

Nicholas D. Holschuh

Curriculum Vitae

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October 2019

Professional Appointments

- 2020-Present *Assistant Professor of Geology, Amherst College*
- 2016-2020 *Postdoctoral Research Associate, University of Washington*
- 2012-16 *NSF Graduate Research Fellow, Pennsylvania State University*
- 2011-12 *University Graduate Fellow, Pennsylvania State University*
Methods and applications of radio-frequency geophysics in glaciology.
- Summers *Graduate Research Intern, Chevron Energy and Technology Company*
- 2014/15 Improving time shift methods for 4D seismic data analysis
- 2010-11 *Research Fellow, Pacific Tsunami Warning Center.*
Investigating the role of fault geometry on tsunamigenesis
- 2008-10 *Research Assistant, Department of Geology - Carleton College.*
Investigating the surface water chemistry of Rice County, MN.

Education

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|------|--|-------------------------------|---------------------------------------|
| 2016 | <i>Ph.D. - Geosciences</i> | Pennsylvania State University | <i>(NSF Graduate Research Fellow)</i> |
| 2015 | <i>Graduate Teaching Certification</i> | Pennsylvania State University | |
| 2011 | <i>B.A. - Geology</i> | Carleton College | <i>(Summa Cum Laude)</i> |
| 2011 | <i>B.A. - Economics</i> | Carleton College | |

Patents

- Holschuh, N., C. Li, M. A. Meadows, and S. Dobbs (2014). Systems and Methods for Aligning a Monitor Seismic Survey with a Baseline Seismic Survey. *Chevron USA Inc.* **US14565117**, 1–16.

Publications

- Alley, K. E., T. A. Scambos, R. B. Alley, and N. Holschuh (2019). Troughs developed in ice-stream shear margins precondition ice shelves for ocean-driven breakup. *Science Advances* **5**, 1–7.
- Smith, B., H. A. Fricker, N. Holschuh, A. S. Gardner, S. Adusumilli, K. M. Brunt, B. Csatho, 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*, 1–17.
- Holschuh, N., D. Lilien, and K. Christianson (2019). Thermal Weakening, Convergent Flow, and Vertical Heat Transport in the Northeast Greenland Ice Stream Shear Margins. *Geophysical Research Letters* **46**, 8184–8193.
- Koellner, S., B. R. Parizek, R. B. Alley, A. Muto, and N. Holschuh (2019). The impact of spatially-variable basal properties on outlet glacier flow. *Earth and Planetary Science Letters* **515**, 200–208.
- Riverman, K. L., R. B. Alley, S. Anandakrishnan, K. Christianson, N. Holschuh, B. Medley, A. Muto, and L. Peters (2019). Enhanced Firn Densification in High-Accumulation Shear Margins of the NE Greenland Ice Stream. *Journal of Geophysical Research: Earth Surface* **124**, 365–382.
- Muto, A., S. Anandakrishnan, R. B. Alley, H. J. Horgan, B. R. Parizek, S. Koellner, K. Christianson, and N. Holschuh (2019). Relating bed character and subglacial morphology using seismic data from Thwaites Glacier, West Antarctica. *Earth and Planetary Science Letters* **507**, 199–206.
- Alley, R., D. Pollard, B. Parizek, S. Anandakrishnan, M. Pourpoint, N. Stevens, J. MacGregor, K. Christianson, A. Muto, and N. Holschuh (2019). Possible Role for Tectonics in the Evolving Stability of the Greenland Ice Sheet. *Journal of Geophysical Research: Earth Surface* **124**, 97–115.
- Holschuh, N., K. Christianson, H. Conway, R. W. Jacobel, and B. C. Welch (2018). Persistent Tracers of Historic Ice Flow in Glacial Stratigraphy near Kamb Ice Stream, West Antarctica. *The Cryosphere* **5**(May), 1–10.

7. Kehrl, L., H. Conway, N. Holschuh, S. Campbell, A. A. V. Kurbatov, and N. E. N. Spaulding (2018). Evaluating the duration and continuity of potential climate records from the Allan Hills Blue Ice Area, East Antarctica. *Geophysical Research Letters* **45**, 4096–4104.
6. Holschuh, N., B. R. Parizek, R. B. Alley, and S. Anandakrishnan (2017). Decoding ice sheet behavior using englacial layer slopes. *Geophysical Research Letters* **44**(11), 5561–5570.
5. Luthra, T., L. L. E. Peters, S. Anandakrishnan, R. R. B. Alley, N. Holschuh, and A. A. M. Smith (2017). Characteristics of the sticky spot of Kamb Ice Stream, West Antarctica. *Journal of Geophysical Research: Earth Surface* **122**(3), 641–653.
4. Holschuh, N., K. Christianson, S. Anandakrishnan, R. B. Alley, and R. W. Jacobel (2016b). Constraining attenuation uncertainty in common midpoint radar surveys of ice sheets. *Journal of Geophysical Research: Earth Surface* **121**(10), 1876–1890.
3. Luthra, T., S. Anandakrishnan, J. P. Winberry, R. B. Alley, and N. Holschuh (2016). Basal characteristics of the main sticky spot on the ice plain of Whillans Ice Stream, Antarctica. *Earth and Planetary Science Letters* **440**, 12–19.
2. Holschuh, N., D. Pollard, R. R. B. Alley, and S. Anandakrishnan (2014). Evaluating Marie Byrd Land stability using an improved basal topography. *Earth and Planetary Science Letters* **408**, 362–369.
1. Holschuh, N., K. Christianson, and S. Anandakrishnan (2014). Power loss in dipping internal reflectors, imaged using ice-penetrating radar. *Annals of Glaciology* **55**(67), 49–56.

Awards and Honors

- 2018 1st Place Presentation - University of Washington Postdoctoral Research Symposium
- 2016 3rd Place Presentation - Penn State Graduate Student Exhibition
- 2015 Outstanding Student Paper Award - AGU Fall Meeting
- Schenck Teaching Assistant of the Year - PSU College of Earth and Mineral Science
- 2nd Place Presentation - Penn State Geosciences Colloquium
- 2014 Dr. Gabriel and Mrs. Katherine Leblanc Fellowship in the Geosciences
- 2013 Shell Research Facilitation Award
- 2012 NSF Graduate Research Fellowship
- 2011 University Graduate Fellowship - Pennsylvania State University
- Distinction in Undergraduate Thesis - Economics
- Distinction in Undergraduate Thesis - Geology
- Phi Beta Kappa Qualification
- Sigma Xi Qualification
- 2010 Duncan Stewart Fellow in Geology
- 2009 Ernest F. Hollings Scholar

Teaching Experience

- Spring 2019 **University of Washington, ESS 203: Glaciers and Global Change**, (*Course Instructor*)
I will be co-teaching ESS203 in Spring, 2019, with Dr. Peter Neff.
- Fall 2017 **University of Washington, ESS 431/505: Principles of Glaciology**, (*Course Instructor*)
In this course and the associated lab section, we covered: cloud nucleation, snow deposition and metamorphism, glacier surface energy balance, the physics of ice flow, glacier erosion, and sea ice dynamics.
Teaching Assistant: Laura Kehrl – (Enrollment: 25UG, 3G)

Guest Lecture Positions (# Lectures provided)

- 05/2017 **240: Geophysics**, *Carleton College* - Active Source Imaging Techniques (2L)
- 10/2016 **431: Principles of Glaciology**, *UW* - Glacier Sliding and Hydrology (1L)
- 02/2016 **330: Geology of Climate Change**, *PSU* - Carbon Dating and Calibration (2L)
- 01/2016 **216: Antarctic Earth Science**, *Carleton College* - Dynamics of the Modern Ice Sheets (2L)
- 02/2015 **558: Multichannel Seismic Processing**, *PSU* - Correlation, Convolution, and Filtering (4L)
- 01/2013 **330: Geology of Climate Change**, *PSU* - Black Body Radiation, Heat Transport (3L)

Teaching Assistantships

- Fall 2014 **230: Physical Processes in the Geosciences** - PSU, Geosciences
- Fall 2010 **331: Intermediate Macroeconomic Theory** - Carleton College, Economics
- Spring 2010 **110: Fundamentals of Macroeconomics** - Carleton College, Economics
- Winter 2010 **255: Petrology** - Carleton College, Geology
- Fall 2010 **250: Mineralogy** - Carleton College, Geology

Other Teaching Experience

2014-16 **Graduate Writing Tutor**, *College of Earth and Mineral Sciences - Pennsylvania State University.*

Field Experience

- 2018-19 **Radar Profiling and Measurements of Englacial Strain**, *Hercules Dome, East Antarctica*
(10 weeks) In support of a future ice coring program, a team from the University of Washington worked to characterize the structure and dynamics of Hercules Dome, a local ice divide sitting just east of the Transantarctic mountains. This is an ideal site to identify the behavior of the West Antarctic Ice Sheet (WAIS) during the previous interglacial (the Eemian), a period thought to be 2 degrees warmer than the present. If WAIS were substantially thinner during the Eemian, the difference in local atmospheric circulation that would result will be recorded in ice at Hercules Dome.
- 2017-18 **Terrestrial Radar Interferometry**, *Coleman and Roosevelt Glaciers, Mt. Baker, WA*
(2 weeks) Together with 3 graduate and 3 undergraduate students, we conducted a series of repeat GPRi (Gamma Portable Radar interferometer) radar campaigns over the course of summers, 2017-18, in order to measure temporal variations in glacier flow speed. These were calibrated with simultaneous flow-speed measurements taken on glacier, using real-time kinematic GPS.
- 2014 **Surface and Borehole Geophysics**, *WAIS Divide, West Antarctica*
(8 weeks) We conducted a seismic AVO survey, using both a surface geophone array and a borehole seismometer stationed in the relict WAIS Divide Ice Core borehole. We also deployed a 3MHz radar system, and performed shallow refraction seismic surveys to compute firn density profiles at several locations along a transect perpendicular to the ice divide.

Funded Proposals

I have received over 15 travel funding, research, and outreach facilitation proposals funded. **At present I do not have status to act as a PI, but I have assisted with the writing and submission of 14 NASA, NSF, and Foundation grant proposals.**

Advising

I have participated in the advising of the following students:

2017+	Andrew Hoffman	(Grad - UW) Surface elevation change, Thwaites Glacier
2017+	Ben Hills	(Grad - UW) Radar reflection power interpretation, NEGIS
2016+	Annika Horlings	(Grad - UW) Surface elevation change over Thwaites Glacier
2017	Adam Stanford-Moore	(UG - Stanford) Radar interferometry on Mt. Baker, WA
2017	Ethan Guzek	(UG - UW) Englacial structures at subglacial lake Whillans
2016	Priyanka Bose	(UG - PSU) Basal crevasse mapping, Kamb Ice Stream
2015	Gina Sarkawi	(UG - PSU) Radar data processing on Kamb Ice Stream

Service

- 2013-Present **Referee** - Nature, Geology, The Cryosphere, IEEE, Journal of Glaciology
- 2017-Present **Session Convener** - AGU Fall Meeting, GSA Annual Meeting
- 2017-Present **Proposal Review Panelist and External Reviewer** - NASA, NSF
- 2012-Present **Member of the Following Departmental Committees:**
Diversity Committee - University of Washington Earth and Space Sciences (*Member, 2017+*)
Earth and Space Sciences Museum Board - PSU (*Student Member, 2015-16*)
Faculty Committee - PSU Department of Geosciences (*Student Representative, 2012-15*)
- 2017-Present **NASA Sea Level Change Team**
Determined through an open call for proposals, NASA has selected 8 teams to collaborate to identify, quantify, and project decadal sea level change. Together with Dr. Knut Christianson, I am responsible for altimetry integration into predictions of future sea level rise from the ice sheets.
- 2016-Present **ICESat-II Science Definition Team**

Working with Dr. Ben Smith at the University of Washington's Applied Physics lab, I assist with algorithm testing and optimization for the ice sheet surface height determination scheme in development for the upcoming ICESat-II mission.

Outreach

- 2017/18 **Polar Science Weekend**
Presented ice dynamics and ice-core exhibits at the Pacific Science Center as part of Polar Science Weekend.
- 2017/18 **Middle School Curriculum Development and Science Night**
Worked with Guy Lawrence (TOPS School, Seattle Public School System) to develop outreach events for his middle school science classroom.
- 2017/18 **UW Earth and Space Sciences Diversity and Inclusion Committee**
A student, faculty, and postdoc committee dedicated to formulating department priorities for recruiting, admission, and culture to foster departmental diversity.
- 2016 **Chair - Geoscience Graduate Colloquium Committee**
Lead the organization of Penn State's annual Geosciences colloquium, a two day conference where geoscience students from Penn State University and Tohoku University presented their research in both oral and poster formats.
- 2015-16 **Chair - Student Museum Committee, Penn State Earth and Mineral Sciences Museum**
I organized and a lead a student run committee for museum exhibit development and curation. Through this committee, I lead the development of an exhibit on ocean acidification currently on display in Penn State's EMS Museum. This committee been converted into a 1 credit seminar in the PSU department of Geosciences.
- 2015-16 **Museum Board Member - Penn State Earth and Mineral Sciences Museum**
Student representative to the campus museum evaluation board.
- 2012-15 **Student Representative to the Faculty - Penn State Department of Geosciences**
I acted as an advocate for student interests at Penn State's Geoscience faculty meetings.
- 2014 **Data Sonification Team - Penn State Polar Center**
Worked with Dr. Mark Ballora and Dr. David Pollard to convert Ice Sheet time-series data to sound. This was done as a public exhibit on novel ways to communicate climate data.

Conference Proceedings and Invited Talks (Presenting Author)

2019

39. Holschuh, N. (2019). Investigating modern and paleo ice sheet dynamics using ice penetrating radar. *Western Washington University Colloquium*. Bellingham, WA.
38. Holschuh, N., K. Christianson, and J. Paden (2019a). Swath topography and the future of polar bed mapping. *UW Colloquium - Postdoctoral Lightning Talks*. Seattle, WA.
37. Holschuh, N., K. Christianson, and J. Paden (2019b). Contextualizing the slow-down of Whillans Ice Stream using ICESat-2 and swath radar topography. *WAIS Workshop*. Julian, CA.
36. Holschuh, N., K. Christianson, and J. Paden (2019c). Swath topography, and the future of polar bed mapping. *IGS: Symposium on Five Decades of Radioglaciology*. Palo Alto, CA.
35. Holschuh, N., K. Christianson, J. Pade, R. B. Alley, and S. Anandakrishnan (2019). Linking Postglacial Landscapes and Subglacial Processes through Swath Radar Imaging at Thwaites Glacier, West Antarctica. *IGS: Glacial Erosion and Sedimentation*. Madison, WI.

2018

34. Holschuh, N. (2018a). Beyond Ice Thickness: Inferring the Flow Dynamics and Physical Properties of Ice Sheets Using Radar. *University of Oregon: Geosciences Colloquium Series*. Eugene, OR.
33. Holschuh, N., K. Christianson, J. D. Paden, R. B. Alley, and S. Anandakrishnan (2018). Reinterpreting the Global Paleo-Ice Sheet Record through Observed, In Situ Subglacial Landforms at Thwaites Glacier. *WAIS Workshop*. Stony Point, NY.
32. Holschuh, N., D. Lilien, K. Christianson, and E. Bagshaw (2018). Using radar to evaluate the thermal stabilization of ice stream shear margins. *SCAR Open Science Meeting*. Davos, Switzerland.
31. Holschuh, N. (2018b). Challenges to layer tracing and insights from direction-of-arrival analysis for Antarctic englacial layers. *AntArchitecture Workshop*. Davos, Switzerland.

30. Holschuh, N., D. Lilien, and K. Christianson (2018). Using radar to understand the processes controlling ice flow speed in Greenland. *University of Washington Postdoctoral Research Symposium*. Seattle, WA.

2017

29. Holschuh, N., D. Lilien, and K. Christianson (2017a). Estimating the Heat Production and Distribution across Ice-Stream Shear Margins Using Surface Velocities. *AGU Fall Meeting*. New Orleans, LA.
28. Holschuh, N., D. Lilien, and K. Christianson (2017b). Disentangling the thermal and hydrologic signals expressed in radar data collected near EGRIP. *NEGIS Workshop*. Copenhagen, DK.
27. Christianson, K., N. Holschuh, S. Anandakrishnan, R. Alley, J. Paden, L. Peters, and J. Sprick (2017). A Varied Subglacial Landscape Under Thwaites Glacier, West Antarctica. *Geological Society of America Fall Meeting*. Seattle, WA.
26. Holschuh, N., K. Christianson, H. Conway, and R. Jacobel (2017). Record of the ice sheet interior response to Siple Coast Ice Stream variability from glacial stratigraphy. *WAIS Workshop*. Coupeville, WA.
25. Holschuh, N. (2017a). Ground-based radar stratigraphy across Antarctica. *AntArchitecture Workshop*. Edinburgh, Scotland.
24. Holschuh, N. (2017b). The intersection of electromagnetics and ice physics. *Department of Earth and Space Science Colloquium Series (UW)*. Seattle, WA.
23. Holschuh, N. (2017c). Active Source Imaging of the Cryosphere. *Carleton Geology Lecture Series*. Northfield, MN.
22. Holschuh, N., K. Christianson, H. Conway, and R. W. Jacobel (2017). The effects of subglacial volcanism on ice dynamics near the onset of the Siple Coast Ice Streams. *European Geophysical Union Annual Meeting*. Vienna, Austria.

2016

21. Holschuh, N., K. Christianson, S. Anandakrishnan, R. B. Alley, and R. W. Jacobel (2016a). Common-midpoint radar surveys of ice sheets: a tool for better ice and bed property inversions. *AGU Fall Meeting*. San Francisco, CA.
20. Holschuh, N. (2016a). A framework for interpreting internal layer slopes as a record of past and present ice-sheet boundary conditions. *WAIS Workshop*.
19. Holschuh, N., R. Alley, and S. Anandakrishnan (2016). Investigating the Potential for Reconfiguration of the Antarctic and Greenland Ice Sheets. *Penn State Geosciences - Graduate Student Colloquium*. University Park, PA.
18. Holschuh, N., B. R. Parizek, R. B. Alley, and S. Anandakrishnan (2016). Structures, Radars, and Antarctic Adventure. *Seminar Series - Carleton College Department of Geology*. Northfield, MN.

2015

17. Holschuh, N., K. Christianson, S. Anandakrishnan, and R. Alley (2015). What I'm Thankful for this Year: Radar's ability to independently measure the electrical properties of the ice column. *Penn State Geosciences - Geodynamics Colloquium*. University Park, PA.
16. Holschuh, N., B. Parizek, R. Alley, and S. Anandakrishnan (2015a). Internal Reflector Slope Fields as a Proxy for Ice Sheet Velocity Structure. *WAIS Workshop*. Loveland, CO.
15. Holschuh, N., B. Parizek, R. Alley, and S. Anandakrishnan (2015b). Discriminating between Steady-State and Transient Controls on Englacial Structures. *International Symposium on Contemporary Ice-Sheet Dynamics: ocean interaction, meltwater, and non-linear effects*. Cambridge, UK.
14. Holschuh, N., B. R. Parizek, R. B. Alley, S. Anandakrishnan, and R. B. Alley (2015). Using the Englacial Geometry of West Antarctica to Determine its Future Stability. *Advances in Polar Research since the International Polar Year*. University Park, PA.

2014

13. Holschuh, N., K. Christianson, S. Anandakrishnan, and R. Alley (2014). Bistatic Radar case Studies from Antarctica and Greenland. *WAIS Workshop*. Julian, CA.

2013

12. Holschuh, N., D. Pollard, S. Anandakrishnan, and R. Alley (2013a). Consequences of a Deeper Bed for Marie Byrd Land Stability. *WAIS Workshop*. Sterling, VA.
11. Holschuh, N. and S. Anandakrishnan (2013). The Effects of Reflector Geometry on Radar Data Acquisition. *International Glaciological Society Symposium on Radioglaciology*. Lawrence, KS.

10. Holschuh, N., D. Pollard, S. Anandakrishnan, and R. Alley (2013b). Improving our Understanding of Marie Byrd Land Geometry through Geophysical Observations and Flow Modeling. *Midwest Glaciology Meeting*. University Park, PA.
9. Holschuh, N., D. Pollard, S. Anandakrishnan, and R. Alley (2013c). Inferring Ice Sheet Basal Topography using Surface Observations and Flow Modeling. *NSF Review Panel for the Center for Remote Sensing of Ice Sheets*. Elizabeth City, NC.
8. Holschuh, N. (2013). Below the Ice: Investigating the Subsurface Environment of Thwaites Glacier through Radio Echo Sounding. *Penn State Polar Day*. University Park, PA.
7. Holschuh, N., D. Pollard, S. Anandakrishnan, and R. Alley (2013d). Inferring Bed Topography in West Antarctica through Ice Surface Inversion. *Penn State Geosciences - Graduate Student Colloquium*. University Park, PA.

2011

6. Holschuh, N. (2011a). A Systematic Analysis of Potential Leading Indicators in the United States through Vector Autoregression. *Economics Comprehensive Poster Session - Carleton College*. Northfield, MN.
5. Holschuh, N. (2011b). An Analysis of Tsunami Sensitivity to Fault Plane Orientation Using a Rapid Linear Model. *Geology Comprehensive Symposium - Carleton College*. Northfield, MN.

2010

4. Holschuh, N., G. Fryer, and D. Wang (2010). Improving Tsunami Warning Protocols with a Rapid Linear Model. *Sigma Xi Induction Banquet*. Northfield, MN.
3. Fryer, G., N. Holschuh, D. Wang, and N. Becker (2010). Improving Tsunami Warning with a Rapid Linear Model. *AGU Fall Meeting*. San Francisco, CA.
2. Holschuh, N. and G. Fryer (2010). Improving Tsunami Warning Protocols through the Incorporation of Historical Data. *Hollings Scholar Symposium*. Silver Spring, MD.

2009

1. Holschuh, N. and B. Haileab (2009). A Preliminary Geochemical Analysis of Spatial and Temporal Variations in the Surface Water Chemistry of Rice County, MN. *Geological Society of America National Conference*. Portland, OR.