022
In charge of writing and grading problem sets and exams, and holding weekly office hours and review sessions for a class of 38 undergraduate, graduate, and Navy/Coast Guard master's students. Overall rating: 6.6/7.

MIT Division of Student Life - Graduate Resident Advisor September 2021 - Present
Live-in resident advisor at Next House supporting 45 undergraduate students. Responsible for setting community expectations, organizing social activities, managing crises, and providing mental health support.

MIT MechE ENGAGE - Peer Mentor September 2022 - Present
Mentor for incoming women and underrepresented minority first year graduate students. Responsible for attending and organizing semesterly workshops, weekly group discussions, and regular one-on-one meetings.

The Bike Lab - President and Founder June 2022 - Present
Founded a new student-run bike repair cooperative at MIT. In charge of fundraising, purchasing tools and parts, recruiting volunteers, coordinating hours, and leading repairs.