Colin R. Meyer

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Education

2013–2017 PhD in Applied Mathematics
Advised by Professor James R. Rice
School of Engineering and Applied Sciences
Harvard University

2012–2013 MASt in Applied Mathematics
Part III of the Mathematical Tripos
University of Cambridge

2008–2012 BS in Civil and Environmental Engineering
University of California, Berkeley
With High Honors

Research Interests

Fluid dynamics; snow and ice mechanics; glaciology; icy satellites; applied mathematics

Appointments

2019–now **Dartmouth College**, Thayer School of Engineering, Assistant Professor of Engineering; Adjunct Professor of Earth Sciences.

Professional Experience

2017–2019 **University of Oregon** *Postdoctoral scholar*
Research on how glacier sliding responds to the freezing of subglacial sediments.
Reference: Professor Alan Rempel, rempel@uoregon.edu

2013–2017 **Harvard University** *Graduate research assistant*
Research on the thermodynamics and hydrology of ice stream shear margins.
Reference: Professor Jim Rice, rice@seas.harvard.edu

2016 **Woods Hole Oceanographic Institute** *Geophysical fluid dynamics fellowship*
Lectures on swimming and biolocomotion. Research on meltwater flow in firn.
Reference: Professor Ian Hewitt, hewitt@maths.ox.ac.uk

2014 **University of Alaska, Fairbanks** *McCarthy glaciology summer school*
Field experience on Kennicott glacier. Research on lumped subglacial hydrology models.
Reference: Professor Ed Bueler, elbueler@alaska.edu

2012–2013 **University of Cambridge** *Research assistant*
Lab experiments on the scaling of the transition to turbulence in stratified shear flow.
Reference: Professor Paul Linden, p.f.linden@damtp.cam.ac.uk

2012 **Sea Engineering, Inc.** *Environmental engineer (intern)*
Hydro-acoustic monitoring, particle size distributions, and Sedflume erosion experiments.
Reference: Mr Ken Israel, kisrael@integral-corp.com

2011–2012 **McGill University** *Research trainee*
Wind tunnel turbulence data comparison to predictions for passive scalar statistics.
Reference: Professor Laurent Mydlarski, laurent.mydlarski@mcgill.ca

2010–2012 **University of California, Berkeley** *Research assistant*
Experiments to determine ellipsoidal particle rotation in turbulence using PIV.
Reference: Professor Evan Variano, variano@ce.berkeley.edu

Scholarships, Honors & Awards

2018 Travel grant, International Glaciological Society
2017 David Crighton Fellow to the University of Cambridge
2013–2016 National Science Foundation Graduate Research Fellowship
2013–2015 Harvard Certificate of Distinction in Teaching
2012–2013 Winston Churchill Scholarship to the University of Cambridge
2012 Clement T. Wiskocil Award, UC Berkeley Civil & Environmental Engineering Honor
2011 Chevron Environmental Engineering Scholarship
2011 Travel grant, American Physical Society Division Fluid Dynamics
2009 APWA Civil Engineering Scholarship
2008–2012 Robert C. Byrd Scholarship

Teaching Experience

Winter 2021 Dartmouth ENGS 150 (graduate fluid mechanics, Instructor)
Spring 2020 Dartmouth ENGS 150 (graduate fluid mechanics, Instructor)
Winter 2020 Dartmouth ENGS 34 (undergraduate fluid mechanics, Instructor)
Spring 2018 Oregon GEOL 462/562 (environmental geomechanics, Co-Instructor with Prof A Rempel)
Spring 2016 Harvard ES 123 (undergraduate fluid mechanics, TA, Prof S Rubinstein)
Fall 2015 Harvard AM 104 (undergraduate complex analysis, TA, Dr N Upadhyaya)
Spring 2015 Harvard AM 105 (undergraduate differential equations, TA, Prof M P Brenner)
Fall 2014 Harvard ES 220 (graduate fluid dynamics, TA, Prof J R Rice)
Spring 2014 Harvard EPS 162 (undergraduate hydrology, TA, Prof J R Rice)
Fall 2013 Harvard ES 220 (graduate fluid dynamics, TA, Prof L Mahadevan)

Mentoring

2020–now Aleah Sommers (Dartmouth postdoc)
2019–now Jacob Buffo (Dartmouth postdoc): Buffo et al (2021, submitted 202X, in prep 202X)
2020–now Brita Horlings (Dartmouth graduate student): NASA FINESST 2020 recipient
2020–now Ayobami Ogunmolasuyi (Dartmouth graduate student; co-advised with Ian Baker)
2018–2020 Pierce Hunter (Oregon masters student; co-advised with Alan Rempel): Hunter et al (2021)

Academic Service

Editor

2021–now Editorial board, Proceedings of the Royal Society A

Reviewer

Cold Regions Science and Technology. The Cryosphere. ERDC. Fluid Dynamics Research. Journal of Fluid Mechanics. Geophysical Research Letters. Journal of Geophysical Research. Journal of Glaciology. International Journal of Solids and Structures. Nature Communications. Nature Geoscience. NASA SSW. NASA Cryosphere. NDSEG fellowship. NSF ANS. NSF GRFP. Journal of Materials Science. Polar Science. PNAS. Proceedings of the Royal Society A. SACNAS conference. Water Resources Research.

Conferences

2017–2020 *American Geophysical Union Fall Meeting — Hydrology of Mountain Glaciers and Ice Sheets* session organizer (with K. Poinar, C. Dow, S. Moustafa, K. Schild, L. Stevens)
2015–2017 *American Physical Society Division of Fluid Dynamics — Geophysical Fluid Dynamics: Cryosphere* session organizer and chair (2015, 2016)

Funding

Research grants

2020-2023 National Science Foundation. *Collaborative Research: Freeze-on of Subglacial Sediments in Experiments and Theory.* NSF–2012958. $698,284 ($330,715 to Dartmouth). (Lead PI)

2020-2023 Heising-Simons Foundation. *Follow the water: meltwater infiltration through snow and subglacial hydrology at Helheim Glacier.* $546,814. (PI)

2020 U.S. Army Engineer Research and Development Center. *Frost heaving: comparison between laboratory experiments and mathematical theory.* ERDC/CRREL–W913E519C0008. $24,782. (PI)

Student fellowships

2020-2023 National Aeronautics and Space Administration. *Investigating Snow and Firn Compaction Through Two-Phase Flow Modeling and 'French Press' Experiments.* FINESST fellowship $135,000. (FI Brita Horlings; PI Meyer)

Publications

Journal articles

In preparation (drafts available on request)

2021 1. Jacob J. Buffo, Lujendra Ojha, **Colin R. Meyer**, Ken Ferrier, and Marisa C. Palucis. Revisiting Subglacial Hydrology as an Origin for Mars' Valley Networks. *March 2021 to Earth Planet. Sci. Lett.*

2021 2. Meghana Ranganathan, Brent Minchew, and **Colin R. Meyer**, and Matěj Peč. Rethinking the energy balance in glaciers. *April 2021 to Geophys. Res. Lett.*.

2021 3. Logan E. Mann, Alexander A. Robel, and **Colin R. Meyer**. Mutual Synchronization of Internally Generated Heinrich and Dansgaard-Oeschger Events through Ice-Ocean Interactions. *May 2021 to Paleoceanogr. Paleoclimatol.*

2021 4. **Colin R. Meyer**, Christian Schoof, and Alan W. Rempel. A thermomechanical model for frost heave and subglacial frozen fringe. *June 2021 to J. Fluid Mech.*

Submitted

2021 1. Samuel Boury, **Colin R. Meyer**, Geoff M. Vasil, and Andrew J. Wells. Convection in a mushy-layer along a heated wall: a model for the geysers of Enceladus. *submitted to J. Fluid Mech.* arXiv:2103.07613

2021 2. Meghana Ranganathan, Brent Minchew, **Colin R. Meyer**, and Matěj Peč. Recrystallization of ice enhances the creep and vulnerability to fracture of ice shelves. *submitted to PNAS.* doi: 10.31223/X5W31W

2020 3. Jacob J. Buffo, **Colin R. Meyer**, and James R. G. Parkinson. Dynamics of a solidifying icy satellite shell. *in revision at J. Geophys. Res.* doi: 10.1002/essoar.10504589.1

2020 4. Alan W. Rempel, **Colin R. Meyer**, and Kiya L. Riverman. Melting temperature changes during slip across subglacial cavities drive basal mass exchange. *in revision at J. Glac.*

Published

2021 26. Jacob J. Buffo, Britney E. Schmidt, Christian Huber, and **Colin R. Meyer**. Characterizing the Ice-Ocean Interface of Icy Worlds: A Theoretical Approach. *Icarus.* doi: 10.1016/j.icarus.2021.114318

2021 25. Pierce Hunter, **Colin R. Meyer**, Brent Minchew, Marianne Haseloff, and Alan W. Rempel. Thermal Controls on Ice Stream Shear Margins. *J. Glac.* doi: 10.1017/jog.2020.118

2020 24. Meghana Ranganathan, Brent M. Minchew, **Colin R. Meyer**, and Hilmar Gudmundsson. A new approach to inferring basal drag and ice rheology in ice streams, with applications to West Antarctic ice streams. *J. Glac.* 1–14. doi: 10.1017/jog.2020.95

2020 23. Baptiste Vandecrux and 22 others, including **Colin R. Meyer**. The firn meltwater Retention Model Intercomparison Project (RetMIP): Evaluation of nine firn models at four weather station sites on the Greenland ice sheet. *Cryosphere*, doi: 10.5194/tc-14-3785-2020

2020 22. Lizz Ultee, **Colin R. Meyer**, and Brent M. Minchew. Tensile strength of glacial ice deduced from observations of the 2015 Eastern Skaftá Cauldron collapse, Vatnajökull ice cap, Iceland. *J. Glac.* 1–10. doi: 10.1017/jog.2020.65

2020 21. Brent M. Minchew and **Colin R. Meyer**. Dilation of subglacial sediment governs incipient surge motion in glaciers with deformable beds. *Proc. R. Soc. London A*, 476: 20200033. doi: 10.1098/rspa.2020.0033

2020 20. **Colin R. Meyer**, Kaitlin M. Keegan, Ian Baker, and Robert L. Hawley. A model for French-press experiments of dry snow compaction. *Cryosphere*, 14:1449–1458, doi: 10.5194/tc-14-1449-2020

2020 19. Adam J. O. Butler, **Colin R. Meyer**, and Jerome A. Neufeld. Deformation of an elastic beam on a winkler foundation. *J. Appl. Mech.* 87(5): 051010. doi: 10.1115/1.4046197

2019 18. **Colin R. Meyer**, Alexander A. Robel, and Alan W. Rempel. Frozen fringe explains sediment freeze-on during Heinrich events. *Earth Planet. Sci. Lett.* 524. doi: 10.1016/j.epsl.2019.115725

2019 17. Bradley Lipovsky, **Colin R. Meyer**, Lucas K. Zoet, et al. Glacier sliding, seismicity, and sediment entrainment. *Ann. Glac.* 60(79):182-192. doi: 10.1017/aog.2019.24

2019 16. Alan W. Rempel and **Colin R. Meyer**. Premelting increases the rate of regelation by an order of magnitude. *J. Glac.* 65(251):518–521. doi: 10.1017/jog.2019.33

2019 15. Brent M. Minchew, **Colin R. Meyer**, Samuel S. Pegler, et al. Comment on "Friction at the bed does not control fast glacier flow." *Science*, 363(6427). doi: 10.1126/science.aau6055

2018 14. **Colin R. Meyer**, L. Mydlarski, and L. Danaila. Statistics of incremental averages of passive scalar fluctuations. *Phys. Rev. Fluids*, 3(9). doi: 10.1103/PhysRevFluids.3.094603

2018 13. **Colin R. Meyer**, Anthony S. Downey, and Alan W. Rempel. Freeze-on limits bed strength beneath sliding glaciers *Nat. Comms.* 9. doi: 10.1038/s41467-018-05716-1

2018 12. **Colin R. Meyer**, Alissar Yehya, Brent M. Minchew, and James R. Rice. A model for the downstream evolution of temperate ice and subglacial hydrology along ice stream shear margins. *J. Geophys. Res.* 123:1682–1698. doi: 10.1029/2018JF004669

2018 11. **Colin R. Meyer** and Brent M. Minchew. Temperate ice in the shear margins of the Antarctic Ice Sheet: Controlling processes and preliminary locations. *Earth Planet. Sci. Lett.* 498:17–26. doi: 10.1016/j.epsl.2018.06.028

2018 10. Brent M. Minchew, **Colin R. Meyer**, Alexander A. Robel, Hilmar Gudmundsson, and Mark Simons. Processes controlling the downstream evolution of ice rheology in glacier shear margins: Case study on Rutford Ice Stream, West Antarctica. *J. Glaciol.* 64(246):583-594. doi: 10.1017/jog.2018.47

2017 9. **Colin R. Meyer** and Ian Hewitt. A continuum model for meltwater flow through compacting snow. *Cryosphere*, 11:2799-2813, doi: 10.5194/tc-11-2799-2017

2017 8. **Colin R. Meyer** and Timothy T. Creyts. Formation of ice eddies in subglacial mountain valleys. *J. Geophys. Res.* 122(9):1574–1588. doi: 10.1002/2017JF004329

2017 7. Navid Zolfaghari, **Colin R. Meyer**, and Andrew P. Bunger. Blade-shaped (PKN) hydraulic fracture driven by a turbulent fluid in an impermeable rock. *J. Eng. Mech.* doi: 10.1061/(ASCE)EM.1943-7889.0001350

2017 6. **Colin R. Meyer**, John W. Hutchinson, and James R. Rice. The path-independent M integral implies the creep closure of englacial and subglacial channels. *J. Appl. Mech.* 84(1), 011006:1-9. doi: 10.1115/1.4034828

2016 5. **Colin R. Meyer**, Matheus C. Fernandes, Timothy T. Creyts, and James R. Rice. Effects of ice deformation on Röthlisberger channels and implications for transitions in subglacial hydrology. *J. Glaciol.* 62(234):750–762. doi: 10.1017/jog.2016.65

2016 4. Douglas J. Brinkerhoff, **Colin R. Meyer**, Ed Bueler, Martin Truffer, and Timothy Bartholomaus. Inversion of a glacier hydrology model. *Ann. Glaciol.* 57(72):1–12. doi: 10.1017/aog.2016.3

2014 3. **Colin R. Meyer** and Paul Linden. Stratified shear flow: experiments in an inclined square duct. *J. Fluid Mech.* 753: 242–253. doi: 10.1017/jfm.2014.358

2013 2. **Colin R. Meyer**, Margaret L. Byron, and Evan A. Variano. Rotational diffusion of particles in turbulence. *Limnol. Oceanogr.: Fluids & Environ.* 3:89–102. doi: 10.1215/21573689-2326592

2012 1. Gabriele Bellani, Margaret L. Byron, Audric G. Collignon, **Colin R. Meyer** and Evan A. Variano. Shape effects on turbulent modulation by large nearly neutrally buoyant particles. *J. Fluid Mech.* 712:41–60. doi: 10.1017/jfm.2012.393

Invited talks

2020 Caltech Seismological Laboratory (October), Howard University Physics (October), Oxford Applied Mathematics (October)

2019 University of Limerick Applied Mathematics (April), Colorado School of Mines Geophysical Engineering (October), University of Pennsylvania Earth Science (November)

2018 University of Oregon Earth Science (January), UC Santa Cruz Earth Science (January), Dartmouth College Thayer Engineering (February), MIT Civil & Environmental Engineering (March), Oregon State Earth Science (October), University of Wisconsin–Madison Geoscience (November)

2017 Oxford Applied Mathematics (January), Cambridge Applied Mathematics (January), British Antarctic Survey (February), University of Pittsburgh Civil & Environmental Engineering (March)

2016 University of New Hampshire Applied Mathematics (February), Princeton Geosciences (November), Woods Hole Oceanographic Institution Geology & Geophysics (November)

2013 UC Santa Cruz Applied Mathematics (October)

Selected conference presentations

2018 **Colin R. Meyer**, Alan Rempel. Maximum sediment flux precedes peak ice discharge in Heinrich events. *AGU Fall Meeting.*

2018 **Colin R. Meyer**, Alan Rempel. An enthalpy method for subglacial frozen fringe. *IGS Buffalo.*

2017 **Colin R. Meyer**, Ian Hewitt, and Jerome Neufeld. Turbulent flow through channels in a viscously deforming matrix. *American Physical Society Division of Fluid Dynamics conference.*

2016 **Colin R. Meyer** and Ian Hewitt. Meltwater percolation and refreezing in compacting snow. *American Physical Society Division of Fluid Dynamics conference.*

2015 **Colin R. Meyer**, Timothy T. Creyts, and James R. Rice. Moffatt eddies at the base of ice sheets. *American Physical Society Division of Fluid Dynamics conference.*

2014 **Colin R. Meyer** and Paul Linden. Stratified shear flow in an inclined square duct. *American Physical Society Division of Fluid Dynamics conference.*

2013 **Colin R. Meyer** and Paul Linden. Transition to turbulence in stratified shear flow through an inclined square duct. *14th European Turbulence Conference.*

2011 **Colin R. Meyer** and L. Mydlarski. Statistics of incremental averages of passive scalar fluctuations. *American Physical Society Division of Fluid Dynamics conference.*

Selected conference posters

2019 **Colin R. Meyer**, Christian Schoof, Alan W. Rempel. An enthalpy method for subglacial frozen fringe. *AGU Fall Meeting.*

2017 **Colin R. Meyer**, Ian J. Hewitt. A continuum model for meltwater flow through compacting snow. *AGU Fall Meeting.*

2016 **Colin R. Meyer**, Bradley P. Lipovsky, and Matthew R. Siegfried. Inferring subglacial lake water pressure from a bending model of surface displacement observations. *AGU Fall Meeting.*

2015 **Colin R. Meyer**, and James R. Rice. The path-independent M Integral around Röthlisberger channels. *AGU Fall Meeting.*

2015 **Colin R. Meyer**, Matheus C. Fernandes, and James R. Rice. Adding antiplane shear to Röthlisberger channels. *IGS Cambridge.*

2014 **Colin R. Meyer**, Timothy T. Creyts, and James R. Rice. Formation of Ice Eddies in Mountain Valleys of East Antarctica. *AGU Fall Meeting.*

2013 **Colin R. Meyer**, Margaret L. Byron, and Evan A. Variano. Rotational diffusion of particles in turbulence. *Microenvironments conference.* Les Houches, France.

2011 Margaret L. Byron, **Colin R. Meyer**, Gabriele Bellani, and Evan A. Variano. Coupled Dynamics of Turbulent Water Flow and Non-Spherical Particles Through Novel Measurement Method. *AGU Fall Meeting.*

Book reviews

2021 **Colin R. Meyer**, Review of "Fundamental Glaciology," by K. Hutter. International Glaciological Society, 2020; *to be submitted April 2021 to J. Glac.*

2019 **Colin R. Meyer**, Review of "Enceladus and the Icy Moons of Saturn," edited by Paul M. Schenk, Roger N. Clark, Carly J. A. Howett, Anne J. Verbiscer, J. Hunter Waite, University of Arizona Press, 2018; *Pure Appl. Geophys.*. 10.1007/s00024-019-02314-0

2018 **Colin R. Meyer**, Review of "The Mechanics and Reliability of Films, Multilayers and Coatings," by M. R. Begley and J. W. Hutchinson, Cambridge University Press, 2017; *Pure Appl. Geophys.*. doi: 10.1007/s00024-018-1894-x

2018 **Colin R. Meyer**, Review of "Variational Formulation of Fluid and Geophysical Fluid Dynamics," by G. Badin and F. Crisciani, Springer, 2018; *Pure Appl. Geophys.*. doi: 10.1007/s00024-018-1895-9

2017 **Colin R. Meyer**, Review of "Singularities: Formation, Structure, and Propagation," by J. Eggers and M. A. Fontelos, Cambridge University Press, 2015; *Pure Appl. Geophys.*. doi: 10.1007/s00024-017-1701-0

2017 **Colin R. Meyer**, Review of "Multiphysics Modeling Using COMSOL 5 and MATLAB," by Roger W. Pryor, Mercury Learning, 2016; *Pure Appl. Geophys.*. doi: 10.1007/s00024-017-1594-y

2016 **Colin R. Meyer**, Review of "Flow, Deformation and Fracture," by G. I. Barenblatt, Cambridge University Press, 2014; *Pure Appl. Geophys.*. doi: 10.1007/s00024-016-1240-0

2016 **Colin R. Meyer**, Review of "Fluid Dynamics in Complex Fractured-Porous Systems," edited by Boris Faybishenko, Sally M. Benson, and John E. Gale, John Wiley & Sons/American Geophysical Union, 2015; *Pure Appl. Geophys.*. doi: 10.1007/s00024-016-1239-6

2015 **Colin R. Meyer**, Review of "Flow in Porous Rocks," by Andrew W. Woods, Cambridge University Press, 2015; *Pure Appl. Geophys.*. doi: 10.1007/s00024-015-1138-2

2015 **Colin R. Meyer**, Review of "Introduction to Geophysical Fluid Dynamics, Second Edition," by Benoit Cushman-Roisin and Jean-Marie Beckers, Academic Press, 2011; *Pure Appl. Geophys.*. doi: 10.1007/s00024-015-1091-0

2015 **Colin R. Meyer**, Review of "Granular Media," by Bruno Andeotti, Yöel Forterre, and Olivier Pouliquen, Cambridge University Press, 2013; *Pure Appl. Geophys.* doi: 10.1007/s00024-015-1094-x

2015 **Colin R. Meyer**, Review of "Double-Diffusive Convection," by Timour Radko, Cambridge University Press, 2013; *Pure Appl. Geophys.*. doi: 10.1007/s00024-015-1089-7