Dr. Eric Ivan Petersen, PhD
Geophysical Institute, University of Alaska Fairbanks
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Research Interests: I investigate the processes that occur when glacial ice becomes covered with rocky debris and soil, with implications for understanding the relationship between climate, cryosphere, and water resources on Earth and Mars. I employ a wide variety of techniques, including field instrumentation, melt modeling, geophysical surveying, remote sensing, and geomorphic observation.

Education:

2018 PhD Geosciences Jackson School of Geosciences, UT Austin
Advisors: John W. Holt, PhD and Joseph S. Levy, PhD
Dissertation Title: "The Ice Content and Internal Structure of Candidate Debris-Covered Glaciers on Mars and Earth: Insights from Radar Sounding"
2012 B.Sc. Physics Simon Fraser University

Professional Appointments:

Postdoctoral Research Associate, *Geophysical Institute*– April 2020 - Now

• Conducting an NSF-funded field project on the debris-covered terminus of Kennicott Glacier. Focus on the use of in-situ thermal and meteorological data to quantify the energy balance of supraglacial debris, as well as the use of remote sensing and time lapse imagery to quantify the morphology and evolution of ice cliffs.

Postdoctoral Research Associate, *Lunar and Planetary Laboratory* –
Sept 2018 – Dec 2020

• Participation as a radar scientist in Subsurface Water Ice Mapping (SWIM), a team effort to comprehensively map mid-latitude Martian ice deposits in support of NASA's Mars Exploration Program. More info at: https://swim.psi.edu/.

• Planning, prepping, and leading geophysical fieldwork to debris-covered glaciers in the Wrangell Mountains, Alaska and the Absaroka Mountains, Wyoming.

Student Research Assistantships and Internships:

Graduate Research Fellow, *Univ. of Texas Inst. for Geophysics* – Aug 2013 – Aug 2018

• Surveyed Martian debris-covered glaciers using orbital radar sounding to constrain their internal ice content.

• Analyzed high resolution stereophotogrammetric images of Martian debris-covered glaciers to quantify surface roughness and its effect on radar sounding.

Research Assistant, *Simon Fraser University Geology Dept.* – Aug 2011 – May 2013

- Worked in Dr. Gwenn Flowers' research group managing field campaign data, investigating variable temperature lapse rates, and calculating mass balance for alpine glaciers in the St. Elias Mountains, Yukon Territory. Some of this work was included in Wheler et al. (2014), which I co-authored.

Undergraduate Research Intern, *Laboratory for Atmospheric and Space Physics, CU Boulder* – June – Aug 2011

- Performed observational analysis of cloud evolution on Venus using data from the Visible and Infrared Thermal Imaging Spectrometer (VIRTIS).

Lab Technician, *Simon Fraser University Chemistry Dept.* – Aug 2009 – May 2011

- Worked in Dr. Paul Li's Lab constructing a prototype fluorescence microscope and aiding in microfluidics experiments.

Undergraduate Research Intern, *Northern Arizona University* – June – Aug 2010

- Worked with Dr. David Trilling on photometric analysis of near-Earth asteroid observations to aid in developing an automated spectral classification scheme. This work was published in Mommert et al. (2016), which I co-authored.

Undergraduate Research Intern, *University of Idaho.* – June – Aug 2009

- Worked with Dr. Gwen Barnes on analysis of Martian craters and crater ejecta using data from the High Resolution Imaging Science Experiment (HiRISE).

Grants:

[As Co-I]:

"Subsurface Water Ice Mapping (SWIM) 2.0: Extension to the Southern Hemisphere of Mars"

- Funded by JPL to support NASA's Mars Exploration Program
- Total budget = $540,338
- PIs: Nathaniel E. Putzig and Gareth A. Morgan

"Subsurface Water Ice Mapping (SWIM) in the Northern Hemisphere of Mars"

- Funded by JPL to support NASA's Mars Exploration Program
- Total budget = $230,000
- PIs: Nathaniel E. Putzig and Gareth A. Morgan

[As Graduate Research Fellow]:

"Determining the origin of thermally-insulating surface debris on Martian glaciers through integrative data analysis" — NASA Earth and Space Science Fellowship — NNX15AR08H

- Fellowship won through competitive proposal process. Written proposal outlined self-developed research plans for my PhD.
- Budget = $30,000 per year (3 years)
- Supported graduate salary, tuition, conference travel, and textbooks for three years from 2015-2018.

Student Awards

2015 Vargas Endowed Presidential Scholarship
- Merit-based monetary award in the amount of $5000

Field Experience:

2020 Investigation of mass balance and surface morphology of the Kennicott Glacier, AK
2019 Geophysical surveying of Gilpin Peak Rock Glacier, Colorado
2019 Geophysical surveying of Sulphur Creek and Galena Creek Basins, Wyoming.
2019 Late-winter geophysics on snow-covered Sourdough Rock Glacier, AK
2018 Late-winter geophysics on snow-covered Sourdough Rock Glacier, AK.
2016, 2015 Geophysical surveying of Galena Creek Rock Glacier, Wyoming.
2015, 2014 St. Elias Mountains, Alaska: geophysical surveying of Sourdough Rock Glacier.
2014 Marine Geophysics field course, investigations near Galveston, TX.
2013 Geophysical investigation of terrace deposits in South Austin, TX.
2013 Geophysical investigation of the hydrology of the upper Nueces River, TX.
2013 Uinta Mountains, Utah: geophysical surveying of a rock glacier.

Publications:

[Under review]:

Petersen, Eric. I. and J. W. Holt, "Surface Roughness Prevents Radar Penetration of Some Martian Debris-Covered Glaciers," submitted to *Transactions on Geoscience and Remote Sensing,* April 2021.

Anderson, Leif S., W. H. Armstrong, R. S. Anderson, D. Scherler, and **E. Petersen**, "The causes of debris-covered glacier thinning: evidence for the importance of ice dynamics from Kennicott Glacier, Alaska," submitted to *The Cryosphere*, 2021.

[Published]:

Morgan, Gareth A., N. E. Putzig, M. R. Perry, H. G. Sizemore, A. M. Bramson, **E. I. Petersen,** Z. M. Bain, D. M. H. Baker, M. Mastrogiuseppe, R. H. Hoover, I. B. Smith, A. Pathare, C. M. Dundas, B. A. Campbell, "Mapping H_2O-Ice on Mars: Human Mission Resources and Climatic Implications," *Nature Astronomy*, https://doi.org/10.1038/s41550-020-01290-z, 2021.

Petersen, Eric I., Joseph S. Levy, John W. Holt, and Cassie M. Stuurman, "New insights into ice accumulation at Galena Creek Rock Glacier from radar imaging of its internal structure," *Journal of Glaciology*, 66(255), pp. 1-10, doi:10.1017/jog.2019.67, 2020.

Petersen, Eric I., John W. Holt, and Joseph S. Levy, "High Ice Purity of Martian Lobate Debris Aprons at the Regional Scale: Evidence from an Orbital Radar Sounding Survey in Deuteronilus and Protonilus Mensae," *Geophysical Research Letters* 45(21), pp. 11,595-11,604, doi:10.1029/2018GL079759, 2018.

Kocurek, Gary, Rowan C. Martindale, Mackenzie Day, Timothy A. Goudge, Charles Kerans, Hima J. Hassenruck-Gudipati, Jasmine Mason, Benjamin T. Cardenas, **Eric I. Petersen**, David Mohrig, Daniel S. Aylward, Cory M. Hughes, and Caroline M. Nazworth, "Antecedent aeolian dune topographic control on carbonate and evaporate facies: Middle Jurassic Todilto Member, Wanaka Formation, Ghost Ranch, New Mexico, USA," *Sedimentology*, doi:10.1111/sed.12518, 2018.

Mommert, M., D. E. Trilling, D. Borth, R. Jedicke, N. Butler, M. Reyes-Ruiz, B. Pichardo, **E. Petersen,** T. Axelrod, and N. Moskovitz, "First Results from the Rapid-Response Spectrophotometric Characterization of Near-Earth Objects using UKIRT," *The Astronomical Journal*, Vol 151, No. 4, 2016.

Wheler, B. A., A. H. MacDougall, G. E. Flowers, **E. I. Petersen,** P. H. Whitfield, and K. E. Kohfeld, "Effects of temperature forcing provenance and extrapolation on the performance of an empirical glacier-melt model," *Arctic, Antarctic, and Alpine Research*, Vol. 46, No. 2, pp. 379-393, 2014.

Recent Conference Abstracts:

Petersen, Eric I., R. Hock, and M. Loso, "Ice cliff morphology and evolution on the Kennicott Glacier, Wrangell Mountains, Alaska," Abstract C041-08 presented at 2020 Fall Meeting, AGU, Virtual, 1-17 December 2020. [Talk]

Petersen, E. I., T. M. Meng, J. W. Holt, J. S. Levy, B. S. Tober, and M. S. Christoffersen, "Sulphur Creek and Galena Creek, Wyoming: Laboratories for Understanding the Preservation of Debris-Covered Glaciers on Mars," *Seventh International Conference on Mars Polar Science and Exploration,* #6053, 2020. [Talk]

Petersen, E. I., J. W. Holt, J. S. Levy, T. M. Meng, B. Tober, M. Christoffersen, C. M. Stuurman, B. Cardenas, "The Transition from Alpine Glacier to Rock Glacier: A Case Study at Sulphur Creek, Wyoming," *AGU Fall Meeting*, Abstract C41E-1506, 2019. [Poster]

Petersen, E. I., and J. W. Holt, "Surface Roughness Prevents SHARAD Penetration of Some Martian Debris-Covered Glaciers: A Fractal Analysis of HiRISE DTMs," *50th Lunar and Planetary Science Conference*, #2079, 2019. [Poster]

Petersen, E. I., J. W. Holt, and J. S. Levy, "All Our Aprons Are Icy: No Evidence for Debris-Rich 'Lobate Debris Aprons' in Deuteronilus Mensae, Mars," *49th Lunar and Planetary Science Conference,* #2354, 2018. [Talk]

Petersen, E. I., J. W. Holt, J. S. Levy, and D. E. Lalich, "Variability in radar returns from Martian debris-covered glaciers attributed to surface debris layer roughness and composition: implications for the regional distribution of massive subsurface ice and near-surface pore-filling ice," *AGU Fall Meeting 2017*, Abstract #P43C-2889, 2017. [Poster]

Petersen, E. I., J. W. Holt, J. S. Levy, and C. M. Stuurman, "New Constraints on Surface Debris Layer Composition for Martian Mid-Latitude Glaciers from SHARAD and HiRISE," *48th Lunar and Planetary Science Conference,* #2767, 2017. [Poster]

Petersen, E. I., J. W. Holt, J. S. Levy, and C. M. Stuurman, "Ice-Cored Moraines May Preserve Climate History in their Stratigraphy: a Mars Analog Study at Galena Creek Rock Glacier," *48th Lunar and Planetary Science Conference*, #2966, 2017. [Poster]

Petersen, E. I., J. W. Holt, J. S. Levy, T. A. Goudge, and E. A. McKinnon, "New Constraints on Mid-Latitude Glacier Debris Layer Composition from SHARAD and HiRISE," *Sixth Mars Polar Science Conference*, #6084, 2016. [Poster]

Public Lectures:

June 2021 "The dynamic, melting surface of the debris-covered Kennicott Glacier," Summer Art & Lecture Series, Wrangell Mountains Center, McCarthy AK.

May 2021 "Ice Melt Under Debris and from Exposed Ice Cliffs on the Kennicott Glacier," three-minute flash talk at the virtual UAF Arctic Research Open House.

June 2019 "Rock glaciers: from mountain hikes to the colonization of Mars," Space Drafts—Tucson's Flavor of 'Astronomy on Tap,' Borderlands Brewing Company, Tucson, Arizona.

Classroom Teaching Experience:

2017 UT Austin Geology 382W: Hydrogeophysics
- Guest lectured on the use of ground-penetrating radar for geoscience applications. One 1.5 hour class session.

2016 UT Austin Geology 391: Intro to the Cryosphere
- Guest lectured on debris-covered glaciers and glaciers across the solar system. One 1 hour class session.

2015 UT Austin Geology 303C: Intro to the Solar System
- Guest lectured on the cryosphere, climate history, and planetary astronomy. Four 1.5 hour sessions.
- Performed teacher assistant duties for a 3 credit lecture-based class: grading, materials preparation, and filling in for the professor during absences.

2014 UT Austin Geology 302E: Earth, Wind, and Fire
- Performed teacher assistant duties for the lab component of a 4 credit geology class: leading students in experiments, study activities, class discussion, and grading. Three contact hours per week.

2012 SFU Physics 131: Physics Lab 1 for Engineers
- Performed teacher assistant duties for a 1 credit lab physics class: instructing students on experiments and assignments, grading. Three contact hours per week.

Mentoring Experience:

Cameron Markovsky June – Aug 2021
- Participant in Research Experience for Undergraduates program hosted by IARC.
- Supervised project in modeling glacier melt under a surface debris layer.
- Participated in summer field campaign on the Kennicott Glacier.

Elizabeth McKinnon 2015 – 2016
- Undergraduate Research Assistant, Geoscience
- Supervised geomorphic mapping of terrain types on Martian glaciers

References:

Dr. Regine Hock
Professor, Department of Geosciences, University of Oslo
Postdoc Mentor
e-mail: r.m.e.hock@geo.uino.no

Dr. John W. Holt
Professor, Lunar and Planetary Laboratory, University of Arizona
Postdoc Mentor & PhD Supervisor
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