Colton J. Conroy

Columbia University
Lamont-Doherty Earth Observatory
P.O. Box 1000, 61 Route 9W
Palisades, NY 10964
Email: cjconroy@ldeo.columbia.edu, cjc2235@columbia.edu
websites: https://github.com/coltonjconroy
https://coltonjconroy.squarespace.com

Research Experience

June 2023 - Current
Computational Fluid Dynamics Research Consultant – DockYard
Hingham, MA
Developing an entropic multi-relaxation lattice Boltzmann method on GPUs for sailing yacht velocity prediction.

November 2018 - Current
Adjunct Associate Research Scientist – Lamont-Doherty Earth Observatory
Columbia University, Palisades, NY
Develop physical and numerical models to quantify lava flow dynamics.

January 2019 - March 2024
Senior Research Associate – Roy M. Huffington Department of Earth Sciences
Southern Methodist University, Dallas, TX
Developed physical, statistical, and numerical models to quantify rain induced floods, landslides, and post-wild fire debris flows.

June 2018 - October 2018
Associate Research Scientist – Lamont-Doherty Earth Observatory
Columbia University, Palisades, NY
Developed a nonlinear viscosity model for lava flows. Integrated this physical model into my previously developed computer program to study nonlinear channelized lava flows produced by Kīlauea Volcano, Hawai'i.

November 2017 - May 2018
Postdoctoral Research Scientist – Lamont-Doherty Earth Observatory
Columbia University, Palisades, NY
Developed a mathematical model and computer program to study lava flow dynamics.

June 2015 - August 2017
Postdoctoral Research Scientist – Applied Physics and Applied Mathematics
Columbia University in the City of New York, NY
Developed a statistical model to quantify air-water turbulence, energy transfer, and water wave propagation.

2014 Presidential Fellow – The Ohio State University Graduate School
The Ohio State University, Columbus, Ohio
Developed a computer program to study three-dimensional coastal ocean circulation and transport.

2009 - 2013 Graduate Research Associate – The Computational Hydrodynamics & Informatics Lab
The Ohio State University, Columbus, Ohio
Developed numerical methods and computer programs to study hydrodynamic processes such as coastal ocean circulation, water waves in lakes, and overland flows created by precipitation events.

December 2012 Visiting Fellow – The Isaac Newton Institute for Mathematical Sciences
Cambridge University, Cambridge, United Kingdom
Developed a novel numerical method for three-dimensional coastal ocean circulation.

2008 Undergraduate Research Associate
The Ohio State University, Columbus, Ohio
Created a hydrodynamic computer model of Lake Erie.

Past Funding

April 2020 - March 2024 Interagency Personnel Agreement (IPA)
U. S. Geological Survey
Geologic Hazards Science Center
Award Amount: $503,000
Incorporated post-wild fire debris-flow initiation processes into the USGS model D-Claw, a physics-based numerical model for landslide and debris-flow motion.

Teaching Experience

September 2023 - Current Tutor – Calculus and Physics
Wallace Tutors, LLC
New York, NY

Spring 2015 Lecturer – Fluid Mechanics
Department of Civil, Environmental and Geodetic Engineering
The Ohio State University, Columbus, Ohio

Spring 2015 Lecturer – Open-Channel Hydraulics
Department of Civil, Environmental and Geodetic Engineering
The Ohio State University, Columbus, Ohio

Education

2014 Ph.D. Civil Engineering – The Ohio State University, Columbus, Ohio
Dissertation: "*hp* discontinuous Galerkin methods for coastal ocean circulation & transport"
Advisor: Ethan J. Kubatko

2010 M.S. Civil Engineering – The Ohio State University, Columbus, Ohio
Thesis: "ADmesh: An advanced mesh generator for hydrodynamic models"

2008 B.S. Civil Engineering, *magna cum laude* – The Ohio State University, Columbus, Ohio

2004 Rutherford B. Hayes High School, *Valedictorian* – Delaware, Ohio

Journal Manuscripts

C.J. Conroy, Y. Xiao, D.L. George and E.J. Kubatko, "*hp* discontinuous Galerkin methods for soil pore pressure calculations for debris flow initiation."

C.J. Conroy and D.L. George, "A new model for shallow mass flows over rough and erodible beds," Submitted.

C.J. Conroy and D.L. George, "*hp* discontinuous Galerkin methods for debris flows with dilatancy," Submitted.

C.J. Conroy and D.L. George, "Excess pressure and effective normal stress calculations in debris flows with dilatancy," Submitted, 2023, preprint: DOI:10.13140/RG.2.2.34282.67527

Y. Xiao, E.J. Kubatko, and C.J. Conroy, "A one-dimensional local discontinuous Galerkin Richards' equation solution with dual-time stepping," *Computational Geosciences*, 2021, https://doi.org/10.1007/s10596-021-10098-3

C.J. Conroy and E. Lev, "A discontinuous Galerkin finite element model for fast channelized lava flows v1.0," *Geoscientific Model developement*, 2021, https://doi.org/10.5194/gmd-14-3553-2021

C.J. Conroy, K.T. Mandli, and E.J. Kubatko, "Numerical considerations for quantifying air-water turbulence with moment field equations," *Water Waves*, 2021, https://doi.org/10.1007/s42286-021-00048-y

C.J. Conroy, K.T. Mandli, and E.J. Kubatko, "Quantifying air-water turbulence with moment field equations," *Journal of Fluid Mechanics*, 2021, https://doi.org/10.1017/jfm.2021.242

D. Wood, E.J. Kubatko, M. Rahimi, A. Shafieezadeh, and C.J. Conroy, "Implementation and evaluation of coupled discontinuous Galerkin methods for simulating overtopping of flood defenses by storm waves," *Advances in Water Resources*, 2019, https://doi.org/10.1016/j.advwatres.2019.103501

C.J. Conroy, E.J. Kubatko, A. Nappi, R. Sebian, D. West, and K.T. Mandli, "*hp* discontinuous Galerkin methods for parametric, wind-driven water wave models," *Advances in Water Resources*, 119, pp. 70-83, 2018, https://doi.org/10.1016/j.advwatres.2018.04.008

D. West, E.J. Kubatko, C.J. Conroy, M Yaufman, and D. Wood, "A multidimensional discontinuous Galerkin modeling framework for overland flow and channel routing," *Advances in Water Resources*, 2017, http://dx.doi.org/10.1016/j.advwatres.2017.02.008.

C.J. Conroy and E.J. Kubatko, "*hp* discontinuous Galerkin methods for the vertical extent of the water

column in coastal settings part I: barotropic forcing," *Journal of Computational Physics.* 305, 1147-1171, 2015.

C.J. Conroy, E.J. Kubatko, and D. West, "ADMESH: An automatic 2D unstructured mesh generator for shallow water models," *Ocean Dynamics Topical Collection on 'Multi-scale Modeling of Coastal, Shelf, and Global Ocean Dynamics'.* 62, 1503–1517, 2012.

Journal Manuscripts In Prep.

C.J. Conroy, "Numerical simulation of sailing yacht upwind sails via an entropic multi-relaxation lattice Boltzmann method," 2024.

C.J. Conroy and E. Lev, "Quantifying multiphase lava rheology during the 2018 Kilauea event in the lower East Rift Zone," 2024.

C.J. Conroy and E.J. Kubatko, "*hp* discontinuous Galerkin methods for the vertical extent of the water column in coastal settings part II: baroclinic forcing," 2024.

C.J. Conroy, "A simple dynamical model of intermittent turbulence," 2024.

Invited Seminars

"Modeling sediment entrainment by shallow mass flows," Risk Management Solutions Seminar, January 21, 2022.

"Modeling entrainment of bed sediment by debris flows and water floods," U.S. Geological Survey Landslide Hazards Program Seminar, November 18, 2020.

"Modeling lava flows at Kīlauea Volcano and Pore-fluid pressure calculations in debris flows," U.S. Geological Survey Cascades Volcano Observatory, Vancouver, WA, November 1, 2019.

"Numerical methods for modeling geophysical fluid dynamics with application to landslide initiation and mobility," Roy M. Huffington Department of Earth Sciences Seminar, Southern Methodist University, Dallas, TX, September 6, 2019.

"Quantifying lava breakouts," Coupling Uncertain Geophysical Hazards Workshop, Raleigh, NC, March 25, 2019

"A new interpolation method for geophysical data," MGG-SGT Seminar, Lamont-Doherty Earth Observatory, Palisades, NY, May 9, 2018.

"Fractal air-sea turbulence," NJIT Department of Mathematical Sciences Fluids and Waves Seminar, New Jersey Institute of Technology, Newark, NJ, September 18, 2017.

"Discontinuous Galerkin (DG) finite element methods for coastal ocean dynamics," Davidson Lab, Stevens Institute of Technology. Hoboken, NJ, June 11, 2014.

Conference Presentations

"Field and laboratory measurements of multi-phase lava rheology," E. Lev, J. Birnbaum, J. Baur, C.J. Conroy, A. Whittington, B. Halverson, J. Hammer, and E. Llewellin, The Geological Society of America Connects Meeting, Pittsburgh, PA, October 16, 2023.

"Bed sediment entrainment by shallow mass floods over sloped topography," AGU Fall Meeting, Chicago, IL, December 12, 2022.

"Using D-Claw to model landslides, debris flows, water bodies, and their interactions," D.L. George*, R.M. Iverson, C.J. Conroy, C.M. Cannon, and M. Benage, AGU Fall Meeting, Online, 2020.

"The Rheology of Three-Phase Lavas and Magmas," E. Lev, J. Birnbaum*, C.J. Conroy, A. Whittington, B. Halverson, J. Hammer, and E. Llewellin, Goldschmidt conference, Online, 2020.

"Incorporating rainfall infiltration and pore-pressure diffusion models for simulating landslide initiation and runout," AGU Fall Meeting, San Francisco, December 13, 2019. (POSTER)

"Toward Modeling Lava Breakouts," AGU Fall Meeting, Washington D.C., December 14, 2018.

"Modeling lava flows from the recent eruptions at Kīlauea," VolcaNYC Symposium. New York, NY September 28, 2018.

"Fractally homogeneous, air-sea turbulence and the moment field equations," Frontiers in Applied Mathematics: 60^{th} Birthday Conference of Professor Chi-Wang Shu. Providence, RI, January 4-6, 2017. (POSTER)

"Fractally homogeneous, air-sea turbulence with Frequency-integrated, wind-driven gravity waves," The 15^{th} International Workshop on Multiscale (Un)-structured Mesh Numerical Modeling for Coastal, Shelf, and Global Ocean Dynamics. Toulouse, France, September 27-29, 2016.

"(Two-Layer) Wind-Wave Coastal Ocean Models," SIAM Annual Meeting. Boston, Massachusetts, July 14, 2016.

"Discontinuous Galerkin (DG) modified basis methods for baroclinic flows," 13^{th} US National Congress on Computational Mechanics. San Diego, California, July 26-30, 2015.

"Development and validation of DG–WAVE: a discontinuous Galerkin-based numerical wave prediction model," SIAM Conference on Computational Science and Engineering. Salt Lake City, Utah, March 14-18, 2015.

"A three-dimensional shallow water equation model using high-order discontinuous Galerkin (DG) methods," The 13^{th} International Workshop on Multiscale (Un)-structured Mesh Numerical Modeling for Coastal, Shelf, and Global Ocean Dynamics. Lisbon, Portugal, August 25-27, 2014.

"Applications of a discontinuous Galerkin-based spectral wave model," The 13^{th} International Workshop on Multiscale (Un)-structured Mesh Numerical Modeling for Coastal, Shelf, and Global Ocean Dynamics. Lisbon, Portugal, August 25-27, 2014.

"A high-order, three-dimensional discontinuous Galerkin (DG) coastal ocean circulation and transport model," 11th World Congress on Computational Mechanics. Barcelona, Spain, July 20-25, 2014.

"*hp* DG methods for the vertical extent of the water column," 12^{th} US National Congress on Computational Mechanics. Raleigh, North Carolina, July 21-24, 2013.

"High order DG coupling of the shallow water equations," 12^{th} US National Congress on Computational Mechanics. Raleigh, North Carolina, July 21-24, 2013. (POSTER)

"ADmesh: An advanced unstructured mesh generator for ocean models," ADCIRC Workshop 2013. Vicksburg, Mississippi, April 30, 2013.

"A discontinuous Galerkin method for 3D shallow water flow," 10th World Congress on Computational Mechanics. São Paulo, Brazil, July 8-13, 2012.

"Modeling of circulation and transport in the Gulf of Mexico with application to the deepwater horizon oil spill," The 10th International Workshop on Multiscale (Un)-structured Mesh Numerical Modeling for Coastal, Shelf, and Global Ocean Dynamics. Bremerhaven, Germany, August 22-25, 2011. (POSTER)

"Modeling of circulation and transport in the Gulf of Mexico for ninety days following the deepwater horizon oil spill," 11th U.S. National Congress on Computational Mechanics. Minneapolis, MN, July 25-28, 2011.

"An advanced automatic mesh generator for shallow water models," The 9th International Workshop on Multiscale (Un)-structured Mesh Numerical Modeling for Coastal, Shelf, and Global Ocean Dynamics. Cambridge, MA, August 17-20, 2010. (POSTER)

"An advanced automatic mesh generator for hydrodynamic models," 9th World Congress on Computational Mechanics, 4th Asian Pacific Congress on Computational Mechanics. Sydney, Australia, July 19-23, 2010.

"A finite element hydrodynamic model for Lake Erie," 10th U.S. National Congress on Computational Mechanics. Columbus, OH, July 16-19, 2009.

Honors and Awards

2014, 2013, 2012, 2010	Recipient of U.S. Association of Computational Mechanics Travel Award
2012	Recipient of Complex Systems Travel Award
2011	Recipient of Keith W. Bedford Scholarship
2009, 2008	Recipient of Shumate Memorial Scholarship
2008, 2007	Recipient of Moody Civil Engineering Scholarship
2008, 2007, 2006	Recipient of Dr. Warren G. Elliot Scholarship
2008, 2007, 2006, 2005	Recipient of University Scholarship
2006, 2007	Recipient of Cyrus A. Melick Scholarship
2006, 2005	Recipient of Engineering Dean's Award

Professional Societies

Chi Epsilon, The National Civil Engineering Honor Society

Certification

Certified Engineer In Training, State of Ohio, October 2008

References

Dr. Ethan Kubatko
Associate Professor
The Ohio State University
Civil, Environmental & Geodetic Engineering
417D Hitchcock Hall
2070 Neil Avenue
Columbus, OH 43210
Phone: (614) 292-7176
E-mail: kubatko.3@osu.edu

Dr. Kyle Mandli
Research Scientist
Flatiron Institute
Simons Foundation
162 5th Ave
New York, NY 10010
Phone: (206) 250-3731
E-mail: kyle.mandli@gmail.com

Dr. Einat Lev
Associate Research Professor
Columbia University
Lamont-Doherty Earth Observatory
61 Route 9W
Palisades, NY 10964
Phone: (845) 365-8616
E-mail: einatlev@ldeo.columbia.edu