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CONTACT INFORMATION

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ACADEMIC APPOINTMENTS

Assistant Professor — January 2019 to present
Department of Geophysics
Hydrologic Science and Engineering, Affiliated Faculty
Payne Institute for Public Policy, Faculty Fellow
Colorado School of Mines

Thompson Postdoctoral Fellow — May 2017 to December 2018
Department of Geophysics
School of Earth, Energy, and Environmental Sciences
Stanford University
Mentor: Dr. Dustin M. Schroeder

Postdoctoral Scholar — October 2015 to April 2017
Institute of Geophysics and Planetary Physics
Scripps Institution of Oceanography
University of California, San Diego
Supervisor: Dr. Helen A. Fricker

EDUCATION

PhD in Earth Sciences — October 2015
Institute of Geophysics and Planetary Physics
Scripps Institution of Oceanography, La Jolla, CA
Dissertation: *Investigating Antarctic ice sheet subglacial processes beneath the Whillans Ice Plain, West Antarctica, using satellite altimetry and GPS*
Adviser: Dr. Helen A. Fricker

Master of Science in Earth Sciences — July 2010
Dartmouth College, Hanover, NH
Thesis: *On the use of high-precision GPS surveys for validation of ICESat altimetry measurements and investigation of seasonal ice-surface fluctuations*
Adviser: Dr. Robert L. Hawley

Bachelor of Arts in Earth Sciences — June 2008
Dartmouth College, Hanover, NH
Magna cum Laude, *Phi Beta Kappa*
Senior Thesis for High Honors: *Hydrothermal Waters of Ischia, Italy: A revisitation of groundwater mixing and the ramifications for environmental arsenic contamination*
Adviser: Dr. Benjamin Bostick

MANUSCRIPTS IN REVIEW

* *indicates student or postdoctoral advisee*
† *indicates co-first authors*

[65] *Michaelides, R. J., **M. R. Siegfried**, J. Lovekin, K. Berry, B. Dugan and D. L. Roth, in review. Discrimination of Active and Inactive Burn Areas in the 2020 Cameron Peak Fire from Interferometric Synthetic Aperture Radar (InSAR) Time Series.

[64] *Snow, T., W. Zhang, E. Schreiber, **M. R. Siegfried**, W. Abdalati and T. Scambos, in review. Alongshore winds force warm Atlantic Water toward Helheim Glacier in southeast Greenland.

[63] Robel, A., S. Sim, C. Meyer, **M. R. Siegfried** and C. Gustafson, in review. Contemporary Ice Sheet Thinning Drives Subglacial Groundwater Exfiltration.

[62] Ryan, J. C., B. Medley, C. M. Stevens, T. C. Sutterley and **M. R. Siegfried**, in review. Role of snowfall versus air temperatures for Greenland Ice Sheet melt-albedo feedbacks.

[61] Stubblefield, A. G., C. R. Meyer, **M. R. Siegfried**, W. Sauthoff* and M. Spiegelman, in review. Reconstructing subglacial lake activity with an altimetry-based inverse method.

Refereed Journal Publications

[60] **Siegfried†, M. R.**, R. A. Venturelli†, M. O. Patterson, W. Arnuk, T. D. Campbell, C. D. Gustafson, A. B. Michaud, B. K. Galton-Fenzi, M. B. Hausner, S. N. Holzschuh*, B. Huber, K. D. Mankoff, D. M. Schroeder, P. Summers, S. Tyler, S. P. Carter, H. A. Fricker, D. M. Harwood, A. Leventer, B. E. Rosenheim, M. L. Skidmore, J. C. Priscu and the SALSA Science Team, 2023. The life and death of a subglacial lake in West Antarctica, *Geology*, **51**(5), 434–438, doi:10.1130/G50995.1.

[59] *Savidge, E., T. Snow*, **M. R. Siegfried**, Y. Zheng, A. B. Villas Bôas, G. A. Bortolotto, L. Boehme and K. E. Alley, 2023. Wintertime Polynya Structure and Variability From Thermal Remote Sensing and Seal-Borne Observations at Pine Island Glacier, West Antarctica, *IEEE Transactions on Geoscience and Remote Sensing*, **61**, 1–13, doi:10.1109/tgrs.2023.3271453.

[58] Davis, C. L., R. A. Venturelli, A. B. Michaud, J. R. Hawkings, A. M. Achberger, T. J. Vick-Majors, B. E. Rosenheim, J. E. Dore, A. Steigmeyer, M. L. Skidmore, J. D. Barker, L. G. Benning, **M. R. Siegfried**, J. C. Priscu, B. C. Christner and the SALSA Science Team, 2023. Biogeochemical and historical drivers of microbial community composition and structure in sediments from Mercer Subglacial Lake, West Antarctica, *ISME Communications*, **3**(1), doi:10.1038/s43705-023-00216-w.

[57] Rosenheim, B. E., A. B. Michaud, J. Broda, A. Gagnon, R. A. Venturelli, T. D. Campbell, A. Leventer, M. Patterson, **M. R. Siegfried**, B. C. Christner, D. Duling, D. Harwood, J. E. Dore, M. Tranter, M. L. Skidmore, J. C. Priscu and the SALSA Science Team, 2023. A method for successful collection of multicores and gravity cores from Antarctic subglacial lakes, *Limnology and Oceanography: Methods*, **21**(5), 279–294, doi:10.1002/lom3.10545.

[56] Venturelli, R. A., B. Boehman, C. Davis, J. R. Hawkings, S. E. Johnston, C. D. Gustafson, A. B. Michaud, C. Mosbeux, **M. R. Siegfried**, T. J. Vick-Majors, V. Galy, R. G. M. Spencer, S. Warny, B. C. Christner, H. A. Fricker, D. M. Harwood, A. Leventer, J. C. Priscu, B. E. Rosenheim and the SALSA Science Team, 2023. Constraints on the Timing and Extent of Deglacial Grounding Line Retreat in West Antarctica, *AGU Advances*, **4**, e2022AV000846, doi:10.1029/2022AV000846.

2022

[55] Bienert, N. L., D. M. Schroeder, S. T. Peters, E. J. MacKie, E. J. Dawson, **M. R. Siegfried**, R. Sanda and P. Christoffersen, 2022. Post-Processing Synchronized Bistatic Radar for Long Offset Glacier Sounding, *IEEE Transactions on Geoscience and Remote Sensing*, **60**, 1–17, doi:10.1109/tgrs.2022.3147172.

[54] Gustafson, C. D., K. Key, **M. R. Siegfried**, J. P. Winberry, H. A. Fricker, R. A. Venturelli and A. B. Michaud, 2022. A dynamic saline groundwater system mapped beneath an Antarctic ice stream, *Science*, **376**(6593), 640–644, doi:10.1126/science.abm3301.

[53] Livingstone, S. J., Y. Li, A. Rutishauser, R. J. Sanderson, K. Winter, J. Mikucki, H. Björnsson, J. S. Bowling, W. Chu, C. Dow, H. A. Fricker, M. McMillan, F. Ng, N. Ross, M. J. Siegert, **M. R. Siegfried** and A. J. Sole, 2022. Global synthesis of subglacial lakes and their changing role in a warming climate, *Nature Reviews Earth & Environment*, **3**, 106–124, doi:10.1038/s43017-021-00246-9.

2021

[52] **Siegfried, M. R.** and H. A. Fricker, 2021. Illuminating active subglacial lake processes with ICESat-2 laser altimetry, *Geophysical Research Letters*, **48**(14), doi:10.1029/2020GL091089.

[51] *Michaelides†, R. J., M. Bryant†, **M. R. Siegfried** and A. A. Borsa, 2021. Quantifying Permafrost Deformation with ICESat-2, *Earth and Space Science*, **8**(8), e2020EA001538, doi:10.1029/2020EA001538.

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[45] Stubblefield, A. G., T. T. Creyts, J. Kingslake, **M. R. Siegfried** and M. Spiegelman, 2021. Surface expression and apparent timing of subglacial lake oscillations controlled by viscous ice flow, *Geophysical Research Letters*, **48**(17), e2021GL094658, doi:10.1029/2021GL094658.

2020

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[43] Begeman, C., S. Tulaczyk, L. Padman, M. King, **M. R. Siegfried**, T. Hodson and H. A. Fricker, 2020. Tidal pressurization of the ocean cavity near an Antarctic ice shelf grounding line, *Journal of Geophysical Research – Oceans*, **125**(4), doi:10.1029/2019JC015562.

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[41] Elsworth, C., D. M. Schroeder and **M. R. Siegfried**, 2020. Interpreting englacial layer deformation in the presence of complex ice flow history with synthetic radargrams, *Annals of Glaciology*, **61**(81), 206–213, doi:10.1017/aog.2019.41.

[40] Hawkings, J. R., M. L. Skidmore, J. L. Wadham, J. C. Priscu, P. L. Morton, J. E. Hatton, C. B. Gardner, T. J. Kohler, M. Stibal, E. A. Bagshaw, A. Steigmeyer, J. Barker, J. E. Dore, W. B. Lyons, M. Tranter, R. G. M. Spencer and the SALSA Science Team (incl. **M. R. Siegfried**), 2020. Enhanced trace element mobilization by Earth's ice sheets,

Proceedings of the National Academy of Sciences, **117**(50), 31648–31659, doi:10.1073/pnas.2014378117.

[39] Jordan, T., D. Schroeder, C. Elsworth and **M. R. Siegfried**, 2020. Estimation of ice fabric within Whillans Ice Stream using polarimetric phase-sensitive radar sounding, *Annals of Glaciology*, **61**(81), 74–83, doi:10.1017/aog.2020.6.

[38] MacKie, E. J., D. M. Schroeder, J. Caers, **M. R. Siegfried** and C. Scheidt, 2020. Antarctic topographic realizations and geostatistical modeling used to map subglacial lakes, *Journal of Geophysical Research – Earth Surface*, **125**(3), doi:10.1029/2019JF005420.

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[36] Venturelli, R. A., **M. R. Siegfried**, K. Roush, W. Li, J. Burnett, R. Zook, H. A. Fricker, J. Priscu, A. Leventer and B. Rosenheim, 2020. Mid-Holocene grounding line variability in the southern Ross Embayment, *Geophysical Research Letters*, **47**(15), e2020GL088476, doi:10.1029/2020GL088476.

2019

[35] Schroeder, D. M., J. A. Dowdeswell, M. J. Siegert, R. G. Bingham, W. Chu, E. J. MacKie, **M. R. Siegfried**, K. I. Vega, J. R. Emmons and K. Winstein, 2019. Multidecadal observations of the Antarctic ice sheet from restored analog radar records, *Proceedings of the National Academy of Sciences*, **116**(38), 18867–18873, doi:10.1073/pnas.1821646116.

[34] Smith, B. E., N. Holschuh, A. S. Gardner, S. Adusumili, K. M. Brunt, B. Csatho, H. A. Fricker, K. Harbeck, A. Huth, T. Neumann, J. Nilsson and **M. R. Siegfried**, 2019. Land ice height-retrieval algorithm for NASA's ICESat-2 photon-counting laser altimeter, *Remote Sensing of Environment*, **233**, 111352, doi:10.1016/j.rse.2019.111352.

[33] Tinto, K., L. Padman, C. Siddoway, S. Springer, H. A. Fricker, I. Das, F. C. Tontini, D. Porter, N. Frearson, S. Howard, **M. R. Siegfried** and et al., 2019. Ross Ice Shelf response to climate driven by the tectonic imprint on seafloor bathymetry, *Nature Geoscience*, **12**, 441–449, doi:10.1038/s41561-019-0370-2.

2018

[32] **Siegfried, M. R.** and H. A. Fricker, 2018. Thirteen years of subglacial lake activity in Antarctica from multi-mission altimetry, *Annals of Glaciology*, **59**(76), 42–55, doi:10.1017/aog.2017.36.

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[30] Begeman, C. M., S. M. Tulaczyk, O. J. Marsh, J. A. Mikucki, T. P. Stanton, T. O. Hodson, **M. R. Siegfried**, R. D. Powell, K. Christianson and M. A. King, 2018. Ocean stratification and low melt rates at the Ross Ice Shelf grounding zone, *Journal of Geophysical Research – Oceans*, **123**(10), 7438–7452, doi:10.1029/2018JC013987.

[29] Adusumilli, S., H. A. Fricker, **M. R. Siegfried**, L. Padman, F. Paolo and S. Ligtenberg, 2018. Variable basal melt rates of Antarctic Peninsula ice shelves, 1994–2016, *Geophysical Research Letters*, **45**(9), 4086–4095, doi:10.1002/2017GL076652.

[28] Padman, L., **M. R. Siegfried** and H. A. Fricker, 2018. Ocean tide influences on ice sheet processes, *Reviews of Geophysics*, **56**(1), 142–184, doi:10.1002/2016RG000546.

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2017

[26] **Siegfried, M. R.**, B. Medley, K. Larson, H. A. Fricker and S. Tulaczyk, 2017. Snow accumulation variability on a West Antarctic ice stream observed with GPS reflectometry, 2007–2017, *Geophysical Research Letters*, **44**(15), 7808–7816, doi:10.1002/2017GL074039.

[25] Carter, S. P., H. A. Fricker and **M. R. Siegfried**, 2017. Antarctic subglacial lakes drain through sediment-floored canals: Theory and model testing on real and idealized domains, *The Cryosphere*, **11**, 381–405, doi:10.5194/tc-11-381-2017.

[24] Damsgaard, A., J. Suckale, J. Piotrowski, M. Houssais, **M. R. Siegfried** and H. A. Fricker, 2017. Sediment behavior controls equilibrium width of subglacial channels, *Journal of Glaciology*, **63**(242), 1034–1048, doi:10.1017/jog.2017.71.

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2016

[21] **Siegfried, M. R.**, H. A. Fricker, S. P. Carter and S. Tulaczyk, 2016. Episodic ice velocity fluctuations triggered by a subglacial flood in West Antarctica, *Geophysical Research Letters*, **43**(6), 2640–2648, doi:10.1002/2016GL067758.

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2015

[14] Fisher, A. T., K. D. Mankoff, S. M. Tulaczyk, S. W. Tyler, N. Foley and the WISSARD Science Team (incl. **M. R. Siegfried**), 2015. High geothermal heat flux measured below the West Antarctic Ice Sheet, *Science Advances*, **1**(6), e1500093–e1500093, doi:10.1126/sciadv.1500093.

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2014

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2013

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2012

[2] Taylor, V. F., B. P. Jackson, **M. R. Siegfried**, J. Navratilova, K. A. Francesconi, J. Kirshtein and M. Voytek, 2012. Arsenic speciation in food chains from mid-Atlantic hydrothermal vents, *Environmental Chemistry*, **9**(2), 130–138, doi:10.1071/EN11134.

2011

[1] **Siegfried, M. R.**, R. L. Hawley and J. F. Burkhart, 2011. High-Resolution Ground-Based GPS Measurements Show Intercampaign Bias in ICESat Elevation Data Near Summit, Greenland, *IEEE Transactions on Geosciences and Remote Sensing*, **49**(10), 3393–3400, doi:10.1109/TGRS.2011.2127483.

Technical Reports

Smith, B., D. Hancock, K. Harbeck, L. Roberts, T. Neumann, K. Brunt, H. A. Fricker, A.

Gardner, **M. R. Siegfried**, S. Adusumilli, B. Csathoó, N. Holschuh, J. Nilsson and F. Paolo, 2021. Algorithm Theoretical Basis Document (ATBD) for Land Ice Along-Track Height Product (ATL06), Release 004, *NASA Goddard Space Flight Center Technical Reference*.

Other Publications

Siegfried, M. R., and C. D. Gustafson, 2022. Scientists in Antarctica discover a vast, salty groundwater system under the ice sheet – with implications for sea level rise. *The Conversation*, https://theconversation.com/scientists-in-antarctica-discover-a-vast-salty-groundwater-system-under-the-ice-sheet-with-implications-for-sea-level-rise-182506.

Padman, L., and **M. R. Siegfried**, 2018. Ocean Tides Affect Ice Loss from Large Polar Ice Sheets, *EOS: Earth & Space Science News*, **99**, doi:10.1029/2018EO092835.

Fricker, H. A., F. Paolo, **M. R. Siegfried**, and S. Adusumilli, 2018. Short-term changes in Antarctica's ice shelves are key to predicting their long-term fate, *The Conversation*, https://theconversation.com/short-term-changes-in-antarcticas-ice-shelves-are-key-to-predicting-their-long-term-fate-95207.

Data Sets

Siegfried, M. R., R. A. Venturelli, M. O. Patterson, W. Arnuk, T. D. Campbell, C. D. Gustafson, A. B. Michaud, B. K. Galton-Fenzi, M. B. Hausner, S. N. Holzschuh, B. Huber, K. D. Mankoff, D. M. Schroeder, P. T. Summers, S. Tyler, S. P. Carter, H. A. Fricker, D. M. Harwood, A. Leventer, B. E. Rosenheim, M. L. Skidmore, J. C. Priscu and T. S. S. Team, 2023. Data for Siegfried*, Venturelli*, et al., 2023, Geology, Zenodo, doi:10.5281/ZENODO.7597019.

Smith, B. E., H. A. Fricker, A. Gardner, **M. R. Siegfried**, S. Adusumilli, B. M. Csathó, N. Holschuh, J. Nilsson, F. S. Paolo and the ICESat-2 Science Team, 2021. ATLAS/ICESat-2 L3A Land Ice Height, Version 4, NASA National Snow and Ice Data Center Distributed Active Archive Center, Boulder, Colorado USA, doi:10.5067/ATLAS/ATL06.004.

Published Software

Siegfried, M. R., W. Arnuk, R. A. Venturelli and M. O. Patterson, 2023. SiegVent2023-Geology code repository (Version 1.1), Zenodo, doi:10.5281/ZENODO.7605994.

Siegfried, M. R., 2021. mrsiegfried/Siegfried2021-GRL: Initial release with acceptance (Version 1.0), Zenodo, doi:10.5281/ZENODO.4914107.

Arendt, A., B. Smith, D. Shean, A. Steiker, Alek Petty, F. Perez, S. Henderson, F. Paolo, J. Nilsson, M. Becker, Susheel Adusumilli, D. Shapero, B. Wallin, J. Meyer, A. Schweiger, S. Dickinson, N. Hoschuh, **M. R. Siegfried** and T. Neumann, 2019. ICESAT-2HackWeek/ICESat2_hackweek_tutorials (Version 0.1), Zenodo, doi:10.5281/ZENODO.3360994.

Expanded Abstracts

* *indicates student or postdoctoral advisee*

[7] Bradford, J. H., **M. R. Siegfried**, V. Follingstad*, K. Hughson, A. Routt, B. Schmidt, A. Kubas, E. Quartini, A. Mullen and A. Swidinsky, 2023. Mapping the internal structure Arctic pingos using ground-penetrating radar: Results from the Pingo Canadian Landmark, *Seventh International Conference on Engineering Geophysics*.

[6] Bryant, M., E. Anderson, A. Borsa, C. Masteller, R. Michaelides*, **M. R. Siegfried** and A. Young, 2023. Integrating ICESat-2 elevation observation and satellite optical imagery to measure coastal topography and retreat rates on the Alaskan Beaufort Sea coast, *IGARSS 2023: 2023 IEEE International Geoscience and Remote Sensing Symposium*.

[5] Michalides, R. and **M. R. Siegfried**, 2023. Studying permafrost-wildfire interactions in the age of NISAR, *IGARSS 2023: 2023 IEEE International Geoscience and Remote Sensing Symposium*.

2021

[4] **Siegfried, M. R.**, D. M. Schroeder, W. Sauthoff* and B. E. Smith, 2021. Investigating a large subglacial lake drainage in East Antarctica with ice-penetrating radar, *SEG Annual Meeting* (invited contribution).

[3] *Klemm, J. and **M. R. Siegfried**, 2021. Open Source Visualization for Radar Altimetry Waveforms, /textitIEEE International Symposium on Antenna Technology and Applied Electromagnetics.

[2] Summers, P. T., D. M. Schroeder and **M. R. Siegfried**, 2021. Constraining ice sheet basal sliding and horizontal velocity profiles using a stationary phase senstive radar sounder, *IGARSS 2021: 2021 IEEE International Geoscience and Remote Sensing Symposium*.

2020 [1] Bienert, N., D. M. Schroeder, S. T. Peters and **M. R. Siegfried**, 2020. Processing-based synchronization approach for bistatic glacial tomography, *IGARSS 2020: 2020 IEEE International Geoscience and Remote Sensing Symposium*.

Winner of the IEEE GRSS Symposium Prize Paper Award

FUNDED GRANTS

$5,448,637 PI-share to Mines as faculty ($1,638,358 indirect costs)

National Aeronautics and Space Administration

- Solicitation: Studies with ICESat-2
  Title: *Tracing Antarctic freshwater: Coupling ICESat-2 observations of subglacial lake fluxes with ice-shelf cavity models to quantify impacts on ice-ocean processes*
  Period: 11/2023 – 10/2026
  PI: M. Siegfried
  Co-I: M. Dinniman (Old Dominion University)
  Funded Amount: $579,391

- Solicitation: Topical Workshops, Symposia, and Conferences
  Title: *Accelerating discovery for NASA Cryosphere communities with open-cloud infrastructure*
  Period: 2/2023 – 1/2024
  PI: M. Siegfried
  Co-I: T. Snow (Mines)
  Funded Amount: $249,999

- Solicitation: NASA Unsolicited Proposals
  Title: *Accelerating ICESat-2 science with collaborative cloud-computing*
  Period: 10/2022 – 9/2024
  PI: M. Siegfried
  Co-I: T. Snow (Mines)
  Funded Amount: $362,875

- Solicitation: Decadal Survey Incubation
  Title: *Quantifying bias and uncertainty sources between laser and radar retrievals of surface topography over cryospheric targets*
  Period: 6/2022 – 6/2025
  PI: M. Siegfried
  Co-I: R. Michaelides (Washington U. St. Louis)
  Funded Amount: $590,726

- Solicitation: Cryospheric Science
  Title: *Seeds of Change: Investigating the Impact of Antarctic Basal Channel and Persistent Polynya Co-Evolution on Ice Shelf Stability*
  Period: 2/2022 – 1/2025
  PI: M. Siegfried
  Science PI: T. Snow (Mines)
  Co-Is: A.B. Villas Böas (Mines), T. Scambos (CU Boulder), K. Alley (U. Manitoba)

Collaborators: S. Adusumilli (UC San Diego), L. Boehme (U. St Andrews), F Pérez (UC Berkeley)
Funded Amount: $582,084

- Solicitation: Studies with ICESat-2
  Title: *Leveraging ICESat-2 altimetry for Antarctic subglacial lake identification, evolution, and basal properties*
  Period: 5/2021 – 4/2024
  PI: M. Siegfried
  Co-I: S. Grigsby (Mines)
  Funded Amount: $334,928

- Solicitation: Interdisciplinary Research in Earth Science
  Title: *Observationally constrained simulations of the evolution of polar snow using a multi-sensor approach*
  Period: 9/2020 – 8/2023
  PI: B. Medley (NASA Goddard)
  Lead Mines PI: M. Siegfried
  Co-Is: S. Grigsby (Mines), J. Lenaerts (U. Colorado Boulder), T. Overley (NASA Goddard), J. Ryan (U. Oregon), T. Sutterley (U. Washington)
  Funded Amount: $939,402 ($157,611 to Mines)

- Solicitation: Global Navigation Satellite System Research
  Title: *Constraining West Antarctic snow accumulation and firn densification processes with GNSS reflectometry*
  Period: 9/2020 – 8/2023
  PI: M. Siegfried
  Co-I: B. Medley (NASA Goddard)
  Funded Amount: $565,944 ($315,899 to Mines)

- Solicitation: Topical Workshops, Symposia, and Conferences
  Title: *WAIS Workshops 2020 and 2021: A transdisciplinary forum to accelerate NASA-funded research of marine-based ice sheet systems*
  Period: 9/2020 – 8/2023
  PI: M. Siegfried
  Funded Amount: $77,245

- Solicitation: Planetary Science and Technology from Analog Research (PSTAR)
  Title: *Pingo SubTerranean Aquifer Reconnaissance and Reconstruction (Pingo STARR)*
  Period: 7/2020 – 6/2024
  PI: B. Schmidt (Cornell University)
  Science PI: K. Hughson (University of Alaska Anchorage)
  Lead Mines PI: M. Siegfried
  Co-Is: H. J. Bradford (Mines), Sizemore (Planetary Science Institute), A. Swidinsky (U. Toronto)
  Funded Amount: $2,071,221 ($665,614 to Mines)

- Solicitation: NASA Unsolicited Proposals
  Title: *Long-term validation of ICESat-2 range measurements with ground, air, and satellite surveys of salar de Uyuni, Bolivia*
  Period: 6/2020 – 5/2022
  PI: M. Siegfried
  Co-Is: Shane Grigsby (Mines), Gabriel Walton (Mines), Mike Willis (U. Colorado, Boulder)
  Funded Amount: $199,917

- Solicitation: IceBridge Science Team

Title: *Quantifying the error distribution of Operation IceBridge swath altimetry to generate robust, long-duration time series of height-changes over dynamic features in Antarctica*
Period: 4/2017 – 3/2020
Science PI/Science Team Member: M. Siegfried (Institutional PI: H. Fricker)
Funded Amount: $334,080 ($116,724 to Mines for Y3)

National Science Foundation

- Program: Office of Polar Programs Postdoctoral Fellowship
  Period: 9/2023 – 8/2025
  Title: *OPP-PRF: Disentangling ice-sheet internal and basal processes through novel ice-penetrating radar integration built on scalable, cloud-based infrastructure*
  PI: B. Hills (postdoc; M. Siegfried, mentor)
  Funded Amount: $317,795

- Program: CAREER Program
  Period: 8/2022 – 8/2027
  Title: *CAREER: Teaching old data new tricks: Leveraging legacy field data to investigate ice-stre am shut down and inspire a new generation of cryospheric scientists*
  PI: M. Siegfried
  Funded Amount: $696,481

- Program: Office of Polar Programs - Antarctic Sciences
  Period: 8/2021 – 7/2024
  Title: *Collaborative Research: Investigating four decades of Ross Ice Shelf subsurface change with historical and modern radar sounding data*
  PI: Winnie Chu (Georgia Tech)
  Co-PIs: M. Siegfried (Mines), Dustin Schroeder (Stanford U.)
  Funded Amount: $871,490 ($317,470 to Mines)

- Program: Office of Polar Programs - Antarctic Antarctic Integrated System Science
  Period: 7/2019 – 6/2022
  Title: *WAIS Workshops 2019-2021: An annual transdisciplinary forum for studies of the West Antarctic Ice Sheet by the next generation of polar scientists*
  PI: M. Siegfried
  Funded Amount: $123,524

- Program: Office of Polar Programs - Antarctic Antarctic Integrated System Science (supplement to *Collaborative Research: Subglacial Antarctica Lake Scientific Access*)
  Period: 5/2018 – 5/2019
  Title: *Subglacial Lake Mercer temperature time series for quantifying lake dynamics*
  Science PI: M. Siegfried (Institutional PI: H. Fricker)
  Funded Amount: $39,917

- Program: Office of Polar Programs - Antarctic Glaciology
  Period: 12/2017 – 11/2020
  Title: *Mapping Antarctic subglacial water in three dimensions with novel electromagnetic techniques*
  Science PI: M. Siegfried (Institutional PI: H. Fricker)
  Co-PI: K. Key (Columbia U.)
  Funded Amount: $448,933

Stanford University Department of Geophysics

- Thompson Postdoctoral Fellowship, 2017 – 2019 $135,000

National Aeronautics and Space Administration

- Earth and Space Science Fellowship, 2011 – 2014 $90,000

MENTORING

Postdoctoral Scholars

Shane Grigsby, 2019–2021
(*now: Research & Development Scientist, National Geospatial Intelligence Agency*)
Roger Michaelides, 2020–2022
(*now: Asst. Professor, Washington University in St. Louis*)
Tasha Snow, 2021–present
Benjamin Hills, 2023–present

Graduate Students

Jared Klemm (PhD), Geophysics, 2020–2021
(*post Mines: Software Engineer II, Atmospheric and Environmental Research*)
Kayla Hubbard (MS-NT), Hydrologic Science & Engineering, 2020–2021
(post Mines: Science Assistant, Arctic Sciences Section, National Science Foundation)
Wilson Sauthoff (PhD), Hydrologic Science & Engineering, 2020–present
Elena Savidge (PhD), Geophysics, 2020–present
Hannah Verboncoeur (PhD), Geophysics, 2021–present
Bailey Mullett (MS), Hydrologic Science & Engineering, 2022–present
Gabriel Thomas (MS), Hydrologic Science & Engineering, 2022–present
co-advised with Kamini Singha
Kiara Burgos (PhD), Geophysics, 2023–present
Zachary Katz (PhD), Geophysics, 2023–present

Undergraduate Research

Matt Oleszko, Geophysics, 2019–2021
(post-Mines step: Radar Processing Engineer, The Aerospace Corporation)
Anna Valentine, Geophysics, 2020–2021
(post-Mines step: PhD student at Dartmouth College)
Becca Prentice, Geophysics, 2020–2022
(post-Mines step: M.S. student at Stanford University)
Stephanie Holzschuh, Applied Math and Statistics, 2020–2021
(*post-Mines step: Data Engineer at Chevron*)
Michael Field, Geophysics, 2021–2022
(*post-Mines step: PhD student at University of Florida)*
Cash Koning, Geophysics, 2020–2023
(*post-Mines step: Polar Engineer, Earthscope Consortium)*
Venezia Follingstad, Geophysics, 2021–2023
(*post-Mines step: PhD student at University of Oregon)*
Ashleigh Miller, Geophysics, 2022–2023
(*post-Mines step: PhD student at Georgia Tech)*
Duncan Byrne, Geophysics, 2023–present

Senior Design

Hannah Haugen, 2021 (*post-Mines: M.S. student at U. Arizona*)
Bailey Mullett, 2022 (*post-Mines: M.S. student at Colorado School of Mines*)
Venezia Follingstad, 2022 (*post-Mines: PhD student at U. Oregon*)
Cash Koning, 2022 (*post-Mines: Polar Engineer, Earthscope Cosortium*)

Visiting Students

Emma Pearce (PhD), University of Leeds, 2019
Joanna Millstein (PhD), MIT, 2021–present
Ellie Abrahams (PhD), University of California Berkeley, 2022
Eojin Lee (UG), Columbia University, 2022–present
Sawyer Kaarto (UG), Red Rocks Community College, 2022

Dissertation Committee Membership

Nicholas Dorogy (2023–present) Mines, Department of Geophysics
Ahmad Tourei (2023–present) Mines, Hydrologic Science & Engineering
Melody Zhang (2021–present) Mines, Department of Geology and Geological Engineering

Devon Dunmire (2020–2022) U. Colorado Boulder, Atmospheric & Ocean Sciences
Chloe Gustafson (2020) Columbia U., Lamont-Doherty Earth Observatory

Teaching Experience

Colorado School of Mines, Golden, CO

Instructor of Record

GPGN486: Geophysics Field Camp	*Summer 2024*
GPGN470/570: Applications of Remote Sensing	*Spring 2024*
CSCI303: Data Science	*Spring 2024*
GPGN486: Geophysics Field Camp	Summer 2023
GPGN470/570: Applications of Remote Sensing	Spring 2023
GPGN598b: Polar Cryosphere in the Earth System	Fall 2022
GPGN486: Geophysics Field Camp	Summer 2022
GPGN470/570: Applications of Remote Sensing	Spring 2022
GPGN599: Ice Dynamics at Whillans Ice Stream	Spring 2022
GPGN470/570: Applications of Remote Sensing	Spring 2021
GPGN101: Geophysics & Society	Spring 2021
GPGN599: Antarctic groundwater modeling	Spring 2021
GPGN470/570: Applications of Remote Sensing	Spring 2020
GPGN101: Geophysics & Society	Spring 2020
GPGN498A/C: Geophysical Remote Sensing	Spring 2019

Co-Instructor

GEGN584: Field Methods in Hydrology	*Fall 2023*
GEGN584: Field Methods in Hydrology	Fall 2022
GPGN498: Electrical & Electromagnetic Methods & Applications	Spring 2022
GPGN486: Geophysics Field Camp	Summer 2021
GPGN486: Geophysics Field Camp	Summer 2019
Cryospheric Science with ICESat-2 Hackweek 2019, U. Washington	July 2019

Scripps Institution of Oceanography, La Jolla, CA

Co-Instructor

SIO115: Ice and the Climate System	Winter 2017
GMT Workshop for geodynamics REU students	June 2016

Guest Lecturer

The basal rheology knob	
SIO209: Ice Sheet Seminar	3 Feb. 2017
Antarctic Estuary Dynamics	
SIO219: Estuarine and Coastal Processes	6 Jun. 2016
Ice Dynamics	
SIO115: Ice and the Climate System	25 Feb. 2015
Joint Workshop at the Vatican	
SIO209: Lectures in Sustainable Science	6 Jun. 2014

Teaching Assistant

Remote Sensing — Spring 2013
Instructors: Dr. David Sandwell, Dr. Helen Fricker

Dartmouth College, Hanover, NH

Teaching Assistant

Dartmouth College Field Program — Fall 2009
Glaciology, Quaternery Geology, Structure and Geologic Mapping
Instructors: Dr. Bob Hawley, Dr. Erich Osterberg, Dr. Meredith Kelly

Ecological Agriculture — Summer 2009
Instructors: Dr. Jill Mikucki, Dr. Sarah Smith
Glaciology — Spring 2009
Instructor: Dr. Robert Hawley
Polar Geobiology — Fall 2009
Instructor: Dr. Jill Mikucki
Introduction to Computer Science — Spring 2006
Instructor: Dr. Thomas Cormen

Laboratory Teaching Assistant
Mineralogy — Summer 2007
Instructor: Dr. Ed Meyer

Guest Lecturer
Data analysis and scientific writing
ENVS25: Ecological Agriculture — 25 Aug. 2009
Paleoclimate and ice ages
EARS70: Glaciology — 19 May 2009
Life through a Snowball
EARS86: Polar Geobiology — 9 Dec. 2008

Grader
Differential Equations — Winter 2008

Invited Talks

[title to be determined]
Caltech Division of Geological and Planetary Sciences Seminar — 4 Mar. 2024
Cryosphere@Mines
Finnish Ambassador Visit to Colorado School of Mines — 13 Jun. 2023
Subglacial Secrets: What drilling holes through the Antarctic ice sheet can teach us about the past, present, and future of ice
Osher Lifelong Learning Institute, University of Denver — 4 May 2023
Source to sink: Tracing freshwater beneath the Antarctic ice sheet
Colorado School of Mines Department of Geophysics Heiland Lecture — 7 Mar. 2023
Technology at the coast: Probing for ice-water-ocean-Earth processes
National Academies's Future Directions for Southern Ocean and Antarctic Nearshore and Coastal Research Community Workshop — 9 Feb. 2023
Glaciology at Mines
Colorado School of Mines Student Society of Geophysicists — 16 Sep. 2022
Glaciology at Mines
Tulane University Research Experiences for Undergraduates — 15 Jul. 2022
Twelve years of exploring subglacial Antarctica
Dartmouth College Journeys — 18 Jun. 2022
Process2Paleo: Connecting modern observations to the geologic record to explore the life and death of a subglacial lake
Scripps Polar Hour — 28 Oct. 2021
Slippery when wet: Exploring the hydrosphere beneath the Antarctic ice sheet
Colorado State Antarctic Lecture Series — 19 Oct. 2021
Glaciology data volumes and data rates in Antarctica
2021 Antarctic Subsea Cable Workshop — 28 Jun. 2021
What lies beneath: Exploring the hydrosphere beneath the Antarctic ice sheet
Delaware County Institute of Science — 8 Feb. 2021
(Seminar on SALSA subglacial lake results)
British Antarctic Survey — Jun. 2020
[seminar canceled due to COVID19]

(Seminar on ICESat-2 results)
Newcastle University Jun. 2020
[fellowship delayed to COVID19; seminar canceled]
(Seminar declined due to COVID)
Stanford Geophysics Seminar 4 Jun. 2020
Antarctica at Depth: New observations of subglacial water beneath ice streams
CU Boulder INSTAAR Noon Seminar 16 Mar. 2020
[canceled due to COVID19]
U.S. work int he Ross Sea Sector
International Ross Sea Region Collaboration Workshop, Korea 21 Jul. 2019
Antarctica at Depth: Drilling for Subglacial Access
U.S. Ice Drilling Program's School of Ice 24 June 2019
SALSA – A Field Debrief
Stanford University Cryospheric Scientists 12 Feb. 2019
Slippery When Wet: Dynamic subglacial hydrology and the Antarctic ice sheet
Department of Geosciences Research Seminar, Boise State University 26 Apr. 2018
Building a "Long Data" perspective to examine decadal-scale variability in Antarctica
Geophysics Seminar, Colorado School of Mines 4 Apr. 2018
Deep, Dark, and Wet: Dynamic subglacial hydrology in Antarctica
Earth & Planetary Science Seminar, Washington University in St. Louis 1 Feb. 2018
Piecing together a "Long Data" perspective to examine Antarctic ice-sheet variability
Earth and Climate Seminar, University of Maine 25 Oct. 2017
Piecing together a "Long Data" perspective in Antarctica to understand ice-sheet variability
SIO Research Seminar, Scripps Institution of Oceanography 31 Aug. 2017
Subglacial hydrology, basal processes, and velocity transients in Antarctica
Ice Sheet System Model Workshop 23 Jun. 2016
Antarctic subglacial hydrology: A review
IDPO Subglacial Access Working Group Workshop 21 May 2016
Episodic hydrology, episodic ice streams: Unraveling the impact of active subglacial lakes in Antarctica
Earth Section Seminar, University of California, Santa Cruz 10 May 2016
Unraveling the impact of dynamic subglacial lake drainage in Antarctic
Geophysics Seminar, Scripps Institution of Oceanography 22 Apr. 2016
Planes, penguins, and cookies: Scientific outreach from Antarctica
GPS and the Cyrosphere, 2016 UNAVCO Science Workshop 29 Mar. 2016
Dynamic subglacial hydrology in Antarctica: timescales, evolution, and impacts
Geophysics Seminar, Stanford University 1 Mar. 2016
Extending the episodic hydrology record across Antarctica
West Antarctic Ice Sheet Workshop 19 Sep. 2015
Peering under the ice to the Antarctic Slip 'n' Slide
UCSD Extension: Environmental Leadership & Sustainability 06 Jul. 2015
Investigating coupled subglacial hydrologic and ice dynamic evolution using ground- and satellite-based observations
Center for Climate Sciences Research Seminar, NASA-JPL 19 Jun. 2015
Using CryoSat-2 to retrieve dynamic surface changes (& observations of stick-slip motion)
IGPP Geodesy Seminar, Scripps Institution of Oceanography 22 Apr. 2015
A decade of progress observing and modeling Antarctic subglacial water systems
Subglacial Antarctic lake exploration: first results and future plans, The Royal Society
[H. Fricker invited; M.R.S. presented] 30 Mar. 2015
Understanding the Antarctic Slip 'n' Slide
Scripps Donor Brunch, Scripps Institution of Oceanography 1 Mar. 2015
Highlights and reflections on The Workshop and beyond
CMBC Brown Bag, Scripps Institution of Oceanography 3 Jun. 2014

Instability of the Amundsen Sea Embayment
Climate Journal Club, Scripps Institution of Oceanography 22 May 2014
WISSARD: Progress, Pictures, and Prospects
Scripps Polar Seminar, Scripps Institution of Oceanography 4 Jun. 2013
GLAS accuracy and elevation change at Summit, Greenland
Geolunch Brown Bag Series, Dartmouth College 11 May 2010

Professional Service

Committee Service

- Ice Drilling Program Science Advisory Board, Member, 2023–pesent
- NASA ICESat-2 Mission, Science Team, Member, 2021–present
- IRIS/UNAVCO, Polar Networks Science Committee, Co-Chair, 2021–present
- IRIS/UNAVCO, Polar Networks Science Committee, Member, 2018–2020
- NASA IceBridge Mission, Science Team, Member, 2017–2020
- American Meteorological Society Committee on Polar Meteorology and Oceanography, Member, Jan. 2017–2020
- OpenAltimetry User Working Group, Member, Jun. 2017–present
- NASA ICESat-2 Science Definition Team, Participant, 2011–2020

Editorial Service

- Scientific Editor, *Journal of Glaciology*, 2019–present
- Section Editor for Cryosphere, *Encyclopedia of Ocean Sciences, 3rd Ed.*

Referee Service

- Journals: *Nature, Nature Geoscience, Nature Communications, Geophysical Research Letters, Journal of Glaciology, Annals of Glaciology, The Cryosphere, IEEE Transactions on Geoscience and Remote Sensing, IEEE Geoscience and Remote Sensing Letters, Remote Sensing of Environment, International Journal of Remote Sensing, Journal of Applied Remote Sensing*
- Proposals: *NASA Earth Science (panel member, ad hoc), NASA Earth Science Data Systems (panel member), NASA Planetary Science (panel member), NASA Science Mission Directorate (panel member), NSF Antarctic Sciences (ad hoc), Royal Society of New Zealand (ad hoc), UK Natural Environment Research Council (ad hoc), Netherlands Space Office (ad hoc)*

Conference Service

- Organizing Committee: *West Antarctic Ice Sheet Workshop*, 2019–present.
- Local Organizing Committee: *International Symposium on Five Decades of Radioglaciology* (International Glaciological Society, Stanford, CA, 24–28 Jun. 2019); *International Symposium on Interactions of Ice Sheet and Glaciers with the Ocean* (IGS/FRISP, La Jolla, CA, 10–15 Jul. 2016); *Ice Sheet System Model Workshop* (JPL/ NASA, La Jolla, CA, May 2016), *Scripps Student Symposium* (SIO, La Jolla, CA, 24 Sep. 2015); *ICESat-2 Science Definition Team Meeting* (NASA, La Jolla, CA, 24–25 Feb. 2015); *Sea Level Change Team PI Meeting* (NASA, La Jolla, CA, 14–16 Oct. 2014), *West Antarctic Ice Sheet Workshop* (NSF/NASA, Julian, CA, 24–27 Sep. 2014); *International Symposium on Interactions of Ice Sheet and Glaciers with the Ocean* (IGS/FRISP, La Jolla, CA 5–10 Jun. 2011)
- Session Chair: *Archives and Observations From Sub-Ice Environments* (AGU Fall Meeting 2021, 2022, 2023); *Sub-Ice-Sheet and Sub-Ice-Shelf Environments: Bridging the Gap Between Modern Observations and Geologic Records* (AGU Fall Meeting 2019, 2020); *Cryosphere/Sea-Level* (2018 UNAVCO Science Workshop); *Advances in understanding processes at the beds of glaciers and ice sheets* (AGU Fall Meeting 2015, 2016, 2017); *IgniteIGS—Early career perspectives on the future of ice-ocean research* (IGS La Jolla 2016); *Greenland Run-off* (IGS La Jolla 2016)
- Judging: *Flash Freeze Cryosphere Innovation Award for Students* (AGU Fall Meeting 2017); *Outstanding Student Presentation Award* (AGU Fall Meeting 2017)

White Papers

- *CryoCloud: Accelerating Discovery for NASA Cryosphere Communities with Open-Cloud Infrastructure*, submitted to NASA NNH23ZDA005L: Request for Information: Scientific Data and Computing Architecture to Support Open Science, 2023. [available here]
- *2021 Antarctic Subsea Cable Workshop Report: High-Speed Connectivity Needs to Advance US Antarctic Science*, submitted to National Science Foundation Office of Polar Programs, 2021.
- *Dive, Dive, Dive: Accessing the Subsurface of Ocean Worlds*, submitted to the NASA Planetary Science Decadal Survey, 2020.
- *Early Career Community Vision For Future Magnetotelluric Facility*, submitted to the National Science Foundation in preparation for a competition for a future unified geophysical facility, 2020.
- *An Early Career Investigator Community Vision for the Future NSF Geophysical Facility: Instrumentation Services Needs*, submitted to the National Science Foundation in preparation for a competition for a future unified geophysical facility, 2020.
- *Assessment of East Antarctic Ice Sheet sensitivity to warming and its potential for contributions to sea level rise*, submitted to U.S. Ice Drilling Program Subglacial Access Working Group, 2019.
- *Access Drilling Priorities in the Ross Ice Shelf Region*, submitted to U.S. Ice Drilling Program Subglacial Access Working Group, 2019.
- *How much, how fast? A decadal science plan quantifying the rate of change of the West Antarctic Ice Sheet now and in the future*, submitted to NSF Office of Polar Programs, 2016.

Outreach

- Research highlighted in press released from multiple institutions, including the National Science Foundation, Colorado School of Mines.
- Research highlighted in press releases from multiple institutions, including the National Science Foundation, University of Colorado, Boulder, and Scripps Institution of Oceanography.
- Quoted in "Scientists Just Melted a Hole Through 3,500 Feet of Ice to Reach a Mysterious Antarctic Lake" (Earther, 31 Dec. 2018)
- Featured in "The Machines That Spy on Antarctica's Hidden Lakes" (Earther, 19 Dec. 2018)
- Measuring the Earth with Space Lasers: ICESat-2, NASA's newest mission, Clarence Ruth Elementary School, Lompoc, CA (13 Sept. 2018)
- Developed exhibit "Understanding Ice: Antarctica in 360" for Stanford Library's Earth Day 2018 symposium (24 Apr. 2018)
- Worked with U.S. Senator Lisa Murkowski's DC staff to highlight Operation IceBridge's work in her home state of Alaska (Facebook, 17 Mar. 2017)
- Featured in "Science fest at South Pole: Scripps Institution of Oceanography participating in eight studies, leading seven, in Antarctica this winter" (San Diego Union Tribune, Page B1, 16 Oct. 2016)
- Featured in "What Are You Doing This (Austral) Summer?" (UC San Diego News, 6 Oct. 2016)
- Invited panelist for "A Deep Dive in Ocean and Climate Science", hosted by U.S. Department of State at the COP21 Summit, Paris, France; available on YouTube (9 Dec. 2015)
- Live Q&A on nature.com: "Life on the ice" (13 Nov. 2015)
- Fieldwork weblog: "Antarctic Journal" (*Nature News*, Oct.–Dec. 2015)
- Participated in briefing for Congressman Scott Peters (CA-52) on current climate change research (18 Feb. 2015)
- Featured in "Scripps Grad Students Attend Sustainability Conference at the Vatican" (*explorations now*, 3 Jul. 2014)
- Radio interview: "Maybe Next Year? Antarctic Research Suspended Under Government Shutdown" (KPBS News, 10 Oct. 2013)
- TV interview: "Government Shutdown's Impact on San Diegans" (NBC7 San Diego Evening

News, 1 Oct. 2013)
- Ocean Beach Elementary, 3rd and 4th Grade, 7 Jun. 2013
- Featured in "At the Ends of the Earth" (*Triton Magazine*, May 2013)
- Featured in "Drilling into the Unknown" (*explorations now*, 11 Jan. 2013)
- Ocean Beach Elementary, 3rd and 4th Grade, 26 Mar. 2012

University Service

Colorado School of Mines

Mines Geophysics Undergraduate Advisory Committee, 2022–present
Mines Geophysics Field Camp Director, 2021–present
Mines Geophysics ReImagine Committee, 2021–present
Mines Geophysics Safety Committee, 2021–present
Geophysics GP100@100 Fundraising , 2021–present
Geophysics Diversity, Inclusion, & Access Committee, committee chair, 2019–present
Mines Diversity Council, 2019–present
Mines Field Session Compensation Task Force, 2022
Geophysics Graduate Advisory Committee, member, 2019–2022
Faculty Search Committee: Computational Science & Data Analytics Cluster, 2020–21
Applied Data Science & Machine Learning, subcommittee chair
Computation Hydrology, subcommittee member
#idigmines, department representative, 2019–2020
Faculty Search Committee: Geophysical Data Science, 2019–2020

Stanford University

Postdoctoral Scholar Committee for School of Earth Strategic Plan, member, 2017

Scripps Institution of Oceanography

Leadership Committee for Peer Mentor Program, founding student member, 2014–2016
Scripps Polar Seminar, lead organizer, 2013–2016
Scripps Earth Section Seminar, co-organizer 2012–2013

Dartmouth College

Faculty Search Committee: Geomorphology, student representative, 2008
Faculty Search Committee: Remote Sensing student representative, 2007

Significant Field Experience

Pingo Canadian Landmark, Surface Geophysics — 2023
Mines Lead

Alaskan North Slope, Surface Geophysics — 2021
Mines Lead

Whillans Ice Plain, West Antarctica, Surface Geophysics — 2019–2020
Expedition Lead, Field Medic

Greenland, Airborne Geophysics (Operation IceBridge) — 2019
Mission Science Team member visit

Whillans Ice Plain, West Antarctica, Surface Geophysics — 2018–2019
Expedition Lead, Field Medic

Whillans Ice Plain, West Antarctica, Surface Geophysics — 2017–2018
Expedition Lead, Field Medic

Whillans Ice Plain, West Antarctica, Surface Geophysics — 2016–2017
Expedition Lead, Field Medic

Ross Ice Shelf, Antarctica, Airborne Geophysics — 2015
Flight Scientist, Data Engineer

Whillans Ice Plain, West Antarctica, Surface Geophysics — 2014–2015
Expedition Lead, Field Medic

Whillans Ice Plain, West Antarctica, Surface Geophysics — 2013–2014
GPS Team Leader, Field Medic

Whillans Ice Plain, West Antarctica, Surface Geophysics 2012–2013
Surface Geophysics Team Leader, Field Medic
Whillans Ice Plain, West Antarctica, Surface Geophysics 2011–2012
Northern New Mexico, Southern Colorado, Geology and Geomorphology 2010
Field Trip Organizer and Leader
Cherryfield, Maine, Fluvial Geomorphology & Riparian Habitat Surveying 2009
Banff National Park, Alberta, Canada, Glaciology 2008
Montana, Idaho, Eastern Washington, Geology 2008
Ischia Island, Italy, in situ Geochemical Analysis 2008
Puerto Rico, Soil and Water Sampling 2007
Western United States, Dartmouth Earth Sciences Field Camp 2006
Hawaii, Volcanology and Remote Sensing 2006

Honors and Awards

Colorado School of Mines
Mines Research Council's Excellence in Research Award (Junior Faculty), 2022–2023
Mines Earth & Society Programs Outstanding Assistant Professor Award, 2022–2023
University Public Policy Fellow, inaugural cohort, 2022–2023
Outstanding Mines Faculty Award, 2021–2022
Department of Geophysics T.K. Young Geophysics Leadership Award, 2021
National Science Foundation
NSF CAREER Award recipient, 2022
Mentor for NSF Graduate Research Fellowship Program recipient (H. Verboncoeur), 2022
National Aeronautics and Space Administration
Robert H. Goddard Award as part of the Operation IceBridge Science Team, 2020
Group Achievement Award as part of the ICESat-2 Mission Science Team, 2020
National Sciences and Engineering Research Council of Canada
Mentor for NSERC Graduate Scholarship–Doctoral Recipient (E. Savidge), 2021
American Geophysical Union
Editors' Citation for Excellence in Refereeing, Geophysical Research Letters, 2019
West Antarctic Ice Sheet Workshop
Mentor for Best Student Presentation recipient (H. Verboncoeur), 2021
Best Student Presentation recipient, 2013
Scripps Institution of Oceanography
Student Video Challenge award winner, 2014
Director's Cabinet Quarterly Meeting invited presenter, May 2014
Pontifical Academy of Sciences/Pontifical Academy of Social Sciences
Sustainable Humanity, Sustainable Nature: Our Responsibility
Joint Workshop invited observer, May 2014
United States Congress
Antarctic Service Medal recipient, 2012
Dartmouth College
NASA Space Grant Graduate Student Award, 2010
Aisstant Curator for Dana Collection of Minerals, 2007-2008

Professional Memberships

American Geophysical Union, 2008–present
International Glaciological Society, 2010–present
Society for Advancement of Chicanos/Hispanics and Native Americans in Science 2019–present
Institute of Electrical and Electronics Engineers, 2020–present
American Meteorological Society, 2017–2019
Sigma Xi, 2023–present (nominated)

Conference Abstracts

* *indicates student or postdoctoral advisee*
† *indicates M.R.S. presenting author*
‡ *indicates contributed equally as co-first author*

[199] Schroeder, D. M. and **M. R. Siegfried**, 2023. Enabling Subglacial Geodesy Through High-Precision Radar Sounding and GNSS Time Series Observations, *AGU Fall Meeting*.

[198] Schroeder, D. M. and **M. R. Siegfried**, 2023. Enabling Subglacial Geodesy Through High-Precision Radar Sounding and GNSS Time Series Observations, *Scientific Committee on Antarctic Research INStabilities & Thresholds in ANTarctic (INSTANT) Conference 2023*.

[197] **Siegfried, M. R.**, M. Dinniman and W. Sauthoff*, 2023. Tracing Antarctic freshwater from the grounding zone to the ice front in the Ross Embayment, *Scientific Committee on Antarctic Research INStabilities & Thresholds in ANTarctic (INSTANT) Conference 2023*.

[196] **Siegfried, M. R.**, M. Dinniman and W. Sauthoff*, 2023. Tracing Antarctic freshwater from the grounding zone to the ice front in the Ross Embayment, *Southern Ocean Observing System Symposium 2023: Southern Ocean in a Changing World*.

[195] Rosenheim, B., R. Venturelli, C. Davis, A. Michaud, B. Boehman, B. Christner, V. Galy, D. Harwood, A. Leventer, W. Li, Z. Liu, T. Vick-Majors, **M. R. Siegfried**, J. Priscu and the SALSA Science Team, 2023. Millennial scale marine incursion into an isolated environment fuels a contemporary subglacial microbial community beneath the West Antarctic Ice Sheet, *Geochemical Society Goldschmidt Conference*.

[194] *Sauthoff, W., **M. R. Siegfried** and B. E. Smith, 2023. Surface-deformation delineation algorithm reveals subglacial lake candidates and underestimates of subglacial volume fluxes, *International Glaciology Society Symposium on the Edges of Glaciology*.

[193] **Siegfried†, M. R.**, R. A. Venturelli†, M. O. Patterson, W. Arnuk, T. D. Campbell, C. D. Gustafson, A. B. Michaud, B. K. Galton-Fenzi, M. B. Hausner, S. N. Holzschuh*, B. Huber, K. D. Mankoff, D. M. Schroeder, P. Summers, S. Tyler, S. P. Carter, H. A. Fricker, D. M. Harwood, A. Leventer, B. E. Rosenheim, M. L. Skidmore, J. C. Priscu and the SALSA Science Team, 2023. The life and death of a subglacial lake in West Antarctica, *International Glaciology Society Symposium on the Edges of Glaciology*.

[192] *Verboncoeur, H., **M. R. Siegfried**, J. P. Winberry, N. Holschuh and W. Sauthoff*, 2023. Multidecadal signals of dynamic thickness change in the Crary Ice Rise region driven by century scale reorganization of the Siple Coast ice Streams, *2nd Annual Colorado Glaciology Workshop*.

[191] *Snow, T., J. Millstein*, W. Sauthoff*, J. Colliander, C. Holdgraf, F. Pérez and **M. R. Siegfried**, 2023. Accelerating Discovery for NASA Cryosphere Communities with JupyterHub, *JupyterCon*.

[190] *Snow, T., J. Millstein*, W. Sauthoff*, J. Colliander, C. Holdgraf, F. Pérez and **M. R. Siegfried**, 2023. Accelerating Discovery for NASA Cryosphere Communities with OpenCloud Infrastructure, *American Meteorological Society Annual Meeting*.

2022

[189] *Abrahams, E., T. Snow*, E. Lee*, W. Zheng, M. Field*, E. Savidge*, F. Sapienza, S. Grigsby*, J. Taylor, **M. R. Siegfried**, and F. Pérez, 2022. Automated Detection of West Antarctic Persistent Polynyas with Multiband Remote Sensing Imagery, *AGU Fall Meeting*.

[188] Bryant, M., E. J. Anderson, A. A. Borsa, C. C. Masteller, R. J. Michaelides*, **M. R. Siegfried** and A. Young, 2022. Integrating ICESat-2 altimetry, optical imagery, and digital elevation models to measure erosion rates and coastal morphology along the Alaskan Beaufort Sea Coast, *AGU Fall Meeting*.

[187] *Field, M., T. Snow*, E. Abrahams*, E. Lee*, C. Baumhoer and **M. R. Siegfried**, 2022. Mapping Ice Shelf Calving Fronts at Thwaites Glacier using Deep Learning and Satellite Imagery in a Cloud-Based Workflow, *AGU Fall Meeting*.

[186] Medley, B., T. C. Sutterley, M. E. Dattler, J. Lenaerts, T. B. Overly, J. Ryan, **M. R. Siegfried**, C. M. Stevens, M. Thompson-Munson and N. Wever, 2022. Constraining surface mass balance, firn air content, ICESat-2 volume change, and GRACE/-FO mass change to improve ice-sheet mass balance estimates, *AGU Fall Meeting*.

[185] Roth, D. L., G. Jin, M. Bezada, A. Titov, C. C. Masteller, B. Tate and **M. R. Siegfried**, 2022. The Sound of Water: Spatially Continuous River Monitoring Through Distributed (Hydro)Acoustic Sensing, *AGU Fall Meeting*.

[184] *Sauthoff, W., **M. R. Siegfried** and B. E. Smith, 2022. CryoSat-2/ICESat-2 integrated time series and comparison of shoreline evolution in Antarctic active subglacial lakes, *AGU Fall Meeting*.

[183] *Savidge, E., T. Snow*, **M. R. Siegfried**, Y. Zheng, B. Villas Bôas, G. Bortolotto, L. Boehme and K. E. Alley, 2022. Wintertime Polynya Structure and Variability at Pine Island Glacier, West Antarctica, from Thermal Remote Sensing and Seal-borne Observations, *AGU Fall Meeting*.

[182] Stubblefield, A. G., W. Sauthoff*, **M. R. Siegfried**, M. W. Spiegelman and C. Meyer, 2022. Reconstructing subglacial lake activity with physics-based altimetry inversions, *AGU Fall Meeting*.

[181] *Snow, T., A. Wåhlin, B. Queste, G. Bortolotto, L. Boehme, E. Savidge*, E. Abrahams, **M. R. Siegfried** and W. Abdalati, 2022. Pairing eyes in the sky with instruments in the deep: mapping the Antarctic Coastal Current in the Amundsen Sea, *AGU Fall Meeting*.

[180] Tarzona, A., W. Chu, H. Verboncoeur*, **M. R. Siegfried**, D. M. Schroeder, L. Combs, A. Prabu, A. Altaweel and K. Tran, 2022. Geographical Repositioning Efforts and Vertical Calibration of Z-scopes from SPRI-NSF-TUD surveys at Ross Ice Shelf, Antarctica, *AGU Fall Meeting*.

[179] Venturelli, R., B. Boehman, C. Davis, J. Hawkings, S. E. Johnston, C. Gustafson, A. B. Michaud, C. Mosbeux, **M. R. Siegfried**, T. Vick-Majors, V. Galy, R. G. Spencer, S. Warny, B. Christner, J. E. Dore, H. A. Fricker, D. M. Harwood, A. Leventer, J. C. Priscu, M. L. Skidmore, B. E. Rosenheim and the SALSA Science Team, 2022. Constraints on the Timing and Extent of Deglacial Grounding Line Retreat in West Antarctica from Subglacial Sediments, *AGU Fall Meeting*.

[178] *Verboncoeur, H., **M. R. Siegfried**, P. Winberry, N. Holschuh, A. Tarzona, W. Chu and D. Schroeder, 2022. Leveraging Multidecadal Remote Sensing Data to Evaluate Interactions Between Century-Scale Ice-Dynamics and the Local Evolution of Crary Ice Rise, *AGU Fall Meeting*.

[177] Zheng, W., F. Pérez, C. Holdgraf, E. Sundell, **M. R. Siegfried**, T. Snow*, S. Grigsby, F. Sapienza, J. Taylor and the Executable Books Community, 2022. Jupyter Book-based Supplemental Material: a FAIR Practice to Connect Research Articles with Scientific Data, *AGU Fall Meeting*.

[176] Zheng, W., F. Sapienza, **M. R. Siegfried**, S. Grigsby, T. Snow*, F. Pérez and J. Taylor, 2022. Mapping dynamic mass loss by fully decomposing glacier elevation change, *AGU Fall Meeting*.

[175] Millstein, J., T. Snow*, W. Sauthoff*, J. Colliander, C. Holdgraf, F. Pérez, T. Sutterley and **M. R. Siegfried**, 2022. Accelerating Discovery for NASA Cryosphere Communities with Open-Cloud Infrastructure, *ICESat-2 Open Science Conference*.

[174] *Sauthoff, W., **M. R. Siegfried** and B. E. Smith, 2022. ICESat-2-extended time series of subglacial volume fluxes using time-variable shorelines of Antarctic active subglacial lakes, *ICESat-2 Open Science Conference*.

[173] **Siegfried†, M. R.**, R. A. Venturelli†, M. O. Patterson, W. Arnuk, T. D. Campbell, C. D. Gustafson, A. B. Michaud, B. K. Galton-Fenzi, M. B. Hausner, S. N. Holzschuh*, B. Huber, K. D. Mankoff, D. M. Schroeder, P. Summers, S. Tyler, S. P. Carter, H. A. Fricker, D. M. Harwood, A. Leventer, B. E. Rosenheim, M. L. Skidmore, J. C. Priscu and the SALSA Science Team, 2022. The life and death of a subglacial lake in West Antarctica, *ICESat-2 Open Science Conference*.

[172] *Snow, T., W. Sauthoff*, M. Zhao, L. Bachelot, A.-S. Zinck and **M. R. Siegfried**, 2022. A tale at the coastline: paired year-round ICESat-2 and Landsat thermal infrared observations of persistent polynyas, *ICESat-2 Open Science Conference*.

[171] Hughson, K. H., B. E. Schmidt, E. Quartini, R. Michaelides*, **M. R. Siegfried**, A. Mullen, J. H. Bradford, J. Scully, A. Swidinsky and H. G. Sizemore, 2022. Terrestrial Pingos as morphometric and geophysical analogs for small hills on Ceres, *GSA Connects Annual Meeting*.

[170] *Sauthoff, W., **M. R. Siegfried** and B. E. Smith, 2022. Variable shorelines of Antarctic active subglacial lakes reveal large underestimates of subglacial volume fluxes, *GSA Connects Annual Meeting*.

[169] Robel, A., C. Meyer, J. Sim, **M. R. Siegfried** and C. Gustafson, 2022. Potentially Significant Water Exfiltration from Subglacial Till Driven by Contemporary Ice Sheet Thinning, *West Antarctic Ice Sheet Workshop*.

[168] *Snow, T., A. Wåhlin, B. Queste, G. Bortolotto, L. Boehme, E. Savidge*, E. Abrahams, **M. R. Siegfried** and W. Abdalati, 2022. Pairing eyes in the sky with instruments in the deep: mapping the Antarctic Coastal Current in the eastern Amundsen Sea, *West Antarctic Ice Sheet Workshop*.

[167] Tarzona, A., W. Chu, H. Verboncoeur*, **M. R. Siegfried**, D. Schroeder, L. Combs, A. Altaweel, A. Prabu and K. Tran, 2022. Archival airborne radio-echo sounding data geographical repositioning and calibration progress at Ross Ice Shelf, Antarctica, *West Antarctic Ice Sheet Workshop*.

[166] *Verboncoeur, H., **M. R. Siegfried**, P. Winberry, N. Holschuh, A. Tarzona, W. Chu and D. Schroeder, 2022. Multidecadal surface elevation anomalies of the Crary Ice Rise region from combined ICESat, CryoSat-2, and ICESat-2 altimetry, *West Antarctic Ice Sheet Workshop*.

[165] Zheng, W., F. Pérez, E. Abrahams, S. Grigsby*, F. Sapienza, **M. R. Siegfried**, T. Snow* and J. Taylor, 2022. Recent thinning and speed-up may make the upper Pine Island Glacier more prone to diffusive thinning, *West Antarctic Ice Sheet Workshop*.

[164] *Savidge, E., T. Snow*, **M. R. Siegfried**, Y. Zheng, A. B. V. Bôas, G. A. Bortolotto, L. Boehme and K. E. Alley, 2022. Linking thermal remote sensing and seal-borne measurements to investigate wintertime polynya structure and variability at Pine Island Glacier, West Antarctica, *International Symposium on Ice, Snow and Water in a Warming World*.

[163] *Snow, T., A. Wåhlin, B. Queste, G. Bortolotto, L. Boehme, E. Savidge*, E. Abrahams, **M. R. Siegfried** and W. Abdalati, 2022. Persistent polynya variability infers basal channel outflow at the Eastern Thwaites Ice Shelf, *International Symposium on Ice, Snow and Water in a Warming World*.

[162] *Snow, T., M. Field*, E. Abrahams, F. Sapienza, W. Zheng, E. Savidge*, F. P. J. Taylor, W. Abdalati, T. Scambos and **M. R. Siegfried**, 2022. Single channel and split-window SSTs from Landsat in Antarctica, *GHRSST23 International Science Team Meeting*.

[161] Bradford, J. H., **M. R. Siegfried**, R. Michaelides*, B. Schmidt, K. Hughson, H. Sizemore and A. Swidinsky, 2022. Detailed mapping of the internal structure of Arctic pingos using ground-penetrating radar, *19th International Conference on Ground Penetrating Radar*.

[160] *Hubbard, K. A., **M. R. Siegfried**, W. Sauthoff* and B. Dugan, 2022. Integrating visual imagery and modeling to assess groundwater connectivity in Antarctica's Taylor Valley,

AGU Frontiers in Hydrology Meeting.

[159] *Sauthoff, W., **M. R. Siegfried** and B. E. Smith, 2022. Antarctic subglacial lake shoreline migration and variability in response to fill-drain cycles, *AGU Frontiers in Hydrology Meeting*.

[158] **Siegfried†, M. R.**, R. A. Venturelli†, M. O. Patterson, W. Arnuk, T. Campbell, C. D. Gustafson, A. Michaud, B. Galton-Fenzi, M. B. Hausner, S. N. Holzschuh*, B. Huber, K. Mankoff, D. M. Schroeder, P. Summers, S. Tyler, S. P. Carter, H. A. Fricker, D. Harwood, A. Leventer, B. E. Rosenheim, M. Skidmore, J. C. Priscu and the SALSA Science Team, 2022. The Life and Death of a Subglacial Lake in West Antarctica: A Process-to-Paleo Perspective, *AGU Frontiers in Hydrology Meeting*.

[157] Roth, D., M. Zhang, V. Sahakian, J. Marshall, G. Jin, A. Titov, **M. R. Siegfried**, C. Masteller and H. Jacobson, 2022. Bridging the data gap: seismo-acoustic advances from ridgelines to rivers, *European Geosciences Union General Assembly*.

[156] Vick-Majors, T. J., C. L. Davis, B. C. Christner, W. Li, J. E. Dore, M. Tranter, J. Barker, **M. R. Siegfried**, M. L. Skidmore, , J. C. Priscu and the SALSA Science Team, 2022. Physiochemical drivers of microbial ecosystems in Antarctic subglacial aquatic environments, *Joint Aquatic Science Meeting*.

[155] Bradford, J. H., **M. R. Siegfried**, R. Michaelides*, B. Schmidt, K. Hughson, H. Sizemore and A. Swidinsky, 2022. Detailed mapping of the internal structure of Arctic pingos using ground-penetrating radar, *Polar Radar Science and Technology Conference*.

[154] Pérez, F., E. Sundell, Y. Panda, E. Abrahams, A. Azari, S. Grigsby, C. Holdgraf, F. Sapienza, **M. R. Siegfried**, T. Snow*, J. Taylor and W. Zheng, 2022. Keeping your head in the clouds: reproducible, collaborative science with open cloud infrastructure, *EarthCube Annual Meeting*.

[153] Zheng, W., C. Holdgraf, F. Pérez, E. Sundell, **M. R. Siegfried**, T. Snow*, S. Grigsby, F. Sapienza, J. Taylor and the Executable Books Community, 2022. Let supplemental material be FAIR: using narrative and reusable Jupyter Book to complement your journal paper, *EarthCube Annual Meeting*.

2021

[152] **Siegfried‡, M. R.**, R. A. Venturelli‡, M. O. Patterson, W. Arnuk, T. Campbell, C. D. Gustafson, A. B. Michaud, B. K. Galton-Fenzi, M. B. Hausner, S. N. Holzschuh*, B. Huber, K. Mankoff, D. M. Schroeder, P. Summers, S. Tyler, S. P. Carter, H. A. Fricker, D. Harwood, A. Leventer, B. E. Rosenheim, M. Skidmore, J. C. Priscu and the SALSA Science Team, 2021. The life and death of a subglacial lake in West Antarctica, *AGU Fall Meeting*.

[151] *Michaelides, R. J., **M. R. Siegfried**, J. Lovekin, K. Berry, B. Dugan and D. L. Roth, 2021. Discrimination of Active and Inactive Burn Areas in the 2020 Cameron Peak Fire from Interferometric Synthetic Aperture Radar (InSAR) Time Series, *AGU Fall Meeting*.

[150] *Savidge, E., T. M. Snow*, **M. R. Siegfried**, L. Boehme, G. Bortolotto and K. E. Alley, 2021. Investigating Persistent Polynya Structure and Variability at Pine Island Glacier, West Antarctica, Using Seal-borne Measurements and Thermal Remote Sensing, *AGU Fall Meeting*.

[149] *Snow, T., F. Sapienza, S. Grigsby*, J. Taylor, E. Savidge*, W. Zheng, K. E. Alley, F. Perez and **M. R. Siegfried**, 2021. Basal channel outflow inferred from persistent polynya variability at the Eastern Thwaites Ice Shelf, *AGU Fall Meeting*.

[148] Bienert, N. L., D. M. Schroeder, R. Sanda, E. Dawson, E. MacKie, S. T. Peters and **M. R. Siegfried**, 2021. Passively Synchronized Bistatic Radar System for Subsurface Tomography of Glaciers, *AGU Fall Meeting*.

[147] Bryant, M., A. A. Borsa, R. J. Michaelides* and **M. R. Siegfried**, 2021. Exploring coupled surface hydrology and freeze-thaw dynamics around Toolik Lake, Alaska, using ICESat-2 and InSAR data, *AGU Fall Meeting*.

[146] Gardner, A. S., S. Adusumilli, P. A. Arndt, K. Brunt, B. M. Csatho, D. Felikson, F. Paolo, H. A. Fricker, C. A. Greene, S. Kacimi, N. T. Kurtz, R. Kwok, B. Medley, T. Neumann, J. Nilsson, A. Petty, D. E. Shean, **M. R. Siegfried** and B. Smith, 2021. Surface Topography Observations Needed to Advance Cryosphere Science in the Coming Decades, *AGU Fall Meeting*.

[145] Grigsby, S., F. Sapienza, W. Zheng, J. Taylor, T. Snow*, E. Savidge*, F. Perez and **M. R. Siegfried**, 2021. Mission in a minute: Complex Spatial Query and Data Access in the Cloud for the ICESat-2 Mission, *AGU Fall Meeting*.

[144] Hawley, R. L., S. Grigsby*, G. Lewis and **M. R. Siegfried**, 2021. CrackMap: Automated Extraction of Crevasses from High-Resolution Optical Imagery using Edge Detection, *AGU Fall Meeting*.

[143] Roth, D. L., G. Jin, A. Titov, **M. R. Siegfried**, C. C. Masteller and H. Jacobson, 2021. A river on fiber: capturing fluvial processes with distributed acoustic sensing, *AGU Fall Meeting*.

[142] Sapienza, F., S. Grigsby*, W. Zheng, J. Taylor, F. Perez and **M. R. Siegfried**, 2021. Spectral Unmixing of Antarctic Snow Grain Size Distribution: A Data-Driven Perspective, *AGU Fall Meeting*.

[141] Smith, B. E., T. C. Sutterley, S. Dickinson, B. P. Jelley, S. Adusumilli, H. A. Fricker, A. S. Gardner, N. Holschuh, T. Neumann, L. Padman and **M. R. Siegfried**, 2021. An introduction to ICESat-2's gridded land-ice products, *AGU Fall Meeting*.

[140] Sutterley, T. C., B. Smith, K. Brunt, L. Padman, S. L. Howard, **M. R. Siegfried**, A. S. Gardner, H. A. Fricker, S. Adusumilli and N. Holschuh, 2021. Estimating Antarctic Grounding Zone Ice Flexure with ICESat-2 Data, *AGU Fall Meeting*.

[139] *Follingstad, V., R. Michaelides* and **M. R. Siegfried**, 2021. Quantifying the surface deformation of pingos on the Alaskan North Slope using interferometric synthetic aperture radar (InSAR), *2021 Regional Conference on Permafrost & 19th International Conference on Cold Regions Engineering*.

[138] *Michaelides, R. M., M. Bryant, A. A. Borsa and **M. R. Siegfried**, 2021. Quantifying Surface-Height Change over a Periglacial Environment with ICESat-2 Laser Altimetry, *2021 Regional Conference on Permafrost & 19th International Conference on Cold Regions Engineering*.

[137] Hughson, K. H., B. E. Schmidt, E. Quartini, R. Michaelides*, **M. R. Siegfried**, A. Mullen, J. H. Bradford, A. Swidinsky and H. G. Sizemore, 2021. Pingos as planetary analogs: The geophysical perspective, *GSA Connects Annual Meeting*.

[136] *Sauthoff, W., **M. R. Siegfried** and B. E. Smith, 2021. Observing connected subglacial lake drainage at Slessor Glacier, East Antarctica, using ICESat-2 laser altimetry, *WAIS Workshop*.

[135] *Savidge, E., T. Snow*, **M. R. Siegfried**, L. Boehme, G. A. Bortolotto and K. E. Alley, 2021. Investigating persistent polynya structure and variability at Pine Island Glacier, West Antarctica, using seal-borne measurements and thermal remote sensing, *WAIS Workshop*.

[134] *Snow, T., F. Sapienza, S. Grigsby*, J. Taylor, E. Savidge*, W. Zheng, K. Alley, F. Pérez and **M. R. Siegfried**, 2021. Eastern Thwaites basal channel outflow inferred from persistent polynya variability, *WAIS Workshop*.

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