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EDUCATION

The Ohio State University Columbus, OH
Ph.D. Earth Sciences August 2013
Advisor: Dr. Ian Howat
Dissertation: Observations and modeling of Greenland outlet glacier dynamics

The Ohio State University Columbus, OH
M.S. Geological Sciences March 2010
Advisor: Dr. Ian Howat
Thesis: Controls on west Greenland outlet glacier sensitivity to climate forcing

Lehigh University Bethlehem, PA
B.S. Environmental Science January 2008
Advisor: Dr. Joan Ramage Macdonald
Honors Thesis: Landsat TM and ETM+ derived snowline altitudes in the Cordillera Huayhuash and Cordillera Raura, Peru, 1986-2005

AT A GLANCE

- Research Assistant Professor at the University of Maine
- Studies marine-terminating glacier dynamics and ice-ocean interactions using a suite of remotely sensed data, in situ observations, and numerical ice flow models
- 9 peer-reviewed publications, 7 as first-author
- Awarded 2 NASA grants totaling $349,654 & a $172,086 NSF grant, all as PI
- Experience teaching introductory Earth Science, Geomorphology, and Glaciology
- Actively involved in outreach activities, including numerous high school presentations and service as a council member for the Association of Polar Early Career Scientists

RESEARCH INTERESTS

- Understanding variability in the response of glaciers to climate change
- Ice-ocean interactions & how changes in the interactions can trigger glacier change
- Predicting glacier behavior using numerical ice flow modeling & remote sensing techniques
- Relative influence of internal and external controls of tidewater glacier behavior

GRANTS

Awarded

- NASA Earth and Space Sciences Fellowship (2010-2013), *Observations and modeling of Greenland outlet glacier dynamics*, $90,000, 3 years, Co-PI: Ian Howat (OSU/BPRC)
- NASA Research Opportunities in Space and Earth Sciences (4/23/14-4/22/16): Cryospheric Science, *Intra-annual Force Balance Analysis of Tidewater Glaciers*, $259,654, 2 years, Co-PI: Evan Burgess (USGS & UAlaska Fairbanks)
- NSF Arctic Research Opportunities (8/15/14 – 8/14/16), *Quantifying Greenland Iceberg Melt Rates using Remotely-sensed Data*, $172,372, 2 years, Co-PI: Gordon Hamilton (UMaine)

In Review

- NSF Arctic Research Opportunities (7/1/15 – 6/30/17), *Validation of Calving Laws for Greenland's Tidewater Glaciers*, $192,473, 2 years, Co-PI: Tim Bartholomaus (UTexas)

PUBLICATIONS (*née E. M. McFadden)

Enderlin, E.M. & G.S. Hamilton, 2014. Estimates of iceberg submarine melting from high-resolution digital elevation models: Applications to Sermilik Fjord, East Greenland. *J. Glaciol*., **60**(224), doi:10.3189/2014JoG14J085.

Enderlin, E. M., I. M. Howat, S. Jeong, M.-J., Noh, J. H. van Angelen, & M. R. van den Broeke, 2014. An improved mass budget for the Greenland ice sheet. *Geophys. Res. Lett.*, 866-872, doi: 10.1002/2013GL059010.

Enderlin, E. M., I. M. Howat, & A. Vieli, 2013. The sensitivity of tidewater glacier flowline models to parameter uncertainty. *Cryosphere*, *7*, 1579-1590, doi:10.5194/tc-7-1579-2013.

Enderlin, E.M., I.M. Howat, & A. Vieli, 2013. High sensitivity of tidewater glacier dynamics to shape. *Cryosphere*, **7**, 1007-1015, doi:10.5194/tc-7-1007-2013.

Enderlin, E. M. & I. M. Howat, 2013. Submarine Melt Rate Estimates for Floating Termini of Greenland Outlet Glaciers (2000-2010). *J. Glaciol.*, **59**(213), 67-75, doi:10.3189/2013JoG12J049.

Walsh, K. M., I. M. Howat, Y. Ahn, & **E. M. Enderlin**, 2012. Changes in the marine-terminating glaciers of central east Greenland, 2000-2010. *Cryosphere* **6,** 211-220, doi:10.5194/tc-6-211-2012.

***McFadden, E. M.**, I. M. Howat, I. Joughin, B. E. Smith, & Y. Ahn, 2011. Changes in the dynamics of marine-terminating outlet glaciers in west Greenland (2000-2009). *J. Geophys. Res.*, **116**(F2), F02022, doi:10.1029/2010JF001757.

***McFadden, E. M.**, J. Ramage, & D. T. Rodbell, 2011. Landsat TM and ETM+ derived snowline altitudes in the Cordillera Huayhuash and Cordillera Raura, Peru, 1986-2005. *Cryosphere*, **5**, 419-430, doi:10.5194/tc-5-419-2011.

Howat, I. M., J. E. Box, Y. Ahn, A. Herrington, & ***E. M. McFadden**, 2010. Seasonal variability in the dynamics of marine-terminating outlet glaciers in Greenland. *J. Glaciol*ogy **56**(198), 601-613.

RESEARCH EXPERIENCE

University of Maine Orono, ME
Research Assistant Professor November 2014 – present

- Constructing force balance time series from high-resolution DEMs and synthetic aperture radar (SAR)-derived surface flow speeds to examine short-term variations in glacier dynamics at Columbia Glacier, Alaska and Helheim Glacier, East Greenland
- Comparing glacier force balance time series with environmental forcing datasets to determine the optimal spatial and temporal sampling intervals for future glacial studies
- Constructing iceberg submarine freshwater fluxes and area-averaged melt rates for ~12 of Greenland's large glacial fjords using high-resolution digital elevation models (DEMs)
- Assessing spatio-temporal variations in iceberg freshwater fluxes and melt rates and the importance of differences in iceberg geometry, iceberg motion, and fjord hydrography

University of Maine Orono, ME
Postdoctoral Research Associate August 2013 – October 2014

- Developed a remote sensing method to estimate iceberg submarine freshwater fluxes and area-averaged melt rates using high-resolution DEMs
- Compared remote sensing-derived iceberg melt estimates for Sermilik Fjord, East Greenland and Ilulissat Fjord, West Greenland to assess the controls of iceberg melting
- Constructed high-resolution DEMs for Columbia Glacier, Alaska and Helheim Glacier, East Greenland for use in a comparative force balance analysis

The Ohio State University Columbus, OH
NASA Earth and Space Science Fellow September 2010 - August 2013

- Used satellite-derived digital elevation models and surface speeds to construct annual grounding line discharge time series for 178 tidewater glaciers in Greenland for 2000-2012
- Compared changes in glacier discharge to the difference between accumulation and ablation (i.e., surface mass balance) for the Greenland ice sheet in order to quantify ice sheet mass loss and the assess the changes in mass loss partitioning since 2000
- Estimated average melt season submarine melt rates beneath the floating termini of 13 tidewater glaciers in Greenland to quantify mass loss from submarine melting
- Developed a one-dimensional numerical ice flow (i.e., flowline) model in Matlab for analysis of tidewater glacier behavior
- Assessed the influence of fjord geometry on glacier behavior in response to an environmental perturbation using a flowline model
- Investigated glacier sensitivity to variations in effective viscosity using a numerical ice flow model to improve the validity of prognostic models of glacier dynamics

The Ohio State University Columbus, OH
Graduate Research Assistant June 2008 - September 2010

- Analyzed changes in terminus positions and surface elevations for 59 tidewater outlet glaciers in west Greenland using satellite imagery obtained from 2000-2009
- Examined West Greenland tidewater glacier terminus position, speed, and elevation changes from 2000-2009 to determine the magnitude and timing of changes in glacier dynamics
- Compared West Greenland glacier behavior, air temperature, and ocean temperature records from 2000-2009 to assess the influence of climate forcing on glacier behavior
- Assisted a Masters student with analyzing terminus positions, surface elevations, and speeds for tidewater glaciers in east Greenland

Lehigh University Bethlehem, PA
Undergraduate Research Assistant June 2005 - May 2008

- Determined the location of modern snowlines in the Cordillera Huayhuash and Cordillera Raura, Peru using satellite imagery
- Inferred regional air temperature change in the central Peruvian Andes from the mid-1980s to early 2000s using snowline data

FIELD EXPERIENCE

McMurdo Shear Zone, Antarctica October 2014
PI: Dr. Gordon Hamilton (UMaine)

- Produced surface ice flow velocity grids using automated feature-tracking techniques to determine the optimal locations to perform geophysical surveys of buried crevasses
- Installed and repeatedly surveyed a stake network with high-precision GPS units in order to construct strain rate grids for stability analysis of the McMurdo Shear Zone

Helheim Glacier-Sermilik Fjord, Greenland July 2014
PI: Dr. Gordon Hamilton (UMaine)

- Deployed and retrieved high-precision GPS units on the highly-crevassed Helheim Glacier terminus with Gordon Hamilton (UMaine) and an undergraduate assistant via helicopter to provide precisely-located reference points for scanning lidar observations of ice motion
- Conducted expendable conductivity, temperature, and depth (XCTD) surveys in open-ocean leads in the Sermilik Fjord ice mélange via helicopter for oceanographer colleagues
- Worked with helicopter pilots to select icebergs for 'iceberg tracker' GPS unit deployment for collaborator Dave Sutherland (UOregon)
- Installed an automated weather station near the Helheim terminus with colleagues from the US Army Cold Regions Research and Engineering Laboratory

Jokulsarlon Lagoon, Iceland April 2012
PI: Dr. Ian Howat (OSU)

- Supervised field program preparation and provided logistical support for a Masters student in the OSU Glaciology group
- Collected along- and across-lagoon conductivity, temperature, and depth (CTD) surveys in Jokulsarlon lagoon (adjacent to Breiðamerkurjökull Glacier) for estimates of glacier submarine melting
- Serviced a tide gauge & added a wind turbine to a time-lapse camera unit positioned in close proximity to the actively calving portion of the Breiðamerkurjökull terminus

Russell Glacier and Jakobshavn Isbræ, Greenland July 2010
Co-I: Dr. Ian Howat (OSU), Dr. Paul Morin (University of Minnesota)

- Collected high-precision on- and off-ice static GPS points with colleagues from the U. Minnesota Polar Geospatial Center and post-processed data for high-resolution DEM coregistration
- Assessed safety conditions while collecting GPS data on a highly-crevassed glacier terminus

Breiðamerkurjökull Glacier, Iceland March 2008, June 2008, April 2009
PI: Dr. Ian Howat (OSU)

- Installed 12 high-precision GPS stations on the glacier terminus and an off-ice GPS base station used for surface velocity and strain rate calculations during the melt season
- Assisted in the acquisition of ice-penetrating radar observations used to estimate ice thickness and ice-bed interface properties within the GPS grid
- Serviced GPS stations to ensure that battery power was maintained and solar panels were secured and properly functioning

Quelccaya Ice Cap and Hualcan Glacier, Peru June 2008
PI: Dr. Lonnie Thompson (OSU)

- Collected paleo plant samples that emerged from the reteating Quelccaya Ice Cap, which provided a minimum date for the last period of reduced ice extent
- Assisted in snowpit sampling and shallow ice core collection for ice core drill site reconnaissance on Hualcan Glacier

Cordillera Huayhuash, Peru June 2005
PI: Dr. Joan Ramage Macdonald (Lehigh)

- Collected quartzite samples for cosmogenic isotope analysis for constraining regional Last Glacial Maximum deglaciation dates

ABSTRACTS (*née E. M. McFadden)

Talks

Enderlin, E. M., G. S. Hamilton, F. Straneo, & C. Cenedese, 2014. Submarine Melting of Icebergs from Repeat High-Resolution Digital Elevation Models. *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C32B-03.

Enderlin, E. M., I. M. Howat, M.-J. Noh, M. R. van den Broeke, & J. van Angelen, 2014. An Improved Mass Budget for the Greenland Ice Sheet. *IASC Workshop on the Dynamics and Mass Budget of Arctic Glaciers & Network on Arctic Glaciology Annual Meeting.*

Enderlin, E. M., I. M. Howat, M.-J. Noh, M. R. van den Broeke, & J. van Angelen, 2013. An Improved Mass Budget for the Greenland Ice Sheet. *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C31C-01.

Enderlin, E. M., 2013. Submarine melt rates for Greenland outlet glaciers. *Program for Regional Climate Assessment (PARCA),* NASA Polar Initiative Meeting.

Enderlin, E. M., 2012. Do Variations in Outlet Width Influence Dynamic Sensitivity? *Tidewater Glaciers Workshop, Svalbard, Norway.*

Enderlin, E. M., 2012. Observations and Modeling of Greenland Outlet Glacier Dynamics. *Program for Regional Climate Assessment (PARCA),* NASA Polar Initiative Meeting.

Enderlin, E. M., I. M. Howat, & A. Vieli, 2012. Assessing Glacier Sensitivity to Differences in Outlet Width Using a Numerical Ice Flow Model. *Stability and Variations in Arctic Land Ice (SVALI) Ph.D. Workshop.*

***McFadden, E. M.**, I. M. Howat, & A. Vieli, 2011. Assessing How Marine-Terminating Glacier Geometry Controls Dynamic Sensitivity to Calving Using a Numerical Ice Flow Model. *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C31C-06.

***McFadden, E. M**., I. M. Howat, Y. Ahn, I. R. Joughin, B. E. Smith, & W. Maslowski, 2010. West Greenland Outlet Glacier Sensitivity (2000-2009). *International Symposium of Earth's Disappearing Ice: Drivers, Responses and Impacts*, *Int. Glac. Soc.* Abstract 59A005.

***McFadden, E. M.**, I. M. Howat, Y, Ahn, I. R. Joughin, & W. Maslowski, 2009. West Greenland Outlet Glacier Sensitivity (2000-2009). *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C11A-06.

***McFadden, E. M.**, I. M. Howat, Y. Ahn, & I. Joughin, 2008. Controls on Greenland Outlet Glacier Sensitivity to Climate Forcing: A Comparative Approach. *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C32B-05.

Posters

Enderlin, E. M. & I. M. Howat, 2013. Re-examining the timing and magnitude of recent dynamic changes in NW Greenland, *U.S. CLIVAR Workshop: Understanding the response of Greenland's marine-terminating glaciers to oceanic and atmospheric forcing*.

Enderlin, E. M., I. M. Howat, & A. Vieli, 2012. High sensitivity of tidewater glacier dynamics to shape, *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C23C-0662.

Enderlin, E. M., I. M. Howat, & A. Vieli, 2012. Assessing Glacier Sensitivity to Differences in Outlet Width Using a Numerical Ice Flow Model. *Glaciers and Ice Sheets in a Warming Climate, Int. Glac. Soc.* Abstract 63A253.

***McFadden, E. M.** & I. M. Howat, 2011. Assessing Geometric Controls on Tidewater Glacier Dynamics Using a Numerical Ice Flow Model. *International Symposium on Interactions of Ice Sheets and Glaciers with the Ocean, Int. Glac. Soc.* Abstract 60A011.

***McFadden, E. M.** & I. M. Howat, 2010. Assessing Geometric Controls on Tidewater Glacier Sensitivity to Frontal Perturbations Using a Numerical Ice Flow Model. *Eos Transactions AGU*, Fall Meet. Suppl. Abstract C23B-0616.

TEACHING INTERESTS

- Cryosphere-Climate Interactions
- Remote Sensing
- Climatology & Paleoclimatology
- Geomorphology
- Introductory Earth & Environmental Sciences

TEACHING EXPERIENCE

Instructor ERS602 Spring 2015

Glaciology Seminar

- Developing a graduate-level Glaciology seminar
- Course structure: 1.5-hour class per week, 1 credit-hour
    - Introductory lecture on a selected topic (e.g., subglacial hydrology, glacier dynamics)
    - 30 minute student presentation of topical peer-reviewed journal articles
    - Mediated discussion on assigned readings & additional lecture (as necessary)

Substitute Lecturer ES121 September 2012

The Dynamic Earth

- Lectured on mineral identification, silicate structure, magma, and igneous rocks to ~150 students enrolled in an introductory Earth Sciences course at The Ohio State University

Lab Instructor ES550 Spring 2011, Spring 2012
Geomorphology

- Developed 9 new 2-hour laboratory exercises designed for a class of ~25 undergraduate Earth Science majors and non-majors at The Ohio State University
- Revised laboratory exercised annually to improve the quality of student learning
- Taught introductory material for laboratory exercises using illustrations, demonstrations, and examples to ensure students were prepared with the appropriate background knowledge
- Assisted students with questions throughout laboratory exercises by providing one-on-one instruction on difficult concepts or exercises
- Encouraged student participation in laboratory exercises by varying the type of activity (computer-based vs. hands-on) and by developing a good rapport with students
- Conducted anonymous surveys regarding course content and the effectiveness of my teaching

Student EduPL 894.32 Winter 2012
Higher Education Group Study: Course Design

- Attended weekly 3-hour lectures on course design using the backwards design principle
- Applied backwards design to the development of an undergraduate Geomorphology course open to Earth Sciences majors and students from other disciplines
- Developed a Geomorphology course description and course syllabus used to convey the course goals and objectives to administrators and students, respectively
- Created a major scaffolded assignment and grading rubric for the Geomorphology course

HONORS

- **Distinguished Senior Ph.D. Student Award,** The Ohio State University, 2013
- **Michael Johnson Graduate Scholarship**, The Ohio State University, 2012
- **NASA Earth and Space Sciences Fellowship**, The Ohio State University, 2010-2013
- **Rick Toracinta Graduate Scholarship**, The Ohio State University, 2010
- **University Fellowship**, The Ohio State University, 2008-2009
- **Foster Hewett Senior Undergraduate Award**, Lehigh University, 2008
- **Rhodes Scholarship Nominee**, Lehigh University, 2008
- **Presidential Scholar**, Lehigh University, 2008
- **Class of 1904 Scholarship**, Lehigh University, 2007-2008
- **Eckardt College Scholar**, Lehigh University, 2004-2008

PROFESSIONAL SERVICE AND OUTREACH

- **Peer-reviewer**: Geophysical Research Letters; Journal of Geophysical Research; Geology; Inverse Problems; Journal of Glaciology; The Cryosphere; Arctic, Antarctic, and Alpine Research; Earth and Planetary Science Letters
- **Undergraduate Research Supervisor/Mentor**, University of Maine, 2014-2015 academic year
- **Session Convener** ("Glacier-Ocean Interactions: Iceberg Calving & Submarine Melting"), American Geophysical Union Fall Meeting, 2014
- **Co-convener**, Association of Polar Early Career Scientists Cryosphere Career Development Panel, American Geophysical Union Fall Meeting, 2013 & 2014
- **Keynote alumni presentation** ("Glaciers Gone Wild: Rapid Changes in Greenland Glacier Behavior Initiated at the Ocean's Edge"), Earth and Environmental Science Department, Lehigh University, April 2014
- **Guest speaker**, 12th grade Physics, Ellsworth High School, March 2014
- **Co-convener**, Getting out in the Field as a Skill Workshop, American Geophysical Union Fall Meeting, 2013
- **Council Member**, Association of Polar Early Career Scientists (APECS), 2013-present
- **OSU Glaciology Group Outreach Coordinator/Chair**, 2011- 2013
- **Prospective Graduate Student Coordinator**, School of Earth Sciences, The Ohio State University, 2013
- **Graduate Student Representative**, School of Earth Sciences Activity Committee, The Ohio State University, 2012 - 2013
- **Graduate Student Representative**, School of Earth Sciences Diversity Committee, The Ohio State University, 2012 - 2013
- **School of Earth Sciences Graduate Student Representative**, The Ohio State University Council of Graduate Students, 2011 - 2012
- **Guest speaker**, 8th grade Earth Science & 9th grade Physical Science, 2011
- **Guest speaker**, Columbus Ohio Center of Science and Industry, December 2011
- **Climate Change Interviewee**, NBC4 Columbus, April 2010
- **Water, Climate, and the Environment Division Representative**, School of Earth Sciences Graduate Studies Committee, 2009 – 2010

WORKSHOPS

- **Tidewater Glaciers Workshop 2012** (selected participant), Svalbard, Norway, August 2012
- **Stability and Variations in Arctic Land Ice Ph.D. workshop**, Applications of radar data from ice sheets to understand ice flow processes, Copenhagen, Denmark, March 2012
- **Karthaus Summer School on Ice Sheets and Glaciers in the Climate System** (selected participant), Karthaus, Italy, September 2009

PROFESSIONAL AFFILIATIONS

- American Geophysical Union
- European Geosciences Union
- International Glaciological Society
- Association of Polar Early Career Scientists
- Earth Science Women's Network
- Phi Beta Kappa
- Sigma Xi