Kali McDougall

Master of Science Student
University of Victoria

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LinkedIn Profile

Education

University of Victoria *Sept 2022 - Present*

Master of Science - Glaciology & Remote Sensing

– Thesis title: Environmental impacts on rift propagation in Antarctic ice shelves
– Supervisor: Dr. Randall Scharien

University of Victoria *Sept 2019 - Apr 2022*

Honours Bachelor of Science - Physical Geography & Geomatics

– Thesis title: Synoptic drivers of ice-jam flooding in the Peace-Athabasca Delta
– Supervisor: Dr. David Atkinson

Camosun College *Sept 2017 - Apr 2019*

General Arts and Sciences, University Transfer Program

Awards & Distinctions

Student Participation in Space Conferences Grant, Canadian Space Agency *Oct 2023*

Northern Scientific Training Fund, POLAR Knowledge Canada *June 2023*

Graduate Fellowship Award, University of Victoria *Sept 2022*

2021-2022 Honours in Geography, University of Victoria *Apr 2022*

Education Achievement Bursary, BC Youth Federation *May 2019*

Background & Research Interests

My academic background has centered on the study of synoptic climatology, satellite remote sensing, and ice sheet dynamics. Currently, my master's research involves characterizing the detectability of rifts in Antarctic ice shelves using multi-frequency synthetic aperture radar and laser altimetry, and evaluating rift growth in the context of the surrounding environmental and geophysical conditions. My research interests include the use of microwave remote sensing to study ice sheets and their connection to the polar and global climate systems.

Research Experience

MSc Thesis: Environmental impacts on rift propagation in Antarctic ice shelves *Sept 2022 - Present*

University of Victoria, Victoria, BC

– More than half of ice mass loss from Antarctica occurs through iceberg calving at the outer margins of floating ice shelves. These events are associated with the propagation of large rifts which extend through the entire thickness of the ice, and this process has been identified as a precursor to major disintegration events. My master's work has focused on developing a machine learning-based technique for detecting rifts in Antarctic ice shelves using Sentinel-1 C- and PALSAR-2 L-band SAR and ICESat-2 laser altimetry. Rift detectability was assessed as a function of ice surface conditions and radar frequency and polarization, and results were used to guide an object-based classification. Periods of significant rift growth were assessed relative to regional atmospheric and oceanic conditions in order to determine the environmental impact on rift propagation.

Sikuttiaq: Sea ice travel safety and monitoring in Inuit Nunangat *June 2023*

Canada-Inuit Nunangat-United Kingdom (CINUK) Research Programme, Pond Inlet, NU

– Sea ice roughness, thickness, and slush are key characteristics that not only determine the safety and efficiency of ice travel for Inuit communities, but also hold significant implications for their overall well-being. This field research was part of the Sikuttiaq project, which aims to identify and map sea ice hazards to promote safe ice travel for Inuit. We used a GEM-2 electromagnetic sensor and manual sampling techniques to characterize slush and seawater flood zones on melting sea ice. These efforts laid the groundwork for future field campaigns and produced ground truth data for the Sikuttiaq project.

Image processing-based atmospheric river detection over the Antarctic Peninsula *Sept - Dec 2022*

University of Victoria, Victoria, BC

– Landfalling atmospheric rivers contribute large amounts of snowfall and cause strong melt events across the Antarctic Ice Sheet. Changes in the frequency or intensity of atmospheric rivers could have serious consequences for the stability of Antarctic ice shelves, particularly along the Antarctic Peninsula. This project investigated the development of the atmospheric river events which preceded the collapse of the Larsen A and B ice shelves, and the calving of iceberg A68 from Larsen C. I used a top-hat by reconstruction algorithm and ERA5 integrated vapour transport data to detect and track a series of atmospheric rivers on the Antarctic Peninsula.

BSc Thesis: Synoptic drivers of ice-jam flooding in the Peace-Athabasca Delta, AB *Sept 2021 - Apr 2022*

University of Victoria, Victoria, BC

– The Peace-Athabasca Delta is currently threatened by decreasing frequency of high-magnitude ice-jam floods, which are necessary to restore water to ecologically sensitive elevated basins. To understand the cause behind ice-jam floods and how they are affected by a changing climate, it is necessary to study broad-scale synoptic patterns which provide an overview of basin-wide hydrologic activity. I examined 700 mb geopotential height composites to identify the dominant synoptic patterns behind ice-jam flood events in the Peace-Athabasca Delta. I used Linux command line operators such as Climate Data Operators (CDO), and Python geospatial packages to compute seasonal averages and reveal synoptic disparities for major flood years in the delta.

Variability of supraglacial lake extent and ice velocity on the Kangerlussuaq Glacier *Jan - Apr 2022*

University of Victoria, Victoria, BC

– Mass balance of tidewater glaciers in Greenland is the product of a complex set of atmospheric, oceanic, and geometric glacial interactions that operate on time scales ranging from daily to decadal. This project aimed to evaluate the changing dynamics and influences on Greenland's Kangerlussuaq Glacier. We examined the relationships between synoptic climate, ice velocity, and surface melt to estimate the contribution of meltwater to ice mass loss for the Kangerlussuaq Glacier. We used offset tracking of Sentinel-1 imagery to derive ice velocity and glacier terminus position, and compare to Sentinel-2 optical delineations of supraglacial lake extent.

The role of radiation in surface melt and sediment transport on the Leverett Glacier *Jan - Apr 2021*

University of Victoria, Victoria, BC

– The mass balance of ice masses is largely determined by their surface energy balance. During periods of negative mass balance, landscape change is driven through evacuation of meltwater. Therefore, understanding the effects of radiation on mass balance is necessary to model downstream landscape change. I modelled the energy balance and mass balance of Greenland's Leverett Glacier using in situ ice temperature and radiation data. I used ASMR-E passive microwave data to examine the seasonal progression of surface melt. Lastly, I used geomorphic change detection software and Greenland Ice Mapping Project DEMs to investigate proglacial elevation change as a proxy for sediment transport. This was done to estimate the effects of glacial melt on proglacial sediment distribution.

Teaching Experience

Specialist Instructor *Jan 2023 - Present*

University of Victoria, Victoria, BC

GEOG 422: Advanced Topics in Remote Sensing

– In this position, I led laboratory exercises and guided students' capstone projects. Lab topics covered advanced remote sensing techniques and included the use of cloud-computing to process and analyze satellite imagery. For this course, I developed a SAR-based melt onset detection lab using resources from the Alaska Satellite Facility.

GEOG 370: Hydrology

– My main role in this position was to lead laboratory exercises and provide support to students during tutorials and exams. Lab exercises used a variety of geomatics software and covered advanced-level atmospheric, groundwater, and surface hydrology. Additionally, I coordinated field-based assignments and chaperoned off-campus demonstrations.

Professional Experience

Remote Sensing Specialist *Apr 2024 - Present*

SmartICE Sea Ice Monitoring and Information, Victoria, BC

– Used a regression tree model to identify regions of sea ice roughness from SAR imagery, and produced hazard maps for Inuit communities. This work is partnered with the Canada-Inuit Nunangat-United Kingdom Arctic Research Programme as part of the Sikuttiaq project.

Research Assistant *May - Aug 2022*

University of Victoria, Victoria, BC

– Developed Python code to identify and characterize anomalous atmospheric circulation in northwestern Canada, and prepared literature for the Canadian government outlining the geophysical controls on ice-jam flooding.

Volunteer Experience

Polar EO Project Group Member *Oct 2023 - Present*

Association of Polar Early Career Scientists (APECS)

– Assisted in developing a Github database for polar remote sensing resources as part of APECS' Polar Earth Observation Database project group.

Co-Director of Events *Sept 2023 - Present*

UVic Women in Science

– Coordinated educational and social events aimed at supporting women in STEM fields as part of the Events Committee. Hosted the annual Research Symposium to showcase women-led research at UVic.

Graduate Student Representative *Sept 2022 - Aug 2023*

UVic Graduate Student Society

– Represented Geography graduate students in major governance decisions on university policy as a part of the Graduate Representative Council and the Student Affairs Committee.

Conference Presentations

Larsen C Ice Shelf rift detection and evolution using C- and L-band synthetic aperture radar *Sept 2024*

2024 European Polar Science Week, Copenhagen, DK

Detection of rifts on the Larsen C Ice Shelf using C- and L-band synthetic aperture radar *Dec 2023*

American Geophysical Union 2023 Fall Meeting, San Francisco, CA

Detection of rifts on the Larsen C Ice Shelf using C- and L-band synthetic aperture radar *Oct 2023*

9th Association of Polar Early Career Scientists International Online Conference, (virtual)

Rift detection in Antarctica using multifrequency synthetic aperture radar *Oct 2023*

Excellence in Graduate Research Symposium, Victoria, BC

Environmental drivers of rift propagation on the Larsen C Ice Shelf *Apr 2023*

UVic Geography Graduate Student Conference, Victoria, BC

Synoptic drivers of ice-jam flooding in the Peace-Athabasca Delta *Mar 2022*

Circumpolar Students' Association Northern Research Day 2022, Edmonton, AB (virtual)

Synoptic drivers of ice-jam flooding in the Peace-Athabasca Delta *Mar 2022*

Bridging the Gap Undergraduate Student Conference, Victoria, BC

References

Randall Scharien, *Master's supervisor, Associate Professor*
University of Victoria
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David Atkinson, *Honours supervisor, Professor, and Geography Department Chair*
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