

## TWILA A. MOON

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National Snow & Ice Data Center  
Cooperative Institute for Research in Environmental Sciences  
University of Colorado

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### EDUCATION

- 2014 Ph.D. Earth & Space Sciences, **University of Washington**  
*Certificate: Climate Science, Program on Climate Change*
- 2008 M.S. Earth & Space Sciences, **University of Washington**
- 2004 B.S. Geological & Environmental Sciences, **Stanford University**

### ACADEMIC & RESEARCH POSITIONS

- 2017 – present Research Scientist, National Snow & Ice Data Center, Cooperative Institute for Research in Environmental Sciences, University of Colorado - Boulder
- 2016 – 2017 Faculty (Lecturer, equivalent to Assistant Professor), School of Geographical Sciences, University of Bristol, UK
- 2015 – 2016 National Science Foundation Postdoctoral Research Fellow, Department of Geological Sciences, University of Oregon
- 2015 – 2017 Affiliate Scientist, National Snow and Ice Data Center, Cooperative Institute for Research in Environmental Sciences, University of Colorado - Boulder
- 2014 – 2015 Postdoctoral Fellow, National Snow and Ice Data Center, Cooperative Institute for Research in Environmental Sciences, University of Colorado - Boulder
- 2014 – present Affiliate Scientist, Polar Science Center, Applied Physics Lab, University of Washington
- 2012 – 2014 Research Assistant, Earth & Space Sciences, University of Washington
- 2010 – 2012 Research Fellow, National Science Foundation, University of Washington
- 2007 – 2008 Research Fellow, National Science Foundation, University of Washington
- 2006 – 2007 Research Assistant, Earth & Space Sciences, University of Washington
- 2005 – 2006 Research Fellow, Program on Climate Change, University of Washington

### ADDITIONAL PROFESSIONAL EXPERIENCE

- 2017 Founder, Wheelhouse Institute
- 2012 Geoscience Intern, ExxonMobil Upstream Research Company
- 2008 – 2010 Managing Director-Big Sky, Big Sky Institute, Montana State University

### JOURNAL PUBLICATIONS

- 2017 Cavanagh, J. P., D. J. Lampkin, and **T. Moon** (2017), Seasonal variability in regional ice flow due to meltwater injection into the shear margins of Jakobshavn Isbrae, *J Geophys Res-Earth*, 120(3), 580–18, doi:10.1002/2016JF004187.
- 2017 **Moon, T.A.**, D.A. Sutherland, D. Carroll, D. Felikson, L. Kehrl, F. Straneo (2017), Subsurface iceberg meltkey to Greenland fjord freshwater budget, *Nature Geoscience*, doi: 10.1038/s41561-017-0018-z. (*cover article*)

- 2017 Bondzio, J. H., M. Morlighem, H. Seroussi, T. Kleiner, M. Rückamp, J. Mouginot, **T. Moon**, E. Y. Larour, and A. Humbert, The mechanisms behind Jakobshavn Isbrae's acceleration and mass loss: a 3D thermomechanical model study, *Geophys Res Lett*, doi:10.1002/2017GL073309.
- 2017 **Moon, T.**, Saying goodbye to glaciers, *Science*, 356(6338), 580–581, doi:10.1126/science.aam9625.
- 2016 Laidre, K. L., **T. Moon**, D. Hauser, R. McGovern, M. Heide-Jorgensen, R. Dietz, B. Hudson, Use of glacial fronts by narwhals (*Monodon monoceros*) in West Greenland. *Biology Letters*, 12, 20160457. doi: 10.1098/rsbl.2016.0457.
- 2016 Carroll, D., D. Sutherland, B. Hudson, **T. Moon**, G. Catania, E. Shroyer, J. Nash, T. Bartholomaeus, D. Felikson, L. Stearns, B. Noel, M. van den Broeke (2016), The impact of glacier geometry on meltwater plume structure and submarine melt in Greenland fjords. *Geophysical Research Letters* 43, 9739–9748 doi: 10.1002/2016GL070170.
- 2016 Joughin, I., B. Smith, I. Howat, H. Fricker, T. Scambos, **T. Moon**, A SAR record of early 21st century change in Greenland, *Journal of Glaciology*, vol. 62 (231), doi: 10.1017/jog.2016.10.
- 2015 Fahnestock, M., T. Scambos, **T. Moon**, A. Gardner, T. Haran, M. Klinger, Rapid large-area mapping of ice flow using Landsat 8, *Remote Sensing of Environment*, doi:10.1016/j.rse.2015.11.023.
- 2015 **Moon, T.**, I. Joughin, B. Smith, Seasonal to multi-year variability of glacier surface velocity, terminus position, and sea ice/ice mélange in northwest Greenland, *Journal of Geophysical Research-Earth Surface*, vol. 120, doi:10.1002/2015JF003494.
- 2014 **Moon, T.**, I. Joughin, B. Smith, M. R. van den Broeke, W. J. van de Berg, B. Noël, M. Usher, Distinct patterns of seasonal Greenland glacier velocity, *Geophysical Research Letters*, vol. 41 (20), doi:10.1002/2014GL061836.
- 2012 **Moon, T.**, I. Joughin, B. Smith, and I. Howat, 21st century evolution of Greenland outlet glacier velocities, *Science*, vol. 336 (6081), doi:10.1126/science.1219985. (cover article)
- 2010 Joughin, I., B. Smith, I. Howat, T. Scambos and **T. Moon**, Greenland flow variability from ice-sheet-wide velocity mapping, *Journal of Glaciology*, vol. 56 (197), doi:10.3189/002214310792447734.
- 2008 **Moon, T.** and I. Joughin, Changes in ice front position on Greenland's outlet glaciers from 1992 to 2007, *Journal of Geophysical Research-Earth Surface*, vol. 13 (F2), doi: 10.1029/2007JF000927.
- 2008 Joughin, I., S. Das, M. King, B. Smith, I. Howat, **T. Moon**, Seasonal speedup along the western flank of the Greenland Ice Sheet, *Science*, vol. 320 (5877), doi: 10.1126/science.1153288.
- 2008 Joughin, I., I. Howat, R. Alley, G. Ekstrom, M. Fahnestock, **T. Moon**, M. Nettles, M. Truffer, V. Tsai, Ice-front variation and tidewater behavior on Helheim and Kangerdlugssuaq Glaciers, Greenland, *Journal of Geophysical Research-Earth Surface*, vol. 13 (F1), doi: 10.1029/2007JF000837.

#### ADDITIONAL INVITED PUBLICATIONS

- 2015 **Moon, T.** and I. Joughin, Greenland Ice Sheet surface velocities: New data sets [in Arctic Report Card 2015], <http://www.arctic.noaa.gov/reportcard>.

- 2014 **Moon, T.**, Greenland outlet glacier ice-flow variability, *U.S. CLIVAR Variations Newsletter*, vol. 12 (2), p. 1-6.
- 2012 **Moon, T.** and I. Joughin, Greenland glaciers – not so fast!, *RealClimate*, blog post May 15, 2012.

### **PUBLISHED DATASETS**

- 2015 Joughin, I. and **T. Moon**, MEaSURES annual Greenland outlet glacier terminus positions from SAR Mosaics. Boulder, Colorado USA: NASA National Snow and Ice Data Center Distributed Active Archive Center. doi: <http://dx.doi.org/10.5067/DC0MLBOCL3EL>.

### **GRANTS & FELLOWSHIPS**

- 2016 NSF EarthCube RCN (10/01/15-9/30/17), Collaborative Research: Engaging the Greenland Ice Sheet Ocean (GRISO) Science Network, \$299,396, PIs: Fiamma Straneo (WHOI), David Sutherland (UOregon). (Institutional PI)
- 2016 NASA Cryospheric Science (1/1/16-12/31/18), Global Land Ice Velocity Extraction from Landsat (GoLIVE): A robust, comprehensive, and near-real-time record of global glacier flow, \$993,320, PIs: Ted Scambos (NSIDC), Mark Fahnestock (UAlaska), Alex Gardner (JPL). (Scientist)
- 2014 Ocean Sciences Postdoctoral Research Fellowship, National Science Foundation
- 2014 Postdoctoral Visiting Fellowship, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado – Boulder
- 2014 Postdoctoral Fellowship, NOAA Climate and Global Change (*declined*)
- 2007 Graduate Research Fellowship, National Science Foundation
- 2005 Earth and Space Sciences Student Recognition Grant, University of Washington
- 2005 Program on Climate Change Graduate Fellowship, University of Washington
- 2003 Geological and Environmental Sciences Department Summer Research Fellowship, Stanford University
- 2002 Undergraduate Research Opportunities Major Grant, Stanford University

### **OTHER AWARDS**

- 2011 GIS Day Student Poster Award, University of Washington
- 2010 Best Surface Processes Oral Presentation, University of Washington

### **INVITED ACADEMIC TALKS**

- 2017 Lamont-Doherty Earth Observatory, Columbia University
- 2017 Chevron Corporation (Climate Team, Fellows, Advanced Energy & Greenhouse Gas Tech)
- 2017 University of Edinburgh, School of Geosciences
- 2017 Newcastle University, Department of Geography
- 2016 Cambridge University, Scott Polar Research Center

- 2016 Helmholtz Remote Sensing and Earth System Dynamics Alliance Week
- 2016 Delft University of Technology, Geosciences and Remote Sensing
- 2016 Montana State University, Department of Earth Sciences
- 2015 Stanford University, Department of Geophysics Seminar
- 2015 University of Maryland, Atmospheric and Oceanic Sciences Seminar
- 2015 Teton Science School, Graduate Program Seminar
- 2015 University of Oregon, Geology Department Seminar
- 2014 University of Colorado, CIRES Cryosphere and Polar Processes Seminar
- 2014 Northern Arizona University, School of Earth Sciences and Environmental Sustainability Seminar
- 2013 University of Colorado, CIRES Seminar
- 2009 Montana State University, Annual Earth Sciences Colloquium Keynote Lecture

#### **INVITED CONFERENCE ABSTRACTS**

- 2018 Moon, T., Freshwater in Greenland fjords, Community Earth System Model Land Ice Working Group Meeting, Boulder, CO, 10-11 Jan.
- 2017 Moon, T., Redefining glacial pace: Progress and results from a velocity data revolution, IGS Polar Ice, Polar Climate, Polar Change, Boulder, CO, 14-19 Aug.
- 2017 Moon, T., M. Fahnestock, A. Gardner, T. Scambos, M. Klinger, Insights and opportunities with near-real-time global land ice velocities from GoLIVE, Abstract EGU2017-9491, European Geophysical Union General Assembly, Vienna, Austria, 23-28 Apr.
- 2015 Moon, T., M. Fahnestock, T. Scambos, I. Joughin, M. van den Broeke, M. Klinger, Seasonal ice flow patterns as indicators of subglacial hydrology on the Greenland Ice Sheet, Abstract C43E-08, 2015 Fall Meeting, AGU, San Francisco, Calif., 14-18 Dec.
- 2014 Moon, T., I. Joughin, B. Smith, Seasonal and interannual glacier terminus fluctuations in northwest Greenland and links to sea ice and velocity trends during the 21<sup>st</sup> century, Abstract C11E-06, 2014 Fall Meeting, AGU, San Francisco, Calif., 15-19 Dec.
- 2013 Moon, T., Patterns of glacier variability in Greenland, U.S. CLIVAR International Workshop on Greenland Ice-Ocean Interaction, Beverly, Mass., 4-7 June.
- 2012 Moon, T., I. Joughin, B. Smith, and I. Howat, 21st-century Greenland outlet glacier velocities on multiple timescales, Abstract C41E-04, 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 Dec.

#### **CONTRIBUTED ABSTRACTS (presenting author only)**

- 2017 Moon, T., D. Sutherland, D. Carroll, D. Felikson, L. Kehrl, F. Straneo, Spatiotemporally resolved fjord freshwater budget including iceberg melt, IGS Polar Ice, Polar Climate, Polar Change, Boulder, CO, 14-19 Aug.
- 2017 Straneo, F., D. Sutherland, T. Moon, G. Catania, P. Heimbach, D. Felikson, Greenland ice sheet and ocean: Connecting data, science, and scientists, EarthCube All Hands Meeting, Seattle, WA, 7-9 June.
- 2017 Moon, T., D. Sutherland, D. Carroll, L. Kehrl, F. Straneo, D. Felikson, Complete spatiotemporal freshwater flux budget for a major Greenland glacier-fjord system,

- Abstract EGU2017-3748, European Geophysical Union General Assembly, Vienna, Austria, 23-28 Apr.
- 2016 Moon, T., M. Fahnestock, T. Scambos, I. Joughin, Complex patterns of 21<sup>st</sup> century Greenland outlet glacier change, Abstract C13C-0845, 2016 Fall Meeting, AGU, San Francisco, Calif., 12-16 Dec.
- 2015 Moon, T., M. Fahnestock, I. Joughin, T. Scambos, Greenland Ice Sheet glacier motion and ice loss: New understanding of ice sheet behavior through remote sensing, Abstract GC51A-1077, 2015 Fall Meeting, AGU, San Francisco, Calif., 14-18 Dec.
- 2015 Moon, T., M. Fahnestock, T. Scambos, M. Klinger, T. Haran, Variability of seasonal Greenland glacier velocities and implications for ice sheet sensitivity to ocean and surface meltwater changes, International Symposium on Contemporary Ice-Sheet Dynamics, Cambridge, UK, 16-21 Aug.
- 2015 Moon, T., I. Joughin, T. Scambos, M. Fahnestock, M. van den Broeke, Spatial variability of distinct seasonal glacier velocity patterns and implications for Greenland Ice Sheet sensitivity to climate change, Ilulissat Climate Days, Ilulissat, Greenland, 2-5 June.
- 2015 Moon, T., M. Fahnestock, T. Scambos, M. Klinger, and T. Haran, Comprehensive spatiotemporal glacier and ice sheet velocity measurements from Landsat 8, Abstract EGU2015-2095, European Geophysical Union General Assembly, Vienna, Austria, 13-17 Apr.
- 2015 Moon, T., Recent results and products from remote sensing of ice sheet velocities, Community Earth System Model Land Ice Working Group Meeting, Boulder, Colo., 2-3 Feb.
- 2014 Moon, T., I. Joughin, B. Smith, M. van den Broeke, M. Usher, Distinct seasonal velocity patterns based on ice-sheet—wide analysis of Greenland outlet glaciers, Abstract C12B-02, 2014 Fall Meeting, AGU, San Francisco, Calif., 15-19 Dec.
- 2014 Moon, T., T. Scambos, M. Fahnestock, I. Joughin, B. Smith, T. Haran, M. Klinger, M. van den Broeke, W.J. van de Berg, and B. Noël, Observations of sea ice and ice sheet interaction in Greenland and the Antarctic Peninsula, West Antarctic Ice Sheet Workshop, Julian, Calif., 24-27 Sept.
- 2013 Moon, T., I. Joughin, and B. Smith, Sea ice/ice mélange and outlet glacier interaction in northwest Greenland, Abstract OS13D-08, 2013 Fall Meeting, AGU, San Francisco, Calif., 9-13 Dec.
- 2012 Moon, T., C. Bitz, and L. Thompson, Near-Greenland ocean conditions under RCP8.5 forcing, Abstract GC33C-1037, 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 Dec.
- 2012 Moon, T., I. Joughin, B. Smith, and I. Howat, Greenland outlet glacier velocities during 2000-2010, International Symposium on Glaciers and Ice Sheets in a Warming World, International Glaciological Society, Fairbanks, Alaska, 24-29 June.
- 2012 Moon, T., 21<sup>st</sup> century Greenland outlet glacier velocities, Earth & Space Sciences Research Gala, University of Washington.
- 2011 Moon, T., I. Joughin, B. Smith, and I. Howat, 21<sup>st</sup> century evolution of Greenland outlet glacier velocities, Abstract C11D-0702, 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec.
- 2011 Moon, T., I. Joughin, B. Smith, and I. Howat, 21<sup>st</sup> century evolution of Greenland outlet glacier velocities, Northwest Glaciology Meeting.
- 2011 Moon, T., Climate science explained: adventures in teaching climate science, Earth & Space Sciences Research Gala, University of Washington.

- 2010 Moon, T and I. Joughin, Understanding outlet glacier dynamics on the Greenland Ice Sheet, Northwest Glaciology Meeting.
- 2010 Moon, T. and I. Joughin, Understanding Mechanisms for Ice Loss from the Greenland Ice Sheet, Earth & Space Sciences Research Gala, University of Washington.
- 2007 Moon, T. and I. Joughin, Examining ice front variability for Greenland glaciers: 1992 – 2007, 2nd Graduate Climate Conference, University of Washington.
- 2006 Moon, T. and I. Joughin, Ice Front Changes on the Greenland Ice Sheet: 1992-2006, Eos Trans. AGU, 87(52), Fall Meet. Suppl., Abstract C13B-05.
- 2006 Moon, T. and I. Joughin, Terminus change on Greenland outlet glaciers, Graduate Climate Conference, University of Washington.

#### **ACADEMIC PROFESSIONAL DEVELOPMENT**

- 2017 Workshop on Ice Shelf Stability (*invited*)
- 2015 Greenland Ice Sheet Ocean Observing System (GrIOOS) Workshop (*selected participant*)
- 2015 New Generation of Polar Researchers Leadership Symposium (*selected participant*)
- 2014 Community Earth System Model Tutorial (*selected participant*)
- 2013 U.S. CLIVAR International Workshop (*invited*), *Understanding the Response of Greenland's Marine Terminating Glaciers to Oceanic and Atmospheric Forcing*
- 2012 Program on Climate Change Summer Institute, *Topic: Ice-Ocean Interaction*
- 2010 Parallel Ice Sheet Model Workshop
- 2010 Ice Sheet – Ocean Interaction, Advanced Climate Dynamics Course (*selected participant*)
- 2010 Program on Climate Change Summer Institute, *Topic: Climate Feedbacks*
- 2006 Program on Climate Change Summer Institute, *Topic: Anthropogenic CO2 Emissions: Projections, Mitigating Technologies, and Policies*
- 2005 Program on Climate Change Summer Institute, *Topic: El Nino: Past, Present, and Future*

#### **SERVICE**

- 2017 APECS Science Communication Panel
- 2016 APECS-AGU Cryosphere Career Panel
- 2016 Session convener, Glacier-ocean interactions, mechanisms, and synthesis, AGU Fall Meeting
- 2015 Review panelist, National Science Foundation
- 2014 Session convener, Understanding ice loss in coupled glacier-ocean systems through observations, modeling, and theory, AGU Fall Meeting
- 2014 – present Member, Acting Committee, Greenland Ice Sheet-Ocean Interactions (GRISO) Science Network
- 2013 – present Ad hoc proposal reviewer: US National Science Foundation, UK Natural Environment Research Council
- 2012 Science vignette contributor, Key Concepts in Geomorphology textbook
- 2010 – present Paper reviewer: Nature Climate Change; Nature Geoscience; JGR-Earth Surface; Geophysical Research Letters; The Cryosphere; Progress in Phys. Geography; Journal of Glaciology; Nature Communications; Artic, Antarctic, and Alpine Research; Oceanography; Remote Sensing

2010 – 2011 Question writer, National Science Bowl  
 2006 – 2007 Head of Planning & Logistics, Graduate Climate Conference, University of Washington

### **SCIENCE COMMUNICATION**

2017 Briefing for the Senate Arctic Caucus and Senate Ocean Caucus  
 2017 – present Skype a Scientist (e.g., classrooms in AZ, Costa Rica, GA, etc.)  
 2015 Ignite@AGU speaker  
 2015 – present Contributing scientist, Climate Feedback (climatefeedback.org)  
 2014 Speaker, STEM role model event, JASON Live  
 2014 – present Speaker, Climate Voices Science Speaker Network  
 2013 & 2014 Science Fair Judge, Ophir School District  
 2011 SciZone feature contributor, Montana State University Extended University  
 2011 Moderator, Avalanche Safety and the Dynamic Science of Snow, Big Sky Resort  
 2011 Guest lecturer, Environmental Science, Mercer Island High School  
 2010 – 2014 Science Communication Fellow, Pacific Science Center  
 2010 – 2014 Program on Climate Change Outreach Group, University of Washington  
 & 2005 – 2008  
 2010 & 2014 Polar Science Weekend, Pacific Science Center  
 2006 – 2008  
 2010 – 2012 Scientist Spotlight, Pacific Science Center (multiple times per year)  
 2008 Scientist talk, Houston Natural Science Museum

### **SCIENCE COMMUNICATION DEVELOPMENT**

2017 Metcalf Institute Science Communication Workshop  
 2015 Communication training during New Generation of Polar Researchers Leadership Symposium  
 2013 University of Washington Course: Writing about science and technology for general audiences  
 2012 Compass Science Communication Training course  
 2010 Pacific Science Center Science Communication Fellow training

### **MEDIA COVERAGE (selected)**

Ongoing Regularly provide comment for media, including print, online, audio, and video.  
 2017 *CTV News (Canada)*, Live interview on glacier loss  
 2017 *Nexus Media*, Glacier Ice Loss video feature  
 2016 *Climate Feedback*, Meet our contributors: Dr. Moon, expert in ice sheet behavior and enthusiastic science communicator  
 2015 *Big Sky Weekly*, Multipart newspaper series  
 2015 *Eos*, Building a better glacial speedometer  
 2015 *Nautilus*, How to clock a glacier

- 2013 *Society for Science and the Public*, Intel ISEF finalist Twila Moon now PhD candidate studying glacier velocity on ice sheets
- 2012 *National Public Radio All Things Considered*, Greenland's ice melting more slowly than expected
- 2012 AAAS, Sea level rise could be bad, but not as bad as some models suggest
- 2012 BBC, Data sheds light on speed of Greenland's glaciers

## TEACHING

- 2017 Guest instructor for *Glacial Geology*, Montana State University
- 2016-2017 Pre-session field trip (Year 1 undergraduates)
- (Univ. Bristol) Sea level rise modules in *World in Crisis?* (Year 1 undergraduates)
- Fundamentals of Modern Glaciology* (Year 2 undergraduates)
- Tutorials at all undergraduate levels, including Dissertations
- 2016 Lecturer, ESA Advanced Training Course on Remote Sensing of the Cryosphere, University of Leeds
- 2016 Guest instructor for *Glacial Geology*, Montana State University
- 2015 Faculty, Juneau Icefield Research Program, Alaska
- 2014 Guest lecturer, *The Arctic Climate System*, University of Colorado
- 2013 Instructor and Center for Multiscale Modeling of Atmospheric Processes Fellow, *Introduction to Global Climate Change*, Colorado College
- 2012 Guest lecturer, *Understanding Science through Imagery*, Cornish College of the Arts
- 2011 Organizer, Remote Sensing Seminar, University of Washington
- 2011 Creator & Instructor, *Climate Science Explained*, Montana State University Extended University
- 2003 – 2005 Instructor, National Outdoor Leadership School
- 2001 – 2003 Instructor, Geology 7: Stanford Outdoor Education Program
- 2001 – 2003 Co-founder & Instructor, Stanford Outdoor Outreach Program

## STUDENT MENTORING

- 2016 – present PhD co-supervisor, Jenny Maddalena, University of Bristol, Greenland mass balance from CryoSat and Sentinel 3
- 2016 – present PhD co-supervisor, Matt Trevers, University of Bristol, Modeling of calving processes informed by observations
- 2016 Visiting undergraduate researcher, Anna Covey, University of Southampton