Rodrigo Durán

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Overview

My research at the intersection of mathematics and oceanography produces novel insights into ocean physics using nonlinear dynamics and other advanced mathematical tools. My work encompasses research in physical oceanography, coherent structures, machine learning, and environmental modeling. This interdisciplinary approach combines rigorous mathematical theory, ocean physics, data analysis, and computational methods to solve complex oceanographic problems spanning fundamental research and practical applications for offshore safety and environmental protection. An unusually strong multidisciplinary academic background—spanning chemical, biological, and geological oceanography alongside two advanced degrees in mathematics and physical oceanography—provides the foundation for this dynamic and varied research, enabling me to move fluidly across disciplinary boundaries and develop novel solutions for complicated open problems.

Google Scholar https://scholar.google.com/citations?hl=en&user=d9P4fiYAAAAJ

Research Innovation & Impact

My research has generated 20+ scholarly works (400+ total citations, h-index: 11, i10-index: 12), 5 software packages, and 5 datasets, with methodology adopted across 14 oceanic regions globally, and extensive collaborations across 9 international research groups. Developed and validated novel methodologies to extract persistent Lagrangian patterns, fundamentally improving the analysis of oceanic transport with widespread impact:

- **Altering Research Practices:** Introduced a reliable approach where none previously existed, now utilized by numerous international researchers across 14 diverse oceanic regions worldwide (including, e.g., the Gulf of Mexico, Bay of Plenty New Zealand, Bay of Bengal India, Black Sea, Mediterranean Sea, tropical Atlantic, Caribbean Sea and Indonesian Seas).
- **Driving Operational Advancements:** Under active consideration by NOAA's Emergency Response Division and Environment and Climate Change Canada for oil spill preparedness and response.
- **Next Generation Training:** I developed a methodology that was later incorporated into five doctoral dissertations and adopted by three postdoctoral researchers (with a postdoctoral scholar leading a 2019 drifter validation study as first author), helping cultivate a Lagrangian perspective among the emerging generation of oceanographers.

Research Leadership & Independence

Demonstrated exceptional research autonomy and leadership through an accelerated, non-traditional career trajectory, securing significant funding and establishing an independent research program three years before completing my Ph.D. in 2020.

- **Early Principal Investigator Role:** Played a key role in acquiring $853,281 in research funding as Co-Principal Investigator, beginning in 2017. Assumed responsibility for proposal development, deliverable coordination, and stakeholder engagement years ahead of the typical academic timeline.
- **Independent Research Program Development:** While a doctoral candidate, established a recognized research program on infrastructure risk and environmental modeling, independent from my dissertation work. This program includes Lagrangian transport, environmental modeling, wave modeling, and risk assessment, resulting in substantial outputs valued by stakeholders:
  - 15+ peer-reviewed publications
  - 4 technical reports for federal agencies
  - 5 software packages
  - 5 published datasets
- **International Collaboration Leadership:** Forged and coordinated international research partnerships with leading institutions (e.g., University of Miami, USA; Universidad Nacional Autónoma de México, Mexico; University of Hamburg, Germany; University of Otago, New Zealand; Instituto de Ciencias del Mar, Spain; National Institute for Space Research, Brazil; CICESE, Mexico), leading to multiple co-authored publications and software tools.
- **Prestigious Recognition:** I received two awards for research conducted independently of my doctoral dissertation during my graduate studies. Contributions to the Offshore Risk Modeling Suite were recognized with the **R&D 100 Award (2019)**, and early work on quasi-steady structures organizing

oceanic trajectories using nonlinear dynamics earned a **Best Poster Presentation Award** in the early career category at a SIAM conference (2015), five years before I completed my doctorate.

EDUCATION

Ph.D. Physical Oceanography 2020
College of Earth, Ocean and Atmospheric Sciences, Oregon State University.
Adviser: Prof. Roger M. Samelson.
Kinematics and Dynamics of a Model Eastern-Boundary Poleward Undercurrent
https://ir.library.oregonstate.edu/concern/graduate_thesis_or_dissertations/cj82kf17c

M.S. Physical Oceanography 2014
College of Earth, Ocean and Atmospheric Sciences, Oregon State University.
Adviser: Prof. Roger M. Samelson.
Establishing Suitability of an Ocean Model for a Poleward Undercurrent Study
https://ir.library.oregonstate.edu/concern/graduate_projects/1831cr36v

M.S. Mathematics 2013
Department of Mathematics, College of Science, Oregon State University.
Adviser: Prof. Yevgeniy Kovchegov.
Predicting the Most Likely State for a Basic Geophysical Flow: Theoretical Framework
https://ir.library.oregonstate.edu/concern/graduate_projects/5h73pw846

B.S. Oceanography 2006
Facultad de Ciencias Marinas, Universidad Autónoma de Baja California.
Thesis: Calculation of Superficial Advective Velocities From Sequential Satellite Images (AVHRR) In the Gulf of Tehuantepec, México

AWARDS, HONORS & FELLOWSHIPS

TechConnect Innovation Award 2022
Awarded to a team of researchers at the National Energy Technology Laboratory by TechConnect World Innovation Conference and Expo. "Advanced Infrastructure Integrity Modeling technology integrates big data, big data computing, and multiple machine-learning and advanced spatial models to evaluate energy infrastructure integrity".

Institute of Physics (IOP) Publishing, Trusted Reviewer Award 2020
Certificate "in recognition of an exceptionally high level of peer review competency".

R&D 100 Award 2019
The Offshore Risk Modeling (ORM) Suite, developed at the U.S. Department of Energy's National Energy Technology Laboratory, won an R&D 100 award conferred by R&D World magazine. I developed the Climatological Isolation and Attraction Model (CIAM), one of the eight components of the ORM Suite, based on work with collaborators F. J. Beron-Vera and M. J. Olascoaga. I also participated in developing BLOSOM, another ORM tool, by leading the development of some of its components and assisting with others.

Merit-based invitation, Oceanic Eastern Boundary Upwelling Systems 2019
Awarded travel and full funding to participate in training sponsored by the Intergovernmental Oceanographic Commission (IOC-UNESCO) and CLIVAR, held at the International Center for Theoretical Physics (ICTP) in Trieste, Italy.

Best poster presentation in the early-career category 2015
For my contributions to quasi-steady Lagrangian transport patterns, Society of Industrial and Applied Mathematics (SIAM), Conference on Mathematical and Computational Issues in the Geosciences. Stanford University, California.

U.S. Department of Energy's Oak Ridge Fellowship Program 2014
Oak Ridge Institute for Science and Education (ORISE). Albany, Oregon.

PROFESSIONAL EXPERIENCE

Research Scientist 2024–Present
Planetary Science Institute.

Research Scientist 2017–2024
Theiss Research.

Faculty Research Assistant 2015–2017
College of Earth, Ocean and Atmospheric Sciences. Oregon State University.

Researcher 2014–2015
National Energy Technology Laboratory, U.S. Department of Energy.
U.S. Department of Energy Oak Ridge Fellowship.

Graduate Research Assistant 2008–2014
College of Earth, Ocean and Atmospheric Sciences. Oregon State University.
Funding from the Office of Naval Research.

FUNDING SECURED

Total funding secured: $1,007,856.

Global Eddy-Driven Transport Estimated from *in Situ* Lagrangian Observations. 2021–2026
Co-Principal Investigator. National Science Foundation. $159,506.

Environmentally Prudent Stewardship, Infrastructure and Metocean Technology. 2024
Co-Principal Investigator.
National Energy Technology Laboratory, U.S. Department of Energy. $51,600.

Infrastructure and Metocean Technology, Assessing Current and Future Offshore 2019–2023
Infrastructure Hazards. Co-Principal Investigator.
National Energy Technology Laboratory, U.S. Department of Energy. $482,585.

Current and Future Infrastructure Hazards, Offshore Risk Modeling Suite. 2017–2019
Co-Principal Investigator.
National Energy Technology Laboratory, U.S. Department of Energy. $159,590.

Blowout and Spill Occurrence Model (BLOSOM), Dispersant Performance During 2015–2017
Deep Ocean Application, Integrated Risk Assessment.
National Energy Technology Laboratory, U.S. Department of Energy. $154,575.

PUBLICATIONS IN PREPARATION OR UNDER REVIEW

1. **Duran R.**, N. O. Aksamit, X, S, Liang & C. M. Appendini (to be submitted, manuscript available upon request). On the physical mechanisms controlling Loop Current eddy separations and their seasonality.

2. Pratama B. E., C. Maes, M. Herrmann, A. Ramdhani, P. Marsaleix & **Duran R.** (2025). Redistribution of River Freshwater in the Indonesian Maritime Continent: Evidencing some "Rivers in the Sea" Pathways. Journal of Geophysical Research: Oceans.

3. Nordam, T., Abascal, A. J., Aragon, G., Babaei, H., Barker, C. H., Chang, K.-H., Dagestad, K.-F.,**Duran, R.**, French-McCay, D., Gloekler, M., Hospital, A., Keramea, P., Legrand, S., Lemos, A. T., Lin, Y., Liubartseva, S., Mashayekhi, R., McGrath, G., Mostaani, A., Mueller, R. D., Pettit, D. J., Skancke, J., Song, Y., Sylaios, G., Zacharias, D. C., & Zodiatis, G. (in press). Future directions in oil spill modeling. Marine Pollution Bulletin.

PEER-REVIEWED PUBLICATIONS

Asterisk (★) indicates corresponding author.

1. ASM Alauddin Al Azad, R. Marsooli, M. Jamous, Appendini C. M., P. Ruiz-Salcines & **R. Duran** (2025). Coastal Erosion Hazards in Northwest Florida due to Extreme Wind Waves generated by Tropical Cyclones. *Coastal Engineering*, 104872. https://doi.org/10.1016/j.coastaleng.2025.104872

2. Appendini C. M., P. Ruiz-Salcines, **R. Duran**, R. Marsooli, ASM Alauddin Al Azad & K. Emanuel (2025). Redefining Design Wave Conditions in the Gulf of Mexico under a Changing Climate. *Ocean Engineering*, 334, 121685. https://doi.org/10.1016/j.oceaneng.2025.121685

3. Quintana-Barranco, R., C. M. Appendini, M.E. Allende-Arandía, C, Argaez & **R. Duran** (2025). Enhancing Lagrangian Particle Tracking Using Objective Eulerian Coherent Structures. *Marine Pollution Bulletin*, 214, 117801. https://doi.org/10.1016/j.marpolbul.2025.117801

4. Pfander, I., L. Romeo, **R. Duran**, A. Dyer, C. Schooley, M. Wenzlick, P. Wingo, D. Zaengle, J. Bauer (2024). Extensive Pipeline Location Data Resource: Integrating Reported Incidents, Past Environmental Loadings, and Potential Geohazards for Integrity Evaluations in the U.S. Gulf of Mexico. *Data in Brief*, Volume 55. https://doi.org/10.1016/j.dib.2024.110728.

5. Kunz, L., A. Griesel, C. Eden, **R. Duran**, & B. Sainte-Rose (2024). Transient Attracting Profiles in the Great Pacific Garbage Patch. *Ocean Science*, 20, 1611–1630. https://doi.org/10.5194/os-20-1611-2024

6. Dyer A.S., M. Mark-Moser, **R. Duran**, J. R. Bauer (2024). Offshore application of landslide susceptibility mapping using gradient-boosted decision trees: a Gulf of Mexico case study. *Natural Hazards*. https://doi.org/10.1007/s11069-024-06492-6

7. Mark-Moser, M., L. Romeo, **R. Duran**, J. R. Bauer, and K. Rose (2024). Advanced Offshore Hazard Forecasting to Enable Resilient Offshore Operations. Paper presented at the Offshore Technology Conference, Houston, Texas, USA, May 2024. https://onepetro.org/OTCONF/proceedings-abstract/24OTC/24OTC/D021S017R008/544917

8. López-Aviles B., E. Beier, **R. Duran**, J. Gómez-Valdés, R. Castro, L. Sánchez-Velasco (2024). The California Current System off Baja California Sur. *Progress in Oceanography*. https://doi.org/10.1016/j.pocean.2024.103225

9. Allende-Arandía M. E., **R. Duran**, L. Sanvicente-Añorve & C. M. Appendini (2023). Lagrangian Characterization of Surface Transport From the Equatorial Atlantic to the Caribbean Sea Using Climatological Lagrangian Coherent Structures and Self-Organizing Maps. *Journal of Geophysical Research: Oceans*, 128, e2023JC019894. https://doi.org/10.1029/2023JC019894.

10. Zhen, P., D. Guo, G. Krokos, J. Dong, **R. Duran** & I. Hoteit (2022). Submesoscale Processes in the Upper Red Sea. *Journal of Geophysical Research*. https://doi.org/10.1029/2021JC018015.

11. Dyer, A., D. Zaengle, J. Nelson, **R. Duran**, M. Wenzlick, P. Wingo, J. Bauer, K. Rose & L. Romeo (2022). Applied Machine Learning Model Comparison: Predicting Offshore Infrastructure Integrity with Gradient Boosting Algorithms and Neural Networks. *Marine Structures*, 83, 103152. https://doi.org/10.1016/j.marstruc.2021.103152

12. Nelson, J., L. Romeo & **R. Duran** (2021). Exploring the Spatial Variations of Stressors Impacting Platform Removal in the Northern Gulf of Mexico. *Journal of Marine Science and Engineering*, 9, 1223. https://doi.org/10.3390/jmse9111223.

13. Kurczyn, J. A., **R. Duran**, E. Beier, & A. J. Souza (2021). On the Advection of Upwelled Water on the Western Yucatan Shelf. *Frontiers in Marine Science*, 8:723452. https://doi.org/10.3389/fmars.2021.723452

14. Gouveia, M. B., **R. Duran***, J. A. Lorenzzetti, A. T. Assireu, R. Toste, L. P. de F. Assad & D. F. M. Gherardi (2021). Persistent Meanders and Eddies Lead To Quasi-Steady Lagrangian Transport Patterns in a Weak Western Boundary Current. *Scientific Reports*, **11**(1), 497. https://www.nature.com/articles/s41598-020-79386-9

15. Nordam, T. & **R. Duran** (2020). Numerical Integrators for Lagrangian Oceanography. *Geoscientific Model Development*, 13, 5935–5957. https://doi.org/10.5194/gmd-13-5935-2020.

16. Zhang, R., P. Wingo, **R. Duran**, K. Rose, J. Bauer,& R. Ghanem (2020). Environmental Economics and Uncertainty: Review and a Machine Learning Outlook. *Oxford Encyclopedia of Environmental Economics.* https://doi.org/10.1093/acrefore/9780199389414.013.572.

17. Gough M. K., F. J. Beron-Vera, M. J. Olascoaga, J. Sheinbaum, J. Jouenno, **R. Duran** (2019). Persistent Lagrangian Transport Patterns in the Northwestern Gulf of Mexico. *J. Phys. Oceanogr.*, **49**, 353–367, https://doi.org/10.1175/JPO-D-17-0207.1

18. **Duran, R.***, F. J. Beron-Vera, M. J. Olascoaga (2018). Extracting Quasi-Steady Lagrangian Transport Patterns From the Ocean Circulation: An Application to the Gulf of Mexico. *Scientific Reports*, **8**(1), 5218. https://www.nature.com/articles/s41598-018-23121-y

19. **Duran, R.***, L. Romeo, J. Whiting, J. Vielma, K. Rose, A. Bunn, J. Bauer (2018). Simulation of the 2003 Foss Barge - Point Wells Oil Spill: A Comparison Between Blosom and Gnome Oil-Spill Models. *J. Mar. Sci. Eng.*, **6**(3), 104; https://doi.org/10.3390/jmse6030104

BOOK & DISSERTATION CHAPTERS

1. **Duran, R.**, T. Nordam, M. Serra & C. Barker (2021). Horizontal transport in oil spill modeling. In *Marine Hydrocarbon Spill Assessments*, pp. 59–96, Elsevier. https://doi.org/10.1016/B978-0-12-819354-9.00004-1. A preprint is available at: https://arxiv.org/abs/2009.12954.

2. Nordam T., J. Skancke, **R. Duran** & C. Barker (2021). Vertical mixing in oil spill modeling. In *Marine Hydrocarbon Spill Assessments*, pp. 97–143, Elsevier. https://doi.org/10.1016/B978-0-12-819354-9.00002-8. A preprint is available at: https://arxiv.org/abs/2010.11890.

3. **Duran, R.** & R. M. Samelson (2020). Dynamical and vorticity balances of a model eastern-boundary poleward undercurrent. (Chapter three of Ph.D. Dissertation, Oregon State University). https://ir.library.oregonstate.edu/concern/graduate thesis or dissertations/cj82kf17c.

4. **Duran, R.** & R. M. Samelson (2020). Eulerian and Lagrangian kinematics of a model eastern-boundary poleward undercurrent. (Chapter two of Ph.D. Dissertation, Oregon State University). https://ir.library.oregonstate.edu/concern/graduate thesis or dissertations/cj82kf17c.

TECHNICAL REPORTS

1. Nelson J., A. Dyer, L. Romeo, M. Wenzlick, D. Zaengle, **R. Duran**, M. Sabbatino, P. Wingo, A. Barkhurst, K. Rose, J. Bauer. (2021). Evaluating Offshore Infrastructure Integrity. DOE/NETL-2021/2643; NETL Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Albany, OR. https://doi.org/10.2172/1780656

2. Bonheyo G.T. , K. Rose, A. Bunn, A. Avila, T. Bays, V. Cullinan, **R. Duran**, R. Jeters, L-J. Kuo, J. Park, J. Vielma, E. Winder, P. Wingo (2017). Analysis Of How Environmental Conditions Affect Dispersant Performance During Deep Ocean Application. PNNL-26935. Bureau of Safety and Environmental Enforcement, Washington, DC. p 173. https://www.bsee.gov/research-record/osrr-1066-analysis-how-environmental-conditions-affect-dispersant-performance-during

3. **Duran, R.** (2016). Sub-Grid Parameterizations for Oceanic Oil-Spill Simulations. NETL-TRS-9-2016; EPAct Technical Report Series. U.S. Department of Energy, National Energy Technology Laboratory: Albany, OR; p 36. https://edx.netl.doe.gov/dataset/sub-grid-parameterizations-for-oceanic-oil-spill-simulations

4. Sim, L., J. Graham, K. Rose, **R. Duran**, J. Nelson, J. Umhoefer and J. Vielma (2015). Developing a Comprehensive Deepwater Blowout and Spill Model. NETL-TRS-9-2015; EPAct Technical Report Series. U.S. Department of Energy, National Energy Technology Laboratory: Albany, OR; p 44. https://edx.netl.doe.gov/dataset/developing-a-comprehensive-deepwater-blowout-and-spill-model

SOFTWARE

1. Schooley C., L. Romeo, D. Zaengle, I. Pfander, **R. Duran**, J. Bauer, K. Rose, (2024). Advanced Infrastructure Integrity Modeling (AIIM) Dashboard, https://edx.netl.doe.gov/dataset/offshore-aiim-dashboard

2. Wingo P., D. Zaengle, **R. Duran**, M. Mark-Moser, J. Bauer, J. Harris, I. Pfander, M. Gao, S. Pantaleone, K. Rose, A. Dyer, (2023). Ocean & Geohazard Analysis (OGA) Tool. https://edx.netl.doe.gov/dataset/ocean-geohazard-analysis-tool, DOI: 10.18141/1963841

3. Montaño Orozco, M. M., & **R. Duran** (2024). cLCS code in Python. MireyaMMO/cLCS: v1.0.0 https://doi.org/10.5281/zenodo.10574263; link to repository: https://github.com/MireyaMMO/cLCS

4. **Duran, R.**, F. J. Beron-Vera and M. J. Olascoaga (2019). Climatological Lagrangian Coherent Structures code. https://doi.org/10.18141/1558781; link to repository: https://bitbucket.org/rodu/clcss/src/master/

5. Sim, L., Vielma, J., **Duran, R.**, Romeo, R., Wingo, P., and Rose, K. (2017). BLOwout and Spill Occurrence Model (BLOSOM). https://edx.netl.doe.gov/dataset/blosom-release DOI: 10.18141/1420083

DATASETS

1. Pfander, I., L. Romeo, **R. Duran**, A. Dyer, C. Schooley, M. Wenzlick, P. Wingo, D. Zaengle, J. Bauer (2024). Extensive Pipeline Location Data Resource: Integrating Reported Incidents, Past Environmental Loadings, and Potential Geohazards for Integrity Evaluations in the U.S. Gulf of Mexico (2024). https://doi.org/10.1016/j.dib.2024.110728. Direct link to data: https://edx.netl.doe.gov/dataset/u-s-gulf-of-mexico-pipeline-and-reported-incident-datasets

2. Romeo L., I. Pfander, **R. Duran**, M. Sabbatino, C. Schooley, M. Wenzlick, P. Wingo, D. Zaengle, J. Bauer (2024). U.S. Gulf of Mexico Pipeline and Reported Incident Datasets, https://edx.netl.doe.gov/dataset/u-s-gulf-of-mexico-pipeline-and-reported-incident-datasets. DOI: 10.18141/2280823

3. Appendini C. M., **R. Duran**, P. Ruiz-Salcines, R. Marsooli, ASM Alauddin Al Azad (2023). Extreme waves in present and future climates using physics-based synthetic tropical cyclones in the Gulf of Mexico. https://doi.org/10.18141/2217544.

4. Schooley, C., M. Mark-Moser, J. Bauer, **R. Duran**, J. Pramuk, A. Dyer, I. Pfander, P. Wingo, and D. Zaengle (2023). Gulf of Mexico Risk Analysis Database V1.0. https://doi.org/10.18141/1963233.

5. Romeo, L., A. Dyer, M. Wenzlick, **R. Duran**, J. Nelson, M. Sabbatino, P. Wingo, K. Rose and J. Bauer (2021). Comprehensive Gulf of Mexico Federal Waters Platform, Incident, Metocean, and Geohazard Dataset https://doi.org/10.18141/1779221.

PROFESSIONAL SERVICE

Reviewer for Ocean Science (European Geophysical Union), Limnology and Oceanography, Deep-Sea Research Part I, Science of the Total Environment, Environmental Research Letters, Marine Pollution Bulletin, and Arctic and Marine Oil spill Program (AMOP) conference.

Master of Science degree committee member for Brandon López at CICESE, https://cicese.repositorioinstitucional.mx/jspui/handle/1007/3826

I participated (by invitation only) in a year-long 2024 Modeling Working Group organized by the Coastal Response Research Center (CRRC, University of New Hampshire) and NOAA's Office of Response & Restoration as part of an effort to operationalize innovative ideas for fate, behavior, and trajectory modeling that improve freshwater and arctic oil spill response. Funded by the U.S. Coast Guard's Great Lakes Oil Spill Center of Expertise (GLCOE). My contributions to innovative trajectory modeling using tools from nonlinear dynamics lead to ongoing technical collaborations with both NOAA's Emergency Response Division (ERD) and Environment and Climate Change Canada (ECCC) researchers on advanced trajectory model development and uncertainty quantification.

Served as a contributing researcher on the "Design and Implementation of a Pilot Observation and Early Warning System for Sargassum in the Mexican Caribbean" funded by CONAHCYT (Mexico's national council for science and technology). Applied advanced Lagrangian analysis and machine learning methods, specifically climatological Lagrangian Coherent Structures (cLCS) and Self-Organizing Maps (SOMs), to project the most probable sargassum transport routes using multi-year data. The analysis identified persistent transport-determining structures and primary pathways through which sargassum is directed toward the Mexican coast. This finding provides a key scientific basis for strategic planning, informing where open-ocean containment and collection efforts could be most effectively deployed to mitigate coastal impacts

I participated (by invitation only) in the 2021 Virtual Community Modeling Workshop organized by the National Oceanic and Atmospheric Administration (NOAA). The goal is to support the development of a community-based coupled Earth system modeling approach to improve coastal and operational ocean models within the Unified Forecast System of the United States.

Community discussion for Ocean Science, available at https://doi.org/10.5194/os-2020-83-SC2 and https://doi.org/10.5194/os-2020-83-SC3.

I participated (by invitation only) in phase II of the 2020 Arctic Maritime Spill Response Modeling Workshop. The goal was to improve oil-spill modeling to address United States Coast Guard and Federal On-Scene Coordinator needs during an oil spill in the Arctic.

PRESENTATIONS

Seminars and Working Group Talks

RSMAS University of Miami COMPASS Seminar Series.	2025
NOAA Coastal Ocean Modeling Seminar.	2025
Centro de Investigación Científica y Educación Superior de Ensenada (CICESE), México.	2025
King Abdullah University of Science and Technology, KAUST, Saudi Arabia.	2025
King Abdulaziz University, Jeddah, Saudi Arabia.	2025
International Oil Spill Modeling Working Group, NOAA-GLERL, MI, USA.	2024
Centro de Investigación Científica y Educación Superior de Ensenada (CICESE), México.	2024
International Oil Spill Modeling Working Group, University of New Hampshire.	2024

Instituto de Ciencias del Mar, Departamento de Oceanografía Física. Barcelona, Spain.	2024
Centro de Investigación Científica y Educación Superior de Ensenada (CICESE), México.	2022
Universidad Nacional Autónoma de México, Sisal, Yucatán, México.	2022
Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution, MA, USA.	2022
American Geophysical Union (AGU) Fall Meeting.	2021
NOAA Ocean and Coastal Community Modeling Workshop.	2021
Universidad Nacional Autónoma de México, México.	2021
National Oceanography Center, Liverpool, UK.	2021
American Geophysical Union (AGU) Fall Meeting.	2020
Florida Institute of Technology, Ocean Engineering and Marine Sciences. FL, USA.	2020
First International Coastal Resilience Symposium. Mérida, México.	2019
Universidad Nacional Autónoma de México. Sisal, Yucatán, México.	2019
University of North Carolina, Marine Sciences. Chapel Hill, NC, USA.	2018
Florida Atlantic University, Harbor Branch Oceanographic Institute. FL, USA.	2018
Instituto de Ciencias del Mar, Departamento de Oceanografía Física. Barcelona, Spain.	2017
NOAA Western Regional Center. WA, USA.	2016
Instituto de Ciencias del Mar, Departamento de Oceanografía Física. Barcelona, Spain.	2013

Poster presentations

Gulf of Mexico Oil Spill and Ecosystem Science Conference. LA, USA.	2017
AmeriMech Symposium on Fluid Transport and Nonlinear Dynamics. Woods Hole Oceanographic Institution, MA, USA.	2016
Conference on Mathematical and Computational Issues in the Geosciences. Award-winning poster, Society of Industrial and Applied Mathematics. Stanford University, USA.	2015

COMPUTATIONAL & TECHNICAL EXPERTISE

Computing systems

Windows with Cygwin and Windows Subsystem for Linux, UNIX/Linux and macOS. High Performance Computing on Joule 2.0 supercomputer, U.S. Department of Energy.

Software practices

Git version control, code debugging, testing and reproducibility.

Numerical analysis, data analysis, computer mathematics and programming

Proficient with Matlab. Working knowledge of Julia, Python, Mathematica, Jupyter Notebook, Fortran, Linux shell scripting, Markdown and HTML.

Key Research Software & Tools

Objective Eulerian Coherent Structures and Lagrangian Coherent Structures including Julia package CoherentStructures.jl, Trajectory Stretching Exponent and Trajectory Rotation Average (Coherent Structures from single-trajectories), Instantaneous Vorticity Deviation and Lagrangian-Averaged Vorticity Deviation, ROMS, FVCOM, and Oceananigans.jl (ocean models), Liang information flow (rigorous causality estimates), Coastal Trapped Wave code by Ken Brink (Woods Hole Oceanographic Institution), Gibbs-SeaWater Oceanographic Toolbox, SeaWater Oceanographic Library, jLab Oceanographic Data Analysis, WAFO (Wave Analysis for Fatigue and Oceanography), Chebfun (expands Matlab's ability with vectors and matrices to functions and operators), BLOSOM (BLOwout and Spill Occurrence Model), GNOME (General NOAA Operational Modeling Environment), NCO (netCDF Operators), CDO (Climate Data Operators), LaTeX.

ACADEMIC BACKGROUND

Undergraduate Oceanography (Multidisciplinary Foundation): Comprehensive training across all four branches of oceanography—physical, biological, geological, and chemical—each including theory, field work, and laboratory components. Additional coursework in calculus IV, sequences and series, real and complex analysis, abstract algebra, and linear algebra—deliberate preparation toward a graduate degree in mathematics. Week-long extracurricular seminars: selected topics in numerical analysis, spaces of matrices and their applications, introduction to differential geometry, elements of algebraic topology, on the irrationality of π, e and other numbers, introduction to functional analysis.

Graduate Mathematics (Selected Advanced Coursework): Real analysis (four-course sequence), complex analysis, topology and fundamental groups (two-course sequence), abstract linear algebra, partial differential and integral equations of mathematical physics (three-course sequence), probability (two-course sequence) and topics in stochastic processes, numerical analysis and numerical solutions to differential equations (five courses) including finite element and discontinuous Galerkin methods.

Graduate Oceanography (Selected Advanced Coursework): Geophysical fluid dynamics, large-scale ocean circulation, geophysical waves, stability of geophysical fluid flows, turbulence, eastern boundary currents, advanced coastal physical oceanography, data analysis in the time/space domain.

Cross-Disciplinary Graduate Coursework: Chemical oceanography, principles of climate.

Specialized Intensive Training: Satellite oceanography: theory and applications (20-day advanced course, CICESE). Spectral and time-frequency analysis (10-day intensive, J. M. Lilly https://jmlilly.net/course/).

Graduate coursework totals 66 credits in mathematics versus 52 in oceanography, reflecting deliberate preparation, begun as an undergraduate, for research requiring fluency across disciplinary boundaries. This foundation enables solving problems that have resisted conventional approaches.

Seagoing Experience

SDI SCUBA Diver Instructor No. 42513
SDI Specialty Instructor Ratings (15): Sidemount, Computer Nitrox, Deep, Drift, Night/Limited Visibility, Underwater Navigation, Advanced Buoyancy Control, Boat Diver, Shore/Beach, Wreck, Marine Ecosystems Awareness, Research, Altitude, Underwater Video, and Underwater Photography.
PADI SCUBA diving certifications (non-active): Master SCUBA Diver Trainer.
Technical Diving Certifications: TDI Sidemount, TDI Advanced Nitrox (up to 100% O_2), TDI Decompression Procedures and TDI Extended Range.
First Response Training: Oxygen Administration, CPR/AED, Adult and Child Emergency Care, Bloodborne Pathogens
Experience includes over 5000 SCUBA dives in a wide range of sea conditions; dive types include sidemount, decompression, accelerated decompression (oxygen and nitrox), enriched air nitrox, cavern, deep, night, drift, boat, shore, navigation, research, salvage, shipwreck diving (with and without penetration)—and combinations thereof. I have extensive experience as a PADI SCUBA diving instructor, dive guide (Dive Master), and underwater videographer, teaching 750+ SCUBA introductory experiences consisting of a pool session and an open water dive. I have taught SCUBA certification courses from basic open water to rescue diver and a specialty diver course, resulting in 71 SCUBA diver certifications.
Experience includes SCUBA-diving installation, search and recovery of bottom-mounted oceanographic equipment, and recovery of sunken ships.
Experience in oceanographic data collecting (ADCP, CTD, topography level, water, and sediment samples), including open ocean, coastal lagoons, estuaries, beaches, and other coastal areas, from several ship types, with data processing for each type of sampling.

Teaching Experience

SDI SCUBA Diving Instructor No. 42513 2026–Present

Graduate Teaching Assistant 2006–2008, 2012–2014
Department of Mathematics, Oregon State University.
I tutored for undergraduate math classes taught at Oregon State University, occasionally some graduate-level classes, 3 hours per week. I designed, conducted, and graded weekly math recitation classes for precalculus through differential calculus. I graded and proctored midterm and final exams.

Mathematics Instructor Summer 2008
Department of Mathematics, Oregon State University.
Sole instructor for MTH 251 (Differential Calculus), responsible for all lectures, materials development, and grading.

Mathematics Tutor 2007–2008
Naval Reserve Officers Training Corps, Oregon State University.
Group-tutored precalculus through vector calculus, four hours per week.

PADI SCUBA Diving Instructor 1999–2006

PADI Open Water SCUBA Instructor and Master SCUBA Diver Trainer No. 164213.
I have issued 71 SCUBA diving certifications: 2 Scuba Divers, 1 Junior Open Water Diver, 42 Open Water Divers, 17 Advanced Open Water Divers, 8 Rescue Divers and 1 Drift Diver Specialty Diver.