

MADISON M. DOUGLAS

University of California, Berkeley — mmdouglas@berkeley.edu — mmdouglas.com

RESEARCH INTERESTS

I am interested in how landscapes form and how biological, chemical, and physical processes alter hillslopes and rivers through time. My academic training is in the field of geomorphology, a sub-discipline of geology and Earth science. My core expertise is in hydraulics and sediment transport, which I study through fieldwork and scaled lab experiments. I also collaborate extensively with chemists and biologists to understand how landscape processes interact with the carbon cycle. Much of my research focuses on river systems that link Earth's continents and oceans. Rivers are very important for people around the world, providing food and transportation but posing hazards from floods and erosion. My research also focuses on permafrost landscapes, since these are poorly understood and are rapidly thawing, threatening Arctic communities and geopolitical stability. The aim of my work is to develop and validate new theories for the processes that shape rivers and hillslopes so that we can accurately predict the effects of climate change and better engineer and conserve landscapes for societal benefit.

RESEARCH EXPERIENCE

University of California, Berkeley Department of Earth and Planetary Science Assistant Professor	July 2024-present
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Massachusetts Institute of Technology Department of Earth, Atmospheric and Planetary Science Postdoctoral Associate	July 2023-June 2024
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California Institute of Technology Division of Geological and Planetary Science Advisor: Michael P. Lamb	Sept 2017-June 2023
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US Geological Survey Menlo Park, California, USA Advisors: Jonathan Stock, Corina Cerovski-Darriau	Sept 2016-June 2017
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Fermat Capital Management Catastrophe Bond Analyst	June 2016-Aug 2016
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MIT Geomorphology Group Undergraduate Researcher Advisors: J. Taylor Perron, Dino Bellugi, Kimberly Huppert Senior Thesis: <i>Constraints on Passive Margin Escarpment Evolution from River Basin Reorganization in Brazil</i>	Jan 2013-June 2016
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NASA Goddard Spaceflight Center Summer Intern, visited the Arecibo Radio Observatory to observe Venus Advisor: Lynn Carter	June 2015-Aug 2015
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University of Salamanca, Spain Department of Petrology, MIT MISTI Program Advisors: Antonio Álvarez-Valero, Adelina Geyer	June 2014-July 2014
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MIT Geochronology Laboratory Summer Intern Advisor: Samuel Bowring	June 2011-Aug 2011
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EDUCATION

PhD in Geology Division of Geological and Planetary Sciences, California Institute of Technology PhD Thesis: <i>Mechanics of River Erosion and its Effects on Floodplain Biogeochemistry</i> Committee: Woodward W. Fischer (chair), Jonathan Grotzinger, Michael P. Lamb (advisor), A. Joshua West	June 2023
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Masters in Geology Division of Geological and Planetary Sciences, California Institute of Technology	June 2019
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PUBLICATIONS

1. **Douglas, M. M.** and Li, G. K.: Decoupling of sediment and particulate organic carbon transport in permafrost river systems. In prep. for Geophysical Research Letters.
2. Ke, Y., Geyman, E.C., Reahl, J., Smith, M.I., Anadu, J., Norton, A., Magyar, J., **Douglas, M.M.**, West, A.J., Fischer, W.W., Lamb, M.P.: Carbon storage in permafrost floodplains controlled by lateral river migration and overbank deposition. In review at Science Advances.
3. **Douglas, M. M.**, Colicci, V., Sandu, N. A., Sandu, Yilmaz, L., Kamrin, K., Perron, J. T.: Effects of Root Architecture on Plant Anchoring in Noncohesive Sediment. In review at Journal of Geophysical Research: Earth Surface.
4. Yilmaz, L., **Douglas, M. M.**, Perron, J. T., Kamrin, K.: Elastic Resistive Force Theory: Development and Applications to Flexible Intruders. Soft Matter, 2026. <https://doi.org/https://doi.org/10.1039/D6SM00040A>
5. Geyman, E. C., **Douglas, M. M.**, Avouac, J. P., and Lamb, M. P.: Permafrost slows Arctic riverbank erosion. Nature, 2024. <https://doi.org/10.1038/s41586-024-07978-w>
6. **Douglas, M. M.**, Miller, K. L., and Lamb, M. P.: Mud cohesion governs unvegetated meander migration rates and deposit architecture. GSA Bulletin, 2024. <https://doi.org/10.1130/B37315.1>
7. **Douglas, M. M.**, Li, G. K., West, A. J., Ke, Y., Rowland, J. C., Brown, N., Schwenk, J., Kemeny, P. C., Piliouras, A., Fischer, W. W., and Lamb, M. P.: Permafrost Formation in a Meandering River Floodplain. AGU Advances, 5(4), e2024AV001175, 2024. <https://doi.org/10.1029/2024AV001175>
8. **Douglas, M. M.**, and Lamb, M. P.: A Model for Thaw and Erosion of Permafrost Riverbanks, Journal of Geophysical Research: Earth Surface, 129(4), e2023JF007452, 2024. <https://doi.org/10.1029/2023JF007452>
9. Smith, M.I., Ke, Y., Geyman, E.C., Reahl, J.N., **Douglas, M.M.**, Seelen, E.A., Magyar, J.S., Dunne, K.B., Mutter, E., Fischer, W.W. and Lamb, M.P.: Mercury stocks in discontinuous permafrost and their mobilization by river migration in the Yukon River Basin. Environmental Research Letters, 19(8), 084041, 2024. <https://doi.org/10.1088/1748-9326/ad536e>
10. Kalucha, H., **Douglas, M.M.**, Lamb, M.P., Ke, Y., Fischer, W.W.: Low But Persistent Organic Carbon Content of Hyperarid River Deposits and Implications for Ancient Mars, Journal of Geophysical Research: Planets, 129(5), e2023JE008182, 2024. <https://doi.org/10.1029/2023JE008182>
11. **Douglas, M. M.**, Miller, K. L., Schmeer, M. N., and Lamb, M. P.: Ablation-Limited Erosion Rates of Permafrost Riverbanks, Journal of Geophysical Research: Earth Surface, 128, e2023JF007098, 2023. <https://doi.org/10.1029/2023JF007098>
12. **Douglas, M. M.**, Dunne, K. B. J., and Lamb, M. P.: Sediment Entrainment and Slump Blocks Limit Permafrost Riverbank Erosion, Geophysical Research Letters, 50, e2023GL102974, 2023. <https://doi.org/10.1029/2023GL102974>
13. Rowland, J. C., Schwenk, J. P., Shelef, E., Muss, J., Ahrens, D., Stauffer, S., Piliouras, A., Crosby, B., Chadwick, A., **Douglas, M. M.**, Kemeny, P. C., Lamb, M. P., Li, G. K., and Vulis, L.: Scale-Dependent Influence of Permafrost on Riverbank Erosion Rates, Journal of Geophysical Research: Earth Surface, 128, e2023JF007101, 2023. <https://doi.org/10.1029/2023JF007101>
14. Kemeny, P. C., Li, G. K., **Douglas, M.**, Berelson, W., Chadwick, A. J., Dalleska, N. F., Lamb, M. P., Larsen, W., Magyar, J. S., Rollins, N. E., Rowland, J., Smith, M. I., Torres, M. A., Webb, S. M., Fischer, W. W., and West, A. J.: Arctic Permafrost Thawing Enhances Sulfide Oxidation, Global Biogeochemical Cycles, 37, e2022GB007644, 2023. <https://doi.org/10.1029/2022GB007644>
15. **Douglas, M. M.**, Li, G. K., Fischer, W. W., Rowland, J. C., Kemeny, P. C., West, A. J., Schwenk, J., Piliouras, A. P., Chadwick, A. J., and Lamb, M. P.: Organic carbon burial by river meandering partially offsets bank erosion carbon fluxes in a discontinuous permafrost floodplain, Earth Surface Dynamics, 10, 421–435, 2022. <https://doi.org/10.5194/esurf-10-421-2022>
16. **Douglas, M. M.**, Lingappa, U. F., Lamb, M. P., Rowland, J. C., West, A. J., Li, G., Kemeny, P. C., Chadwick, A. J., Piliouras, A., Schwenk, J., and Fischer, W. W.: Impact of river channel lateral migration on microbial communities across a discontinuous permafrost floodplain, Applied and Environmental Microbiology, 87, AEM.01339-21, 2021. <https://doi.org/10.1128/AEM.01339-21>
17. **Douglas, M. M.**, Stock, J. D., Bishaw II, K., Cerovski-Darriau, C., and Bedford, D. R.: Dust on a Hawaiian

volcano: A regional model using field measurements to estimate transport and deposition, *Earth Surface Processes and Landforms*, 43, 2794–2807, 2018. <https://doi.org/10.1002/esp.4433>

18. **Douglas, M. M.**, Geyer, A., Álvarez-Valero, A. M., and Martí, J.: Modeling magmatic accumulations in the upper crust: Metamorphic implications for the country rock, *Journal of Volcanology and Geothermal Research*, 319, 78–92, 2016. <https://doi.org/10.1016/j.jvolgeores.2016.03.008>
19. Álvarez-Valero, A. M., Okumura, S., Arzilli, F., Borrajo, J., Recio, C., Ban, M., Gonzalo, J. C., Benítez, J. M., **Douglas, M.**, Sasaki, O., Franco, P., Gómez-Barreiro, J., and Carnicero, A.: Tracking bubble evolution inside a silicic dike, *Lithos*, 262, 668–676, 2016. <https://doi.org/10.1016/j.lithos.2016.08.012>

CURRENT EXTERNAL RESEARCH SUPPORT

Grants pending at NSF Office of Polar Programs, US Army Research Office

AWARDS

Academic Excellence in Research Division of Geological and Planetary Sciences, California Institute of Technology	2023
Resnick Sustainability Fellow Resnick Sustainability Institute, California Institute of Technology	2021
Outstanding Student Paper Award (OSPA) Honorable Mention AGU Fall Meeting, Earth and Planetary Surface Processes Section	2020
Outstanding Student Paper Award (OSPA) AGU Fall Meeting, Earth and Planetary Surface Processes Section	2019
National Center for Airborne Laser Mapping (NCALM) Student Seed Grant 40 sq km of LIDAR flown in Death Valley, California	2017
National Defense Science and Engineering Graduate (NDSEG) Fellowship	2017
W. O. Crosby Award for Sustained Excellence MIT Department of Earth, Atmospheric, and Planetary Sciences	2016
Outstanding Student Paper Award (OSPA) AGU Fall Meeting, Planetary Science Section	2015
John Mather Nobel Scholarship \$3000 grant for selected NASA Goddard interns to present research at scientific conferences	2015
EAPS Achievement Award MIT Department of Earth, Atmospheric, and Planetary Sciences	2015
ExxonMobil Recruiter Nominated Grant \$5000 award used for research funding and conference travel	2014

TEACHING EXPERIENCE

Berkeley EPS 127: Coastal Processes Professor, new course to provide an introduction to physical, chemical and biological processes that shape coastlines with a focus on California, leading overnight field trip to Santa Cruz	Spring 2026
Berkeley Geomorphology Group Meetings	Winter 2025-Present
Berkeley EPS 117: Geomorphology Professor, leading field trips to Marin County, Lake Tahoe, and Wildcat Creek to instruct students on the processes that shape landscapes and how to measure, quantify, and predict landscape change in response to perturbations in climate, tectonics, and land-use	Fall 2024, 2025

Berkeley EPS 215: Geomorphology Professor for graduate version of EPS 117 with additional reading and independent projects	Fall 2025
Caltech Ge121a: Advanced Field Geology Teaching assistant, organized a 9-day field trip to Carrizo Plain, California to instruct and assist students in surveying channels and hillslopes offset and uplifted by the San Andreas Fault	Fall 2021
Caltech Ge125: Geomorphology Teaching assistant for virtual course, helped students in lab activities to predict landslide hazard in the Chino Hills using an infinite-slope model and assess terrace formation due to long-term climatic changes in the San Gabriel River	Fall 2020
Caltech Ge121a: Advanced Field Geology Teaching assistant; organized a 9-day field trip to Wax Lake Delta, Louisiana to collect hydraulic datasets, suspended sediment, and sediment cores; assisted student in subsequent labwork and data processing	Fall 2019
Caltech Ge136abc: Regional Geology of the Southwest US Teaching assistant, planned and led 3-4 day field trips to Owens Valley, Southern Nevada, and Utah to introduce students to local geology	Fall 2018, Winter 2019, Spring 2019

RESEARCH MENTORING

Debsmita Das , Berkeley Postdoctoral Scholar	Jan 2026-Present
Sofia Thomas , Berkeley undergrad EPS major	Aug 2025-Present
Maya Looney , Berkeley undergrad Astronomy major	Aug 2025-Present
Tianran Zhang , Berkeley Postdoctoral Scholar	July 2025-Present
Brooke Newell , Berkeley PhD program, second project advisor	Jan 2025-Present
Colin Baciocco , Berkeley PhD program, primary advisor	Sept 2024-Present
Holden Sokey , Berkeley undergrad EPS major	Sept 2024-Present
Benite Ishimwe , Berkeley PhD program, second project advisor	Jan 2025-May 2025
Sam Lockhart , Berkeley MA program Currently PhD student at Northern Arizona University	Sept 2024-June 2025
Vittorio Colicci , MIT 5th Year Masters Currently PhD student at Stanford	Sept 2023-May 2024
Nik Sandu , MIT UROP	Summer 2023, Jan 2024
Vincent Soldano , Caltech WAVE Fellow Currently at Desert Research Institute	Summer 2022
Sarah Preston , Caltech SURF Fellow Currently PhD student at UCLA	Summer 2022
Grace Knuth , High School Volunteer	Sept 2021-May 2022
Maria Schmeer , Caltech SURF Fellow Currently PhD student at Caltech	Summer 2021

ACADEMIC MENTORING

Sara Khosrowshahi , Qualifying exam committee in Environmental Science, Policy, and Management	Winter 2026
Ryan Yohler , PhD thesis committee in Integrative Biology	Winter 2024-Present

Roland Christopher Theiss , PhD thesis committee in Geography	Fall 2025
Sofya Bulavko , Berkeley EPS MA program	Fall 2025-Present
Runze Miao , PhD thesis committee in EPS	Fall 2024

INVITED TALKS

Department of Civil and Environmental Engineering, UC Berkeley	Oct 2025
University of Nevada, Reno	Oct 2025
USGS Santa Cruz Pacific Coastal and Marine Science Center Science Spotlight	July 2025
UC Santa Cruz Planetary Science and Geophysics seminar	May 2025
Department of Earth and Planetary Sciences, University of New Mexico	Jan 2025
Lawrence Berkeley National Laboratory	Oct 2024
Department of Earth and Planetary Sciences, UC Santa Cruz	Oct 2024
Northern California Geomorphology Symposium	Oct 2024
Department of Earth and Environmental Science, Tulane University	Sept 2024
Lamont-Doherty Earth Observatory, Columbia University	May 2024
Dartmouth University	Feb 2024
University of Wisconsin, Madison	Oct 2023
GeoCLaSH Cryosphere Session	May 2023
Southern California Geomorphology Symposium	April 2023
Southern California Geomorphology Symposium	April 2022
Resnick Sustainability Institute Research Seminar	April 2022
UC Berkeley Earth and Planetary Science Seminar	Feb 2022
University of Southern California Paleoenvironmental Seminar	Oct 2021
Southern California Geomorphology Symposium	May 2019
Caltech Geoclub Seminar	Nov 2019
USGS Menlo Park Geology, Minerals, Energy and Geophysics Seminar	April 2017

SELECTED CONFERENCE PRESENTATIONS

1. **M. Douglas**, G. Li, A.J. West, Y. Ke, J.C. Rowland, N. Brown, J.P. Schwenk, P.C. Kemeny, A. Piliouras, W.W. Fischer, M.P. Lamb(2024), Permafrost Formation and Vegetation Succession in a Meandering River Floodplain, Abstract EP43E-08 presented at 2024 AGU Fall Meeting, Washington, DC. (Invited Talk)
2. **M. Douglas**, K.L. Miller, M.P. Lamb (2023), Migration Rates and Basin Stratigraphy for Unvegetated Meandering Channels in Death Valley, Abstract EP43A-05 presented at 2023 AGU Fall Meeting, San Francisco. (Invited Talk)
3. **M. Douglas**, K.L. Miller, M.P. Lamb (2022), Monitoring Flow and Erosion Along an Unvegetated Meandering River in Death Valley, Abstract EP53A-05 presented at 2022 AGU Fall Meeting, Chicago. (Talk)
4. **M. Douglas**, K.L. Miller, M. Schmeer, M.P. Lamb (2021), Permafrost Riverbank Erosion in Frozen Flume Experiments, Abstract EP51B-06 presented at 2021 AGU Fall Meeting, New Orleans. (Talk)

5. **M. Douglas**, K.L. Miller, M. Schmeer, M.P. Lamb (2021), Permafrost Riverbank Erosion in Frozen Flume Experiments, Abstract EP51B-06 presented at 2021 AGU Fall Meeting, New Orleans. (Talk)
6. **M. Douglas**, M.P. Lamb, G. Li, J.C. Rowland, A.J. West, P.C. Kemeny, J. Schwenk, A. Piliouras, A.J. Chadwick, W.W. Fischer (2021), Organic carbon burial by river meandering offsets bank-erosion carbon fluxes in discontinuous permafrost, Abstract EP35A-07 presented at 2021 AGU Fall Meeting, Online. (Invited eLightning)
7. M. Schmeer, **M. Douglas**, K.L. Miller, M.P. Lamb (2021), Using Temperature Sensors to Track the Thaw and Erosion Fronts in an Experimental Permafrost Riverbank, Abstract EP55C-1130 presented at 2021 AGU Fall Meeting, New Orleans. (Poster)
8. **M. Douglas**, M.P. Lamb, G. Li, J.C. Rowland, A.J. West, P.C. Kemeny, J. Schwenk, A. Piliouras, A.J. Chadwick, W.W. Fischer (2020), Floodplain architecture and organic carbon mobilization and storage in discontinuous permafrost, Abstract U016-09 presented at 2020 AGU Fall Meeting, Online. (Invited Talk)
9. **M. Douglas**, M.P. Lamb, J.C. Rowland, G. Li, P.C. Kemeny, A.J. West, A. Piliouras, J. Schwenk, A.J. Chadwick, W.W. Fischer (2020), Quantifying organic carbon mobilization and storage due to bank erosion in discontinuous permafrost, Abstract 359406 presented at 2020 GSA Meeting, Online. (Talk)
10. K. Karlstrom, L. Crossey, G. Humphreys, D. Shuster, K. Whipple, et al. Fieldtrip booklet for GSA Grand Canyon Thompson Field Forum I, Age and Carving of Grand Canyon: Towards a resolution of 150 years of debate. September 14-21, 2019. (Talk)
11. **M. Douglas**, M.P. Lamb, J.C. Rowland, G. Li, P.C. Kemeny, A.J. West, A. Piliouras, J. Schwenk, A.J. Chadwick, W.W. Fischer (2019), Quantifying organic carbon mobilization and storage due to bank erosion in permafrost-dominated river floodplains, Abstract EP42A-04 presented at 2019 AGU Fall Meeting, San Francisco, CA. (Talk)
12. **M. Douglas**, J.C. Rowland, G. Li, P.C. Kemeny, A.J. West, A. Piliouras, J. Schwenk, A.J. Chadwick, M.P. Lamb, W.W. Fischer (2018), Quantifying organic carbon mobilization and storage in permafrost river floodplains, Abstract C53A-06 presented at 2018 AGU Fall Meeting, Washington, DC. (Talk)
13. **M. Douglas**, J. Stock, C. Cerovski-Darriau, K. Bishaw II, D. Bedford (2017), Field Measurements and Modeling of Dust Transport and Deposition on a Hawaiian Volcano, Abstract A33F-2418 presented at 2017 AGU Fall Meeting, New Orleans, LA. (Poster)
14. **M. Douglas**, J.T. Perron, N. Fernandes, L. Silva (2016), Constraints on Passive Margin Escarpment Evolution from River Basin Reorganization in Brazil, Abstract EP51A-0863 presented at 2016 AGU Fall Meeting, San Francisco, CA. (Poster)
15. **M. Douglas**, L.M. Carter (2015), Analysis of Volcanic Deposits on Venus Using Radar Polarimetry, Abstract P51C-2068 presented at 2015 AGU Fall Meeting, San Francisco, CA. (Poster)
16. **M. Douglas**, A. Álvarez-Valero, A. Geyer (2014), Predicting Equilibrium Mineral Assemblages in Contact Metamorphism By Integrating Thermodynamic and Numerical Models of Magma Chamber Cooling, Abstract V31E-4801 presented at 2014 AGU Fall Meeting, San Francisco, CA. (Poster)
17. **M. Douglas**, D. Bellugi, J.T. Perron, J. Coe, K. Schmidt (2013), Root Cohesion Controls on Shallow Landslide Size, Shape and Location, Abstract NH33A-1639 presented at 2013 AGU Fall Meeting, San Francisco, CA. (Poster)

PROFESSIONAL SERVICE AND OUTREACH

Berkeley Outreach and Inreach

Faculty panelist and lunch guest for LS1	Oct 2025
Speaker at Global Engagement Office event for Finland University leaders	March 2025
Speaker for "Basic Science Lights the Way" online lecture series	Dec 2024

Berkeley EPS Departmental Service

EPS assistant professor search committee member, evaluated over 540 applications	Fall 2025-Present
Faculty advisor for EPS website	Fall 2024-Present
Organized lunch for EPS summer undergrad researchers	June 2025
Mathematics and Physical Sciences (MPS) Scholars Retreat	April 2025
Organized admitted graduate student 2-day visit	April 2025

Peer-review of grant applications

NSF WaLCZ panelist	2026
ACS, NSF, NSERC (3 grants)	2025
NSF (2 grants)	2024

Peer-review of scientific manuscripts

Scientific Reports, Nature Communications, Geology, Water Resources and Research, Journal of Geophysical Research: Earth Surface, Science, Hydrology (9 reviews)	2025
Science, Nature Communications, Journal of Geophysical Research: Earth Surface, Geophysical Research Letters (4 reviews)	2024
Proceedings of the National Academy of Sciences (1 review)	2023

Session Co-Convener for AGU Fall Meeting

Landscape Changes and Carbon Cycling in Cold Regions	2025
Geochemical and Sedimentological Insights on Floodplain Development Through Space and Time	2020

AGU Fall Meeting OSPA Judge

2023-2025

Participant in NSF-Sponsored Workshops

Launching Sandpiper Toolchain, Minneapolis, MN	April 2025
Center for Land Surface Hazards (CLaSH), Boulder, CO	Oct 2023

Caltech GO Outdoors

Spring 2022

Developed classroom activities on debris flows in the San Gabriel Mountains and conducted outreach in a fourth grade classroom in San Marino .

Virtual Pod Host at AGU Fall Meeting

2020

Co-hosted *Permafrost Geomorphology Party*

Organizer for Caltech Geoclub Seminar Series

Sept 2019-Aug 2020

Organizer for Lamb Geomorphology Group

May 2018-Jan 2023

Organized reading groups, planned social events, managed listserv

PROFESSIONAL ORGANIZATIONS

American Geophysical Union (AGU)	2013-Present
Geological Society of America (GSA)	2014-Present
US Permafrost Association (USPA)	2019-Present
Permafrost Young Researchers Network (PYRN)	2019-2023