

Dr. Mitchell McMillan

School of Earth and Atmospheric Sciences
Georgia Institute of Technology
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Professional experience

Postdoctoral Fellow, Georgia Institute of Technology

May 2022–Present

Department of Earth and Atmospheric Sciences

Supervisor: Dr. Shi Joyce Sim

Education

Ph.D., University of Toronto

Sep. 2017–May 2022

Department of Earth Sciences

Supervisor: Dr. Lindsay Schoenbohm

M.Sc., University of West Florida

Jan. 2014–Jul. 2016

Department of Earth & Environmental Sciences

Supervisor: Dr. Johan Liebens

B.Sc., University of Alabama

Aug. 2007–May 2012

Department of Geological Sciences

Summa cum laude

Research interests

Tectonic geomorphology

Rates, timing, and kinematics of mountain building; evolution of topography and relief in orogens; arid surface processes.

Geodynamics

Orogenesis and lithospheric deformation; geodynamic/thermodynamic modelling (ASPECT, FEniCS, ThermoCodegen, Perple_X).

Professional activities

Co-convenor AGU special session, Fall 2021 meeting

Lithospheric Foundering: Detection and Effects on Deformation, Topography, and Thermal/Compositional Structure of Continental Lithosphere

Reviewer for: *Geology* (1), *Geophysical Research Letters* (3), *CATENA* (2), *Geomorphology* (1)

Member American Geophysical Union, since 2019

Publications

12. **McMillan, M.**, Sim, S. J., and Wilson, C., (*under review*). Reactive thermodynamics of crustal eclogitization and foundering.
11. **McMillan, M.**, Schoenbohm, L. M., and Tye, A. (2023). Plateau formation controlled by lithospheric foundering under a weak crust. *Geophysical Research Letters* 50 (16), e2023GL103996. <https://doi.org/10.1029/2023GL103996>
10. **McMillan, M.** and Schoenbohm, L. M. (2023). Diverse styles of lithospheric dripping: Synthesizing gravitational instability models, continental tectonics, and geologic observations. *Geochemistry, Geophysics, Geosystems*, e2022GC010488. <https://doi.org/10.1029/2022GC010488>
9. **McMillan, M.**, Schoenbohm, L. M., Tye, A., McMillan, M. F., and Zhou, R. (2022). Eocene to Quaternary deformation of the southern Puna Plateau: Thermochronology, geochronology, and structural geology a hinterland basin (NW Argentina). *Tectonics* 41(6), e2022TC007252. <https://doi.org/10.1029/2022TC007252>
8. Tye, A., **McMillan, M.**, Schoenbohm, L. M. and Zhou, R. (2022). Late Cenozoic extensional formation of the Antofalla depression, southern Puna plateau, Argentina: An effect of lithospheric foundering? *Tectonics* 41(3), e2021TC006807. <https://doi.org/10.1029/2021TC006807>
7. Seagren, E., **McMillan, M.**, and Schoenbohm, L. M. (2022). Tectonic control on drainage evolution in broken forelands: Examples from NW Argentina. *Tectonics* 41(1), e2020TC006536. <https://doi.org/10.1029/2020TC006536>
6. Schoenbohm, L. M. and **McMillan, M.** (2021). Worldbuilding from tectonic first principles: Integrating and challenging undergraduate knowledge through a course project. *Journal of Geoscience Education* 70(1), 56–72. <https://doi.org/10.1080/10899995.2021.1908810>
5. **McMillan, M.** and Schoenbohm, L. M. (2020). Large-scale Cenozoic wind erosion in the Puna Plateau: the Salina del Fraile Depression. *Journal of Geophysical Research: Earth Surface* 125, e2020JF005682. <https://doi.org/10.1029/2020JF005682>
4. **McMillan, M.**, Liebens, J., and Bagui, S. (2018). A statistical model for streambank erosion in the northern Gulf of Mexico coastal plain. *CATENA* 165, 145–156. <https://doi.org/10.1016/j.catena.2018.01.027>
3. **McMillan, M.** and Hu, Z. (2017). A watershed scale spatially-distributed model for streambank erosion rate driven by channel curvature. *Geomorphology* 294, 146–161. <https://doi.org/10.1016/j.geomorph.2017.03.017>
2. **McMillan, M.**, Liebens, J., Metcalf, C. (2017). Evaluating the BANCS streambank erosion framework on the Northern Gulf of Mexico Coastal Plain. *Journal of the American Water Resources Association* 53(6), 1393–1408. <https://doi.org/10.1111/1752-1688.12572>
1. Liebens, J., Metcalf, C., and **McMillan, M.**, (2016). Development of regional bank erosion relationships for the Coastal Plain hydrophysiographic region. Final Report, grant 13058, State Wildlife Grants. Florida's Wildlife Legacy Initiative, Florida Fish and Wildlife Conservation Commission.

Research awards granted

4. **NSF-EAR Tectonics #2420822**
Collaborative Research: RUI: Resolving the effects of lithospheric foundering on orogenesis: An example from the southern Puna plateau, Argentina
June 1, 2024–May 31, 2026 (postdoc co-author)
PIs: Alexander Tye, Shi Joyce Sim, Lindsay Schoenbohm, and Marissa Tremblay
3. **NSF-EAR Geophysics #2323318**
Eclogitization of continental lithosphere from subduction zone devolatilization
November 1, 2023–October 31, 2025 (postdoc co-author)
PIs: Shi Joyce Sim and Cian Wilson
2. **Gulf Coast Association of Geological Societies (GCAGS) Research Grant**
Estimating stream bank erosion in the northern Gulf Coast: Improving practical methods
May 1, 2015–April 30, 2016 (PI)
1. **Geological Society of America (GSA) Research Grant #1121-15**
Estimating stream bank erosion in the northern Gulf Coast: Improving practical methods
April 1, 2015–March 31, 2016 (PI)

Research proposals not granted

1. **NSF-EAR Postdoctoral Fellowship**
The effects of wind erosion on arid landscapes: Bridging spatial and temporal scales with landscape evolution models using Landlab
Panel summary: Competitive

Invited talks

2. **Johannes Gutenberg University Mainz, Germany**, Institute of Geosciences, *Continental drip tectonics: From observations to models* (September 10th, 2024)
1. **University of Oxford, UK**, Department of Earth Sciences, *Continental drip tectonics: From observations to models* (August 28th, 2024)

Conference abstracts

15. **McMillan, M.**, Sim, S. J., and Wilson, C. (2024). Reactive thermodynamic–geodynamic models of lower crustal eclogitization driven by fluid catalysis. AGU Fall Meeting 2024.
14. **McMillan, M.**, Sim, S. J., and Wilson, C. (2024). Eclogitization of the lower crust: A reactive thermodynamic–geodynamic approach. 2024 Ada Lovelace Workshop on Modelling Mantle and Lithosphere Dynamics. Sète, France.
13. **McMillan, M.**, Sim, S. J., and Wilson, C. (2023). Reactive thermodynamics of crustal foundering. AGU Fall Meeting 2023.
12. **McMillan, M.**, Sim, S. J., and Wilson, C. (2022). Investigating the roles of fluids and bulk composition in eclogitization reactions involving continental lithosphere. AGU Fall Meeting 2022.

11. Tye, A., **McMillan, M.**, and Schoenbohm, L. M. (2022). Lithospheric foundering recorded by the complex Miocene to Quaternary tectonic evolution of the Southern Puna Plateau, Argentina. Geological Society of America Abstracts with Programs 54(5).
<https://doi.org/10.1130/abs/2022AM-379900>.
10. **McMillan, M.**, Tye, A., and Schoenbohm, L. M. (2021). Lithospheric dripping under a weak crust: Geodynamic modelling of the Southern Puna Plateau, Argentina. AGU Fall Meeting 2021.
9. **McMillan, M.**, Tye, A., Schoenbohm, L. M., Zhou, R., and McMillan, M. F. (2020). Cenozoic tectonic evolution of the Antofalla Basin in the Puna Plateau, NW Argentina. AGU Fall Meeting 2020.
8. **McMillan, M.** and Schoenbohm, L. M. (2019). Deciphering a large-scale, wind-dominated landscape in the Central Andes: Aeolian topography in the Salina del Fraile Depression, Southern Puna Plateau. AGU Fall Meeting 2019.
7. **McMillan, M.** and Schoenbohm, L. M. (2019). Deformation and exhumation of the Salina del Fraile, NW Argentina: Anatomy of a hinterland basin. Geophysical Research Abstracts, 21, EGU2019-12341.
6. **McMillan, M.** and Schoenbohm, L. M. (2018). Synthesizing global lithosphere removal events: Scale, style, and surface deformation. Geophysical Research Abstracts, 18, EGU2018-10881.
5. Liebens, J. and **McMillan, M.** (2016). A practical streambank erosion model for the coastal plain of the northern Gulf of Mexico. Geological Society of America Annual Meeting. Denver, CO. September 25-26, 2016.
4. **McMillan, M.** and Liebens, J. (2016) Streambank erosion model for the northern Gulf of Mexico Coastal Plain. EcoStream 2016: From Ridgeline to Thalweg, Asheville, NC. August 22-25, 2016.
3. **McMillan, M.**, Liebens, J., and Metcalf, C. (2016). Predicting annual streambank erosion rates in the U.S. Gulf Coastal Plain: BEHI and beyond. Rocky Mountain Stream Restoration Conference. Breckenridge, CO. July 19-21, 2016.
2. **McMillan, M.** and Liebens, J. (2015). Streambank erosion modeling: Improving field methods. American Water Resources Association Conference. Denver, CO. November 16-19, 2015.
1. Liebens, J., **M. McMillan**, and Cambron, D. (2015). Predicting stream bank erosion on the northern Gulf of Mexico Coastal Plain: Pitfalls and solutions. National Association of Environmental Professionals. Honolulu, HI. April 13-16, 2015.

Scholarships

2017–21	Ontario Trillium Scholarship	Government of Ontario
2020	Cameron Allen Explorers Graduate Fellowship	University of Toronto, Earth Sciences
2015	Outstanding Graduate Student Scholarship	University of West Florida, EES
2012	Undergraduate Research Scholarship	University of Alabama, Geology

Awards

2023	Outstanding Paper (with L.M. Schoenbohm)	Journal of Geoscience Education
2021	Best Paper	University of Toronto Mississauga, CPS
2017	Outstanding Master's Thesis	University of West Florida

Mentoring and supervision

2024	Abdulaziz Alajlan – GaTech undergraduate student working on reactive thermodynamics (co-supervised with S.J. Sim).	
2022	Vigil Smith – REU undergraduate student working on two-phase flow (co-supervised with S.J. Sim).	
2014–16	Supervised 28 undergraduate and graduate students on field work collecting soil samples, fluvial measurements, biomass measurements, and laboratory analyses. Students contributed a sum total of >500 hours to the project.	

Teaching experience

6. **ERS402: Advanced Structural Geology (University of Toronto Mississauga)**
Guest lecture: Fall 2021
Designed and delivered 50-minute exercise on numerical modelling (available online at github.com/mitchellmcm27/sandbox-extension-exercise)
5. **ERS302: Tectonics (University of Toronto Mississauga)**
Teaching assistant: Spring 2019, Fall 2020
Third-year tectonics course for Earth science majors.
Co-developed and published an innovative capstone project with Lindsay Schoenbohm (McMillan & Schoenbohm, 2021).
4. **ERS202: Dynamic Earth (University of Toronto Mississauga)**
Teaching assistant: Spring 2019, Spring 2020
3. **ERS 111: Earth, Climate & Life (University of Toronto Mississauga)**
Teaching assistant: Fall 2019
2. **ERS101: Planet Earth (University of Toronto Mississauga)**
Teaching assistant: Spring 2018
1. **GLY2010: Physical Geology (University of West Florida)**
Teaching assistant: Spring 2015

Other information

Industry: Geologist, Longleaf Energy Group, Inc., 2012–2013
Carbonate microfacies analysis. Exploration geology.

Media: Wind erosion research: November 9, 2020, Education News Canada
<https://educationnewscanada.com/article/education/category/research/100/865004/university-of-torontonovember-9-2020-where-the-wind-blows-u-of-t-study-shows-how-a-powerful-force-sculpts-argentina-s-landscape>

Media: Wind erosion research: October 2020, UTM News

<https://www.utm.utoronto.ca/main-news/>

where-wind-blows-new-study-shows-powerful-forces-sculpting-argentinass-landscape

<https://phys.org/news/2020-11-powerful-sculpting-argentina-landscape.html>

Media: Structural geology software: May 22, 2019, UTM News

<https://www.utm.utoronto.ca/vp-research/news/>

tools-trade-multi-million-dollar-software-donation-provides-geologists-peek-past

Science writing: McMillan, M. Pangea's Handiwork. Mobile Bay Magazine, January 2015 issue (available online at mobilebaymag.com/pangeas-handiwork).

Open-source software: github.com/mitchellmcm27

Founder: Cool Font LLC, 2016–present

We develop apps for iPhone, Android, and Windows with a focus on utilizing the internal sensors of modern smartphones (www.coolfont.co).

Homepage: www.mitchell-mcmillan.com