Ian A. Raphael

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Education

Expected 2024 **Ph.D.** Sensor systems engineering
Advised by Professors Donald Perovich and Christopher Polashenski
Thayer School of Engineering at Dartmouth College

2018 **B.A.** with high honors, Earth and Computer Science
Honors thesis: Quantifying volumetric change of Athabasca Glacier in the 20th & 21st centuries.
Advised by Professor Robert Hawley
Dartmouth College

Research Experience

2019–present **Graduate research assistant**, Thayer School of Engineering, Hanover, NH
Measuring and modeling Arctic sea ice mass balance and energy fluxes in the Arctic ice–ocean–atmosphere system. Measuring Arctic upper ocean boundary-layer characteristics. Designing embedded, autonomous instrument networks and analog sensors for measuring sea ice, snow, and upper ocean properties.

2016–2019 **Research assistant**, Dept. of Earth Sciences, Dartmouth College, Hanover, NH
Measuring and projecting volume change of Athabasca Glacier, Jasper NP, AB, Canada.

2017–2018 **Research assistant**, Volunteers in Medicine of the Olympics, Port Angeles, WA
Determining the efficacy of local hepatitis treatment clinics.

Field Experience

2023 **Field scientist**, ArcWatch 1 Expedition, Central Arctic Ocean (60 days at sea)
Deployed autonomous ice mass balance buoys and snow observation network. Conducted snow and sea ice physical characterization surveys at 11 ice stations.

2023 **Field scientist**, Deadhorse/Prudhoe Bay, AK, USA
In a team of three, deployed ice mass balance buoys in the Beaufort Gyre from a fixed-wing, single-engine airplane over two days in early March.

2022 **Field scientist**, Utqiaġvik, AK, USA
Led a seven day field campaign in November 2022 studying thin sea ice thermomechanical processes in Elson Lagoon. Mentored a junior graduate student in preparing for and executing a field

campaign in challenging early-season conditions.

2019–2020 **Field scientist**, MOSAiC Expedition, Central Arctic Ocean (305 days at sea)
Scientist on the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) for eleven months (Legs 1, 2, and 4). Responsible for designing and conducting ice mass balance, snow surface scanning, and upper ocean surveys. Installed and maintained a network of ice dynamics and mass balance instrumentation. Aided in installing, maintaining, and recovering expedition infrastructure and equipment.

2017–2019 **Volunteer field technician**, Olympic National Park, National Park Service, Port Angeles, WA
Seasonal field technician with the National Park Service. Helped plan and conduct multiple 3-7 day backcountry field surveys in the Olympic National Park wilderness, including alpine lake and snow surveys as well as intertidal ecology surveys.

2016–2019 **Senior thesis research**, Athabasca Glacier, Jasper NP, AB, Canada
Designed and conducted yearly Radio Echo Sounding (RES) surveys of Athabasca Glacier to determine the volume and volume trends of the lower Athabasca Glacier.

Teaching Experience

2023 **FYREE mentor**
Mentored an undergraduate engineering student in an independent research project through the FYREE (First Year Research Experience in Engineering) program.

Summer 2022 **Graduate Teaching Fellow**, Joint Science Education Project (JSEP)
Designed and delivered a week-long Arctic Science education curriculum to a cohort of American, Greenlandic, Danish, and Faroese high school students. Facilitated an independent research project conducted by a small group of students focused on understanding the physical processes influencing ice sheet surface melt.

Winter 2019 **Private Tutor**, English as a Second Language (TutorOut Inc.)
Taught curriculum-based ESL course to international, elementary-aged students.

Fall 2019 **Teaching Assistant**, Glaciology field course (Dept. of Earth Sciences, Dartmouth College)
Assisted in teaching geophysical survey theory/techniques, glacier travel, geological mapping.

Fall 2018 **Undergraduate Teaching Assistant**, Glaciology field course (Dept. of Earth Sciences, Dartmouth College)
Assisted in teaching geophysical survey theory/techniques, glacier travel.

2016–2018 **Climbing Instructor**, Intermediate and Advanced Rock Climbing (Outdoor Programs Office, Dartmouth College)
Taught sport and traditional technical rock climbing and self rescue.

Fall 2017 **Undergradute Teaching Assistant**, Earth Sciences 1: How the Earth Works (Dept. of Earth Sciences, Dartmouth College)
Assisted in lab lectures, led field exercises.

Community Engagement

2021 **Invited panelist**, Florida National Ocean Science Bowl career panel

2019 Field demonstrations for APECS MOSAiC School

Grants, Honours & Awards

2024 Most outstanding presentation, *Research in progress seminar, Thayer School of Engineering, Dartmouth College*.

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2023 MOSAiC Conference ECR Award ($1,400), *MOSAiC Consortium*

2022 NDSEG Graduate Fellowship ($306,000), *DoD National Defense Science and Engineering Graduate Fellowship (NDSEG)*

2021–2022 JSEP Graduate Fellowship ($6,000), *NSF Joint Science Education Project (JSEP), Dickey Center for International Understanding, Dartmouth College*

2021 MOSAiC Conference ECR Award ($500), *MOSAiC Consortium*

2019 George Austin Colligan Fellow, *Thayer School of Engineering, Dartmouth College*

2018 Departmental High Honors, *Department of Earth Science, Dartmouth College*

2018 Sigma Xi Nominee, *Sigma Xi Scientific Research Honor Society, Dartmouth College Chapter*

2017 Senior Honors Thesis Grant ($2,500), *Department of Earth Sciences, Dartmouth College*

2016 Citation for Academic Excellence, Photography II (SART 30), *Professor Christina Seely, Department of Studio Arts, Dartmouth College*

2016 James O. Freedman Presidential Scholar research grant ($2,000), *Dartmouth College Undergraduate Advising and Research*

2014, 2015 Academic Honors, *Dartmouth College*

2014 Ernest Everett Just Society, *Dartmouth College*

Certifications, Trainings & Short Courses

2023 Polar Firearms Training and Polar Bear Safety (certification), *ICS of Colorado*

2020 Polar Field Science and Safety (workshop), Bremerhaven, Germany

2019 Helicopter Underwater Egress and STASS (certification)

2019 Polar Field Science and Safety (workshop), Tromsø, Norway

2019 Polar Firearms Training and Polar Bear Safety (certification), *ICS of Colorado*

2019 Fire Fighting and Fire Prevention at Sea (certification), *Connecticut Fire Academy*

2019 Standards of Training, Certification, and Watchkeeping for Seafarers (STCW; certification), *New England Maritime Institute*

2019 Polar Field Science and Safety (workshop), Utqiaġvik, AK, USA

2017, 2019 Wilderness Emergency Medical Technician (W-EMT; certification), *NREMT*

2016 Wilderness First Responder (certification), *SOLO School of Wilderness Medicine*

Publications

Journal Articles

Submitted M.M. Smith et al., including **I.A. Raphael**, "Formation and fate of freshwater on an ice floe in the Central Arctic." *Submitted to The Cryosphere*.

2024 **Raphael, I.A.**, Perovich, DK, Polashenski, CM, Clemens-Sewall, D, Itkin, P, Lei, R, Nicolaus, M, Regnery, J, Smith, MM, Webster, M, Jaggi, M. 2024. "Sea ice mass balance during the MOSAiC drift experiment: Results from manual ice and snow thickness gauges." *Elementa: Science of the Anthropocene* 12(1). DOI: https://doi.org/10.1525/elementa.2023.00040

2024 D. Clemens-Sewall, et al., including **I.A. Raphael**. "High-resolution repeat topography of drifting ice floes in the Arctic Ocean from Terrestrial Laser Scanning." *Nature Scientific Data* 11.1 (2024): 70.

2023 D. Perovich, **I.A. Raphael**, et al. "Sea ice temperature and mass balance measurements during the MOSAiC drift campaign." *Elementa: Science of the Anthropocene* 11.1 (2023).

2023 A. Macfarlane, et al., including **I.A. Raphael**. "A Database of Snow on Sea Ice in the Central arctic Collected during the MOSAiC expedition." *Nature Scientific Data* 10.1 (2023): 398.

2023 V. Nandan, et al., including **I.A. Raphael**."Wind Transport of Snow Impacts Ka-and Ku-band Radar Signatures on Arctic Sea Ice." *The Cryosphere* 17.6 (2023): 2211-2229.

2023 P. Itkin, et al., including **I.A. Raphael**."Sea ice and snow characteristics from year-long transects at the MOSAiC Central Observatory." *Elementa: Science of the Anthropocene* 11.1 (2023).

2022 D. N. Wagner et al., including **I.A. Raphael**. "Snowfall and snow accumulation processes during the MOSAiC winter and spring season." *Cryosphere* 16. ARTICLE (2022): 2373-2402.

2022 O. Hames & M. Jafari et al., including **I.A. Raphael**. Modeling the small-scale deposition of snow onto structured Arctic sea ice during a MOSAiC storm using snowBedFoam 1.0., *Geoscientific Model Development 15.16* (2002): 6429-6449.

2022 M.M. Smith, L. von Albedyll, **I.A. Raphael**, et al. "Quantifying false bottoms and under-ice meltwater layers beneath Arctic summer sea ice with fine-scale observations." *Elem Sci Anth* 10.1 (2022): 000116.

2022 D. Clemens-Sewall et al., including **I.A. Raphael**. FlakeOut: A Geometric Approach to Remove Wind-Blown Snow from Terrestrial Laser Scans. *Cold Regions Science and Technology* (2022): 103611.

2022 B. Light et al., including **I.A. Raphael**. Arctic sea ice albedo: spectral composition, spatial heterogeneity, and temporal evolution observed during the MOSAiC drift. *Elem Sci Anth* 10.1 (2022): 000103.

2022 M.A. Webster et al. including **I.A. Raphael**. Spatiotemporal evolution of melt ponds in the Arctic: MOSAiC observations and model results. *Elem Sci Anth* 10.1 (2022): 000072.

2022 M. Nicolaus et al., including **I.A. Raphael**. Overview of the MOSAiC expedition – Snow and Sea Ice. *Elementa: Science of the Anthropocene*.

2021 H.J. Belter et al., including **I.A. Raphael**. Interannual variability in Transpolar Drift ice thickness and potential impact of Atlantification. *The Cryosphere*. 15.6 (2021): 2575-2591.

2020 E. Welty et al., including **I.A. Raphael**. Worldwide version-controlled database of glacier thickness observations. *Earth System Science Data*. 12.4 (2020): 3039-3055.

2020 C. Katlein et al., including **I.A. Raphael**. Platelet ice under Arctic pack ice in winter. *Geophysical Research Letters*. 47.16 (2020): e2020GL088898.

Selected Abstracts

2023 **I.A. Raphael** et al. Estimates of the effective thermal conductivity of snow on MOSAiC. *Second MOSAiC International Workshop and Conference*.

2023 D. Perovich et al., including **I.A. Raphael**. Solar heat partitioning during the MOSAiC field experiment. *Second MOSAiC International Workshop and Conference*.

2023 D. Perovich et al., including **I.A. Raphael**. A different time. A different place. A different ice? Snow and sea ice at MOSAiC and SHEBA. *Second MOSAiC International Workshop and Conference*.

2022 **I.A. Raphael** et al. Point measurements of mass balance and heat fluxes on MOSAiC*MOSAiC International Workshop and Conference*.

2021 **I.A. Raphael** et al. Snow, ice, and meltwater in a younger Arctic icepack: locally variable processes and the thermodynamic mass balance of first- and second-year ice. *AGU Fall Meeting*.

2021 D. Perovich, **I.A. Raphael** et al. Sea ice temperature and mass balance measurements during the MOSAiC drift campaign. *AGU Fall Meeting*.

2021 C. Polashenski et al., including **I.A. Raphael**. SIDEx Observations of Sea Ice Stress-Strain-Fracture Fields. *AGU Fall Meeting*.

2021 M. Webster et al., including **I.A. Raphael**. Spatiotemporal evolution of melt ponds in the Arctic: MOSAiC observations and model results. *AGU Fall Meeting*.

2021 D. Clemens-Sewall et al., including **I.A. Raphael**. The Impacts of Snow Redistribution on Wintertime Arctic Sea Ice Growth. *AGU Fall Meeting*.

2021 **I.A. Raphael** et al. Manual point-measurements of sea ice mass balance during the MOSAiC Expedition. *EGU Spring Meeting*.

2021 D.K. Perovich, **I.A. Raphael**, R. Moore, D. Clemens-Sewall. Autonomous observations of sea ice mass balance during MOSAiC. *EGU Spring Meeting*.

2021 M.M. Smith, L. Von-Albedyll, **I.A. Raphael**, I. Matero, B. Lange. Freshwater under the MOSAiC floe: implications of under-ice melt ponds for mass balance. *EGU Spring Meeting*.

2021 D. Wagner et al., including **I.A. Raphael**. Snowfall and snow accumulation processes during MOSAiC. *EGU Spring Meeting*.

2021 D. Clemens-Sewall et al., including **I.A. Raphael**. Improving Observations of Aggregate Snow Cover Properties on MOSAiC by Integrating Repeat Terrestrial Laser Scanning and In-Situ Data. *EGU Spring Meeting*.

2021 B. Light et al., including **I.A. Raphael**. The MOSAiC sea ice albedo record: its context and role for informing improved surface radiative budgets in a climate model. *EGU Spring Meeting*.

2021 B.A. Lange et al., including **I.A. Raphael**. An overview of the HAVOC project during MOSAiC: a multi-disciplinary glimpse at bio-physical sea ice ridge habitat properties from winter to summer. *Arctic Frontiers*.

2020 C.M. Polashenski et al., including **I.A. Raphael**. Observations of Stress and Strain at Floe Scale in Sea Ice. *AGU Fall Meeting*.

2020 D. Clemens-Sewall et al., including **I.A. Raphael**. Snow Accumulation and Redistribution Patterns in the Central Arctic. *AGU Fall Meeting*.

2020 T. Kanzow et al., including **I.A. Raphael**. Evolution of the winter mixed layer observed during MOSAiC. *AGU Fall Meeting*.

2020 B. Light et al., including **I.A. Raphael**. In situ observations of the seasonal evolution of Arctic sea ice albedo. *AGU Fall Meeting*.

2020 D. Wagner et al., including **I.A. Raphael**. Working towards a reliable snowfall estimate on Central Arctic sea ice. *AGU Fall Meeting*.

2020 C. Katlein et al., including **I.A. Raphael**. Platelet Ice under Arctic Pack Ice in Winter. *AGU Fall Meeting*.

Last updated: July 21, 2024