

- To investigate the changes that have occurred, are occurring, and may yet occur, to the ice cover on Arctic lakes through monitoring and modelling
- To obtain more detailed in situ observation data to both assist with satellite-based and model-based research, as well as develop a long-term dataset
- To highlight the differences between northern vs. mid-latitude ice processes

Annual activities:

This year, our field party consisted of five members: Laura Brown (May and Aug), Ernest Groh (now Steele) (MSc student, year 1)(May), Lisa Marno (MSc student year 2) (May and August), Riley Forth (MSc year1)(August), and Debbie Iqaluk (Resolute Resident and Research Associate) (May and August). Our group spent 14 days (May 5-18) and another 14 days (July 28 – Aug. 10) working from PCSP in Cornwallis Island, with one brief trip to Nanuit Itillinga, Bathurst Island, for equipment maintenance.

Sadly, my equipment this year suffered severe damage. One of the most important research cameras was removed from Small Lake near town (camera, battery, wiring). The camera had been in place for 10 years and was an important part of several projects, so this was very disappointing.

On May 19, between 11pm and midnight, all of the wiring was ripped out of the weather station on Bathurst Island. This station has been in place since the 1980s and is the only long-term weather data from Bathurst Island. We repaired what we could on site, and I will assess the damage more in 2026, but I do not have the research funds to replace it (I estimate this would cost more than \$200,000).

Cornwallis Island:

In May, we measured the snow conditions and ice thickness on Resolute, Small, Meretta, Char, North and Plateau Lakes near Resolute. We also went by Twin Otter to Eleanor, Sophia, and Laura Lakes. We used a small 2” auger attached to a cordless drill to measure the ice thickness and found that the average ice thickness around Resolute was much thinner than any of the years we have measured, with an average of only 1.8 m (compared to over 2 m for the last three years) and the thinnest ice at only 1.2 m thick under a snow drift on Small Lake. We will also be sharing all of the snow and ice measurements with Dr. Catherine Girard for their projects.

In August, we recovered the ice thickness sensor from Small Lake and retrieved the data for a full ice season. We also downloaded and repaired some of the local lake ice cameras so they were ready for the next year. We have added some metal cases to the cameras to secure them to the new posts we are using and help prevent them from coming off in the winter or being knocked down by animals. We were able to travel to Eleanor, Laura, Sophia and Amituk Lakes to service the cameras there as well.

Bathurst Island:

At Nanuit Itillinga NWA, we found the weather station severely damaged. The team was able to repair some of the wiring; however, I think the power source was affected, and I am not optimistic

that many of the sensors will be functional when we return in 2026. We successfully serviced the small camera structure on the N shore of Hunting Camp Lake. I plan to continue using Hunting Camp Lake as a representative lake for the area for modelling, as existing climate records and snow cover data are available.

Results and Achievements:

The research activities are ongoing, and we are still analyzing the data collected in summer 2025. The annual ice cover dates from the High Arctic Lake Ice Observation network (HALO) cameras can be found at: <https://sites.utm.utoronto.ca/brown/content/lake-ice-cover-dates-nunavut> and information on the network can be found at: <https://sites.utm.utoronto.ca/brown/content/halo>. I was not able to set up a dedicated website for the data distribution yet due to access issues for non-UofT access, but I still hope to in the coming year.

Overall, long-term results include tracking ice phenology since 2016 on some lakes through the HALO. Several publications are in preparation with my graduate students that use the camera imagery along with the ice cover information we have been collecting. Some highlights from these works in progress are examples of how the topography controls the snow redistribution on the local lakes, affecting the ice thickness below, and how the recent seasons have affected the ice phenology (with respect to warm/cool falls/springs, and links to the atmospheric teleconnections).

The most recent publication is listed below, but highlights include an updated example of how the camera imagery is being used to validate the lake ice model results (Figure 1), which can then be used to project the ice cover to the end of the century (Figure 2). Ensuring the present-day ice cover is modelled accurately gives confidence in the future projections.

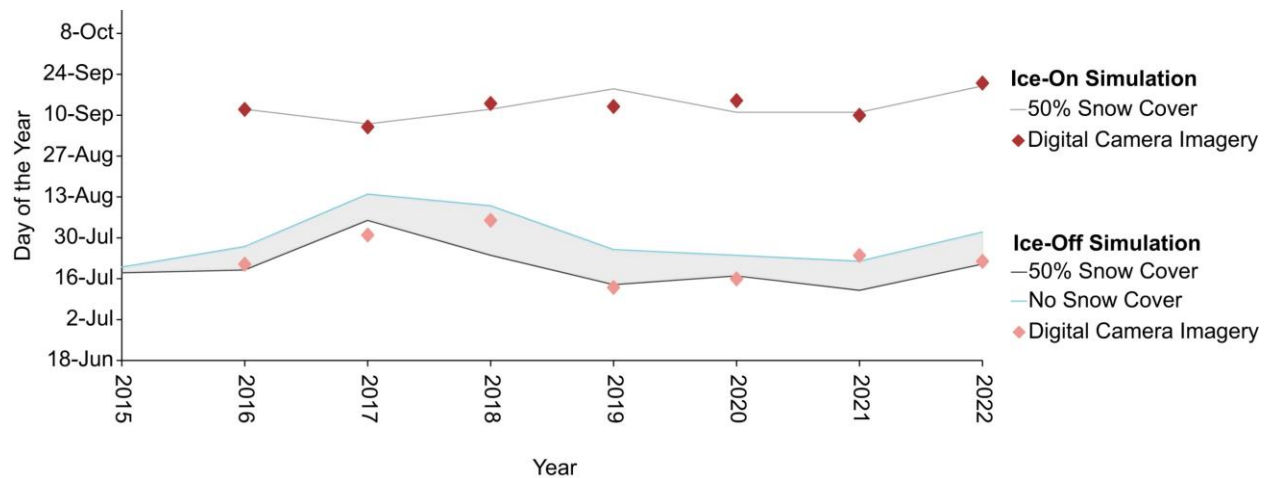


Fig 1: Ice-on and ice-off simulations for partial snow cover and no snow cover compared to observed ice-on and ice-off from a digital camera at Small Lake, Resolute, NU; this is an updated figure from [Robinson et al. \(2021\)](#). Source: Figure 2 from Robinson and Brown, 2025, <https://cdnsiencepub.com/doi/10.1139/as-2024-0081>

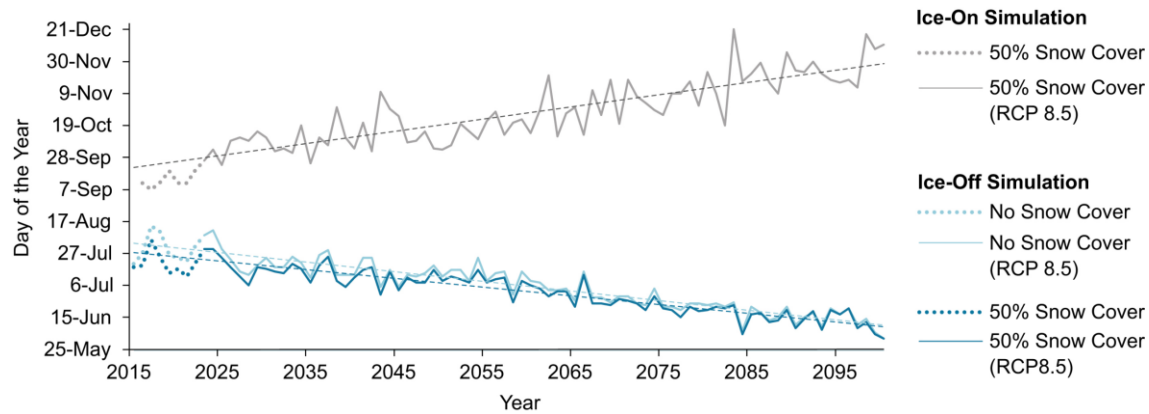


Fig. 2: (2016–2100) ice-on and ice-off under no snow cover and partial (50%) snow cover for the Small Lake region, Resolute, NU, using 0.44° resolution (~50 km) Arctic CoOrdinated Regional climate Downscaling Experiment Representative Concentration Pathway (RCP) 8.5 driven by Canadian Centre for Climate Modelling and Analysis-CanESM2 for 2023–2100 and observation data from Environment and Climate Change Canada Resolute Bay are used for 2015–2023. Linear trends have been added to each snow cover scenario (no snow cover and partial (50%) snow cover). Source: Figure 4 from Robinson and Brown, 2025, <https://cdnsiencepub.com/doi/10.1139/as-2024-0081>

Challenges/Obstacles:

See above re my equipment being damaged and stolen. Our community flyer that reminds people that the cameras are only taking 1 picture a day of the lake ice, and are not motion-activated, was provided for a science day and given to the HTA office to display.

Expected Project Completion Date:

August 2028, or later if funding is renewed

RESEARCH OUTCOMES: BENEFITS

Community engagement:

When the project was originally set up, we connected with the Resolute HTA and the SAO, however, this is a long-term project, so no recent consultation has been done. We have a local community member working with us on the research team for many years who has been

invaluable for the success thus far. Most of the recent community engagement that we have done is through informal conversations while we are outside working, and interested people stop by. One side-project related to the main project was originally of interest to the community through the lake depth mapping. There was too much ice in the way to map Char Lake this year, but we will check again next year if the community is still interested.

Youth engagement:

We contributed a flyer and an example camera to a science day hosted by colleagues in the community this year. It was well attended by the kids in the community. We also made new connections with the new teachers (2025) at the school and hope to build on those for 2026.

Training and Employment:

We have one long-term team member from Resolute, NU, who works on our project with us and is paid by the university as a Research Associate.

Academic Mobility

- Research [UofT, Laval, UQAC]
- Post-Doctoral Research [Motevalli – incoming 2026, will use the data]
- PhD Thesis [Zhao]
- Masters (Major Research Paper) / Masters (Thesis) [Steele, Forth]

BUDGET

Please complete the table below to detail your projected and actual research expenditures during the reporting period.

Category	Planned/Approved Expenditure	Actual Expenditure
Travel and Accommodation	\$40,000	\$34,284.16
Equipment, Materials and Supplies	\$2,000 (shipping)	\$2,484.50
Salaries/Wages for Nunavut residents	\$8,000	\$8,000
Salaries/Wages for non-Nunavut resident researchers	x – I do not have enough funding to pay my graduate students beyond their annual research stipends they receive (non-specific to this project)	
Professional Fees and services in Nunavut	x	

Professional Fees and Services outside of Nunavut	\$2,000	\$1,393.06 (report translation)
TOTAL EXPENDITURES		\$46,161.72

- Excluded: training costs travel to/from training site, first-aid certification costs, firearms licencing costs, field materials that are merged in as general lab supplies

List the total \$ amount of funding from each funding source for your full research program, including in-kind support

NSERC Discovery Grant: \$35,000 [** not all of this is allotted for this project, I run a second field site in ON where we do training prior to trips north*]

NSERC Northern Supplement: \$17,000

NSTP: \$9,450

PCSP: \$153,717 (in kind)

ArcticNet: \$103,391

RESEARCH OUTPUTS / REPORTING TOOLS

peer-reviewed materials:

Both of these papers are open access and may be shared:

Robinson, AL and Brown LC. 2025. Simulated current and projected radiation balance of a High Arctic lake during the open water season, *Arctic Science*, 11, 1-22, DOI: 10.1139/as-2024-0081

Young, KL and Brown LC. 2024. Thermal Regime of High Arctic Tundra Ponds, Polar Bear Pass, Nunavut, Canada, *HESS*, 28, 3931-3945, <https://hess.copernicus.org/articles/28/3931/2024/> (last year but wasn't on my 2024 report, I think it came out after I submitted)

non-peer-reviewed materials produced to either communicate or synthesize results to the public

Presentations:

Marno, L and Brown LC. The relationship of snow phenology and lake ice thickness at High Arctic lakes. Oral Presentation. Canadian Geophysical Union Annual Meeting, Saskatoon, May, 2025

Brown LC. Ice and Snow in the Canadian High Arctic. The Kimel Family Centre for Brain Health and Wellness, Baycrest Health Sciences, Feb 9, 2025.

Groh, EM and Brown LC. White Ice formation on small High Arctic Lakes. Poster Presentation. Cold

Regions Research Centre Student Conference, Waterloo, Jan 30, 2025

Marno, L and Brown LC. Identifying shifts in snow phenology from 2000-2023 in the Canadian Arctic Archipelago. Oral Presentation. Cold Regions Research Centre Student Conference, Waterloo, Jan 30, 2025

Online information about the research cameras and an information flyer:

<https://sites.utm.utoronto.ca/brown/content/halo>