

DAVID A. LILIEN

Research Associate

Centre for Earth Observation Science, University of Manitoba
+1 204-506-0680 david.lilien@umanitoba.ca

EDUCATION

PhD in Earth and Space Sciences 2019
University of Washington, Seattle, WA
Dissertation title: *Understanding Antarctic ice-stream flow using ice-flow models and geophysical observations*
Supervisor: Ian Joughin

BS in Physics and Mathematics 2013
Yale University, New Haven, CT

ACADEMIC APPOINTMENTS

Research associate 2021—present
Centre for Earth Observation Science, University of Manitoba

Postdoctoral researcher 2019—2021
Physics of Ice, Climate, and Earth, Niels Bohr Institute, University of Copenhagen

RESEARCH INTERESTS

I study the dynamics of ice streams and outlet glaciers in Antarctica and Greenland. My technical expertise is in ice-flow modeling and ice-penetrating radar methodology. I am most interested in new ways to use radar to improve numerical models of ice streams and outlet glaciers.

FELLOWSHIPS

NASA Earth and Space Sciences Fellow 2015—2018
3 years stipend, portion of tuition

University of Washington Program on Climate Change Fellow 2013
9 months stipend

PUBLICATIONS

Grinsted, A, CS Hvidberg, **DA Lilien**, NM Rathmann, NB Karlsson, TA Gerber, HA Kjær, P Vallelonga, and D Dahl-Jensen (2022). Accelerating ice flow at the onset of the Northeast Greenland Ice Stream. *Nature Communications*. **13**, 5589. (doi:10.1038/s41467-022-32999-2)

Rathmann, NM, and **DA Lilien** (2022). On the nonlinear viscosity of the orthotropic bulk rheology. *Journal of Glaciology*, 1-6. (doi:10.1017/jog.2022.33).

Rathmann, NM, **DA Lilien**, A Grinsted, TA Gerber, TJ Young, and D Dahl-Jensen (2022). On the Limitations of Using Polarimetric Radar Sounding to Infer the Crystal Orientation

Fabric of Ice Masses. *Geophysical Research Letters*. **49**, e2021GL096244, (doi:10.1029/2021GL096244).

Lilien, DA, NM Rathmann, CS Hvidberg, and D Dahl-Jensen (2021). Modeling ice-crystal fabric as a proxy for ice-stream stability. *Journal of Geophysical Research: Earth Surface*. **126**, e2021JF006306. (doi:10.1029/2021JF006306)

Rathmann, NM, and **DA Lilien** (2021). Inferred basal friction and mass flux affected by crystal-orientation fabric. *Journal of Glaciology*. (doi:10.1017/jog.2021.88)

Lilien, DA, D Steinhage, D Taylor, F Parrenin, C Ritz, R Mulvaney, C Martín, JB Yan, C O'Neill, M Frezzotti, H Miller, P Gogineni, D Dahl-Jensen, and O Eisen (2021). New radar constraints support presence of ice older than 1.5 Myr at Little Dome C. *The Cryosphere*. **15**(4), 1881–1888 (doi:10.5194/tc-15-1881-2021).

Rathmann, NM, CS Hvidberg, A Grindsted , **DA Lilien**, and D Dahl-Jensen (2021). Effect of a nonlinear grain rheology on polycrystalline directional enhancement factors. *Journal of Glaciology*. **67**(263), 569-575 (doi:10.1017/jog.2020.117).

Lilien, DA, B Hills, J Driscoll, R Jacobel, and K Christianson (2020). ImpDAR: An open-source impulse radar processor. *Annals of Glaciology*. **81**(61), 114-123 (doi:10.1017/aog.2020.44).

Fudge, TJ, **DA Lilien**, M Koutnik, H Conway, CM Stevens, ED Waddington, EJ Steig, AJ Schauer, and N Holschuh (2020). Advection and non-climate impacts on the South Pole Ice Core. *Climate of the Past*. **8**, 819-832, (doi:10.5194/cp-16-819-2020).

Lilien, DA, I Joughin, B Smith, and N Gourmelen (2019). Melt at grounding line controls observed and future retreat of Smith, Pope, and Kohler Glaciers, *The Cryosphere*. **13**, 2817–2834 (doi:10.5194/tc-13-2817-2019).

Holschuh, N, **DA 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**(14), (doi:10.1029/2019GL083436).

Lilien, DA, TJ Fudge, MR Koutnik, H Conway, EC Osterberg, DG Ferris, ED Waddington, and CM Stevens (2018). Holocene Ice-Flow Speedup in the Vicinity of the South Pole. *Geophysical Research Letters*. **45**(13), 6557–6565 (doi:10.1029/2018GL078253).

Lilien, DA, I Joughin, B Smith, and DE Shean (2018). Changes in flow of Crosson and Dotson ice shelves, West Antarctica, in response to elevated melt. *The Cryosphere*. **12**, 1415–1431 (doi:10.5194/tc-12-1415-2018).

Poinar, K, I Joughin, **D Lilien**, L Brucker, L Kehrl, and S Nowicki, (2017). Drainage of Southeast Greenland firn aquifer water through crevasses to the bed. *Frontiers in Earth Science*, **5**(5), (doi:10.3389/feart.2017.00005).

Wasik, BR, SF Liew, **DA Lilien**, A Dinwiddie, H Noh, H Cao, & A Monteiro (2014). Artificial selection for structural color on butterfly wings and comparison with natural evolution. *PNAS*, 1402770111 (doi:10.1073/pnas.1402770111).

MANUSCRIPTS ACCEPTED, SUBMITTED, AND IN PREPARATION

*denotes student first author

Rathmann, NM, A Grinsted, K Mosegaard, **DA Lilien**, J Westhoff, CS Hvidberg, D Prior, F Lutz, R Thomas, D Dahl-Jensen. Elastic plane-wave propagation in textured polycrystals: inferring physical properties of glacier ice. Accepted at *Proceedings of the Royal Society A*.

Gerber, TA*, **DA Lilien**, et al., Crystal fabric anisotropy causes directional hardening of the Northeast Greenland Ice Stream. In review at *Nature Communications*.

Lilien, DA, NM Rathmann, CS Hvidberg, A Grinsted, MR Ershadi, R Drews, and D Dahl-Jensen. Simulating complex fabrics in a large-scale, anisotropic ice-flow model: application to Dome C, East Antarctica. In review at *Journal of Glaciology*.

Lilien, DA, NM Rathmann, CS Hvidberg, A Grinsted, and D Dahl-Jensen. The roles of temperature and fabric in localizing ice-stream shear margins. In prep.

Voss, K*, K Alley, **DA Lilien**, and D Dahl-Jensen. The Role of Terminus Conditions in the Ice-Flow Speed of the Upernavik Isstrøm. In prep.

Chung, A*, F Parrenin, D Steinhage, R Mulvaney, D Taylor, **DA Lilien**, C Ritz, M Cavitte, C Martin, C O'Neill, P Gogineni, H Miller, D Dahl-Jensen, and O Eisen. Stagnant ice and age modelling in the Dome C region, Antarctica. In prep.

Dmitrenko, I, SA Kirillov, B Rudels, NX Geilfus, J Ehn, DG Babb, **DA Lilien**, and D Dahl-Jensen. Modification of Pacific water in the western Canadian Arctic. In prep.

Stevens, CM, **DA Lilien**, TJ Fudge, M Koutnik, H Conway, B Horlings, and ED Waddington. Deriving a firn compaction model for South Pole based on strain measurements. In prep.

CONFERENCE PAPERS

Knerr, N, D Taylor, S Gogineni, **D Lilien**, D Steinhage, D Dahl-Jensen, H Miller, and O Eisen (2022). Processing and Analysis of Radar Data to Map Layers Near the Bed to Determine Optimum Ice Core Site. *IGARSS 2022 IEEE International Geoscience and Remote Sensing Symposium*, 4182–4184. (doi:10.1109/IGARSS46834.2022.9884035)

SF Liew, **D Lilien**, H Noh, H Cao, BR Wasik, AJ Dinwiddie, and A Monteiro (2014). Artificial selection for structural color on butterfly wings and comparison to natural evolution. *Conference on Lasers and Electro-Optics (CLEO) - Laser Science to Photonic Applications*. 1-2.

FIELD EXPERIENCE

EastGRIP, Greenland

2022

Worked on extensive radar survey using two new, state-of-the-art radars. Led radar

operation and data processing, co-led survey design. Work included supervision of two PhD students while in the field.

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| Little Dome C, Antarctica | 2019 |
| Part of a 3-person radar team surveying to select the location of the Beyond EPICA Oldest Ice core. Led data processing, assisted in data collection and survey design. | |
| South Pole, Antarctica | 2016—2019 |
| Three seasons on an NSF-sponsored project at South Pole Station and in the deep field. Led extensive high frequency radar survey. Co-led shallow-core and GPS survey. Assisted in drilling operations and firn densification instrument installation. | |
| Mt. Baker and Mt. Rainier, WA | 2015—2018 |
| Assisted with various 1-2 day surveys using Lidar, ground-based interferometric radar, and GPS on Easton, Coleman, and Nisqually glaciers. | |

SERVICE

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| Reviewer for <i>The Cryosphere</i> , <i>Nature Geoscience</i> , <i>JGR: Earth Surface</i> , <i>Journal of Glaciology</i> , and for German polar airtime applications | |
| Participant, NASA DEBRIS mission design workshop | 2022 |
| Graduate student representative on first-year PhD exam committees | 2017—2018 |
| Graduate student representative on student awards committee | 2018 |

TEACHING EXPERIENCE

MENTOR FOR GRADUATE STUDENTS

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| Kelsey Voss, UoM – MSc student, advising on glacier modeling | 2021—present |
| Niels Nymand, UCPH – PhD student, advising on radio echo sounding | 2021—present |
| Debanshu Banjaree, UoM – PhD student, advising on glacier modeling | 2022—present |

MENTOR FOR UNDERGRADUATES

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| Ian Lee – remote sensing of Nivlisen Ice Shelf | 2015 |
| Joshua Driscoll – automatic layer picking for radar | 2018—2019 |

TEACHING ASSISTANT

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| UW ESS 451: <i>Principles of glaciology</i> | 2015 |
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GUEST LECTURES

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| Open source software in the geosciences: lessons from ImpDAR. for University of Washington summer interns in glaciology | 2022 |
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ImpDAR: an open-source radar processor for University of Maine graduate students	2022
Substitute lecturer for University of Washington ESS 431, 1 class	2018

PRESENTATIONS

- “Ice-crystal fabric: inference from radar and why it matters.” *DEBRIS Workshop*. September, 2022. Invited.
- “Modeling ice-crystal fabric as a proxy for ice-stream stability.” Poster. *AGU Fall meeting*. December, 2020.
- “Modeling ice-crystal fabric as a proxy for ice-stream stability.” *University of Tübingen/Alfred Wegner Institute structural geology seminar*. November, 2020. Invited.
- “Melt at grounding line controls observed and future retreat of Smith, Pope, and Kohler Glaciers.” *EGU General Assembly*. May 2020. Highlight talk.
- “Using ice-flow models to understand and contextualize modern ice-stream retreat.” *University of Wisconsin Weeks lecture*. February 2020. Invited.
- “Modeled temperature and basal shear stress of NEGIS and implications for surge mechanics of Storstrømmen.” *EastGRIP Steering Meeting*. November 2018.
- “Elevated melt causes varied response of Crosson and Dotson Ice Shelves.” *West Antarctic Ice Sheet Workshop*. October 2017.
- “Modeling the influence of melt and buttressing on the recent speedup of Smith Glacier.” *International Symposium on the Interaction of Glaciers and Ice Sheets with the Ocean*. July 2016.
- “Quantifying Uncertainty in Inferred Viscosity and Basal Shear Stress Over Ice Streams.” Poster. *AGU Fall Meeting*. December 2015.
- “Modeling ocean-forced changes in Smith Glacier, West Antarctica.” Poster. *AGU Fall Meeting*. December 2014.

OUTREACH

Organizer, glaciology display, Polar Science Weekend, Pacific Science Center	2015—2018
Volunteer, University of Washington Rockin’ Out	2013—2019

COMPUTER SKILLS

Proficient: Python, Git, Bash, Elmer/Ice, Fortran, QGIS
Familiar: Matlab, C, Slurm, Torque

PROFESSIONAL AFFILIATIONS

International Glaciological Society
American Geophysical Union
European Geosciences Union