SIMBA

Case Studies

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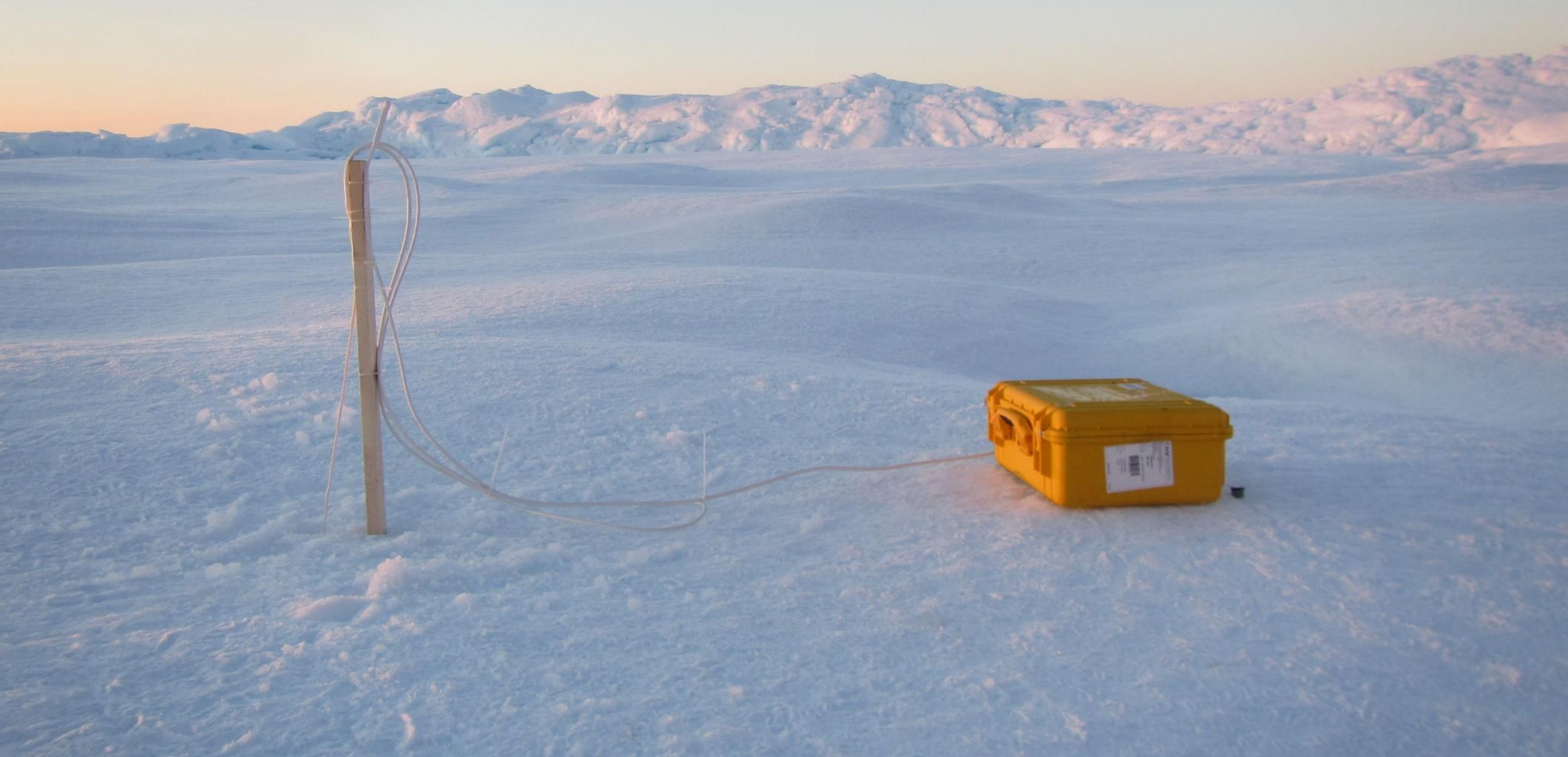
SIMBA has been deployed in remote areas all over the world, collecting data from sea ice, river ice, lake ice, and snow. Please read on through a selection of case studies written using SIMBA data.



Credit: deployment team of 2018T55

SIMBA On Sea Ice – The MOSAiC Expedition

The MOSAiC Expedition, led by the Alfred Wegener Institute, was a year-round operation of the RV Polarstern, which drifted with the sea ice across the central Arctic from September 2019 to October 2020. A distributed regional network of observational sites was set up and as part of this 28 SIMBA units were deployed on the sea ice.

A typical deployment consists of a yellow case, housing the controller unit, communications, and batteries. A 5m thermistor chain is then deployed through an auger hole in the ice and frozen into place to collect snow, ice, water, and air temperature data.

The SIMBA units are compact and portable, which allowed them to be installed by a small deployment team. The setup is very quick and simple, with an estimated 20-30 minutes required to fully deploy each unit on the ice. Once deployed, the units were left to collect data and return this via Iridium to an online data portal.

The SIMBA units were used to study sea ice mass balance data, sea-ice drift data, and temperature profiles of the snow, air, ice, and water. This also allowed the interfaces between these materials to be studied by the scientists.

Data was collected multiple times a day with each unit being deployed for weeks and months at a time.

To view SIMBA data from MOSAiC and find out more about the expedition please use the following links:

https://mosaic-expedition.org/

https://www.meereisportal.de/en/

To view publications using SIMBA data from MOSAiC please use the following link:

www.sams-enterprise.com/simba/references

With thanks to the Alfred Wegener Institute and collaborating parties on the MOSAiC Expedition.

Monitoring River Ice on the Churchill River

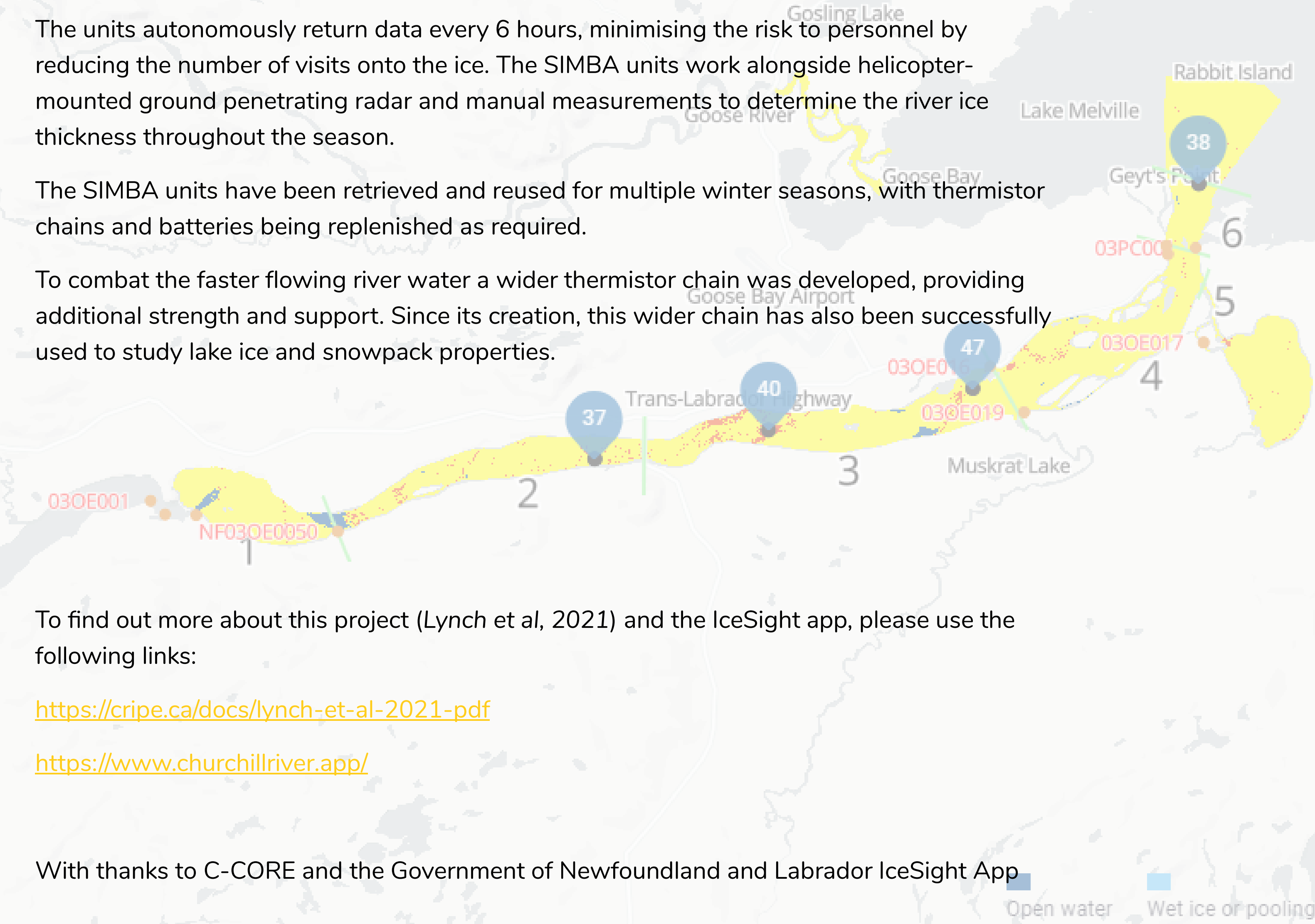
The Churchill River Monitoring project was established after a flood in 2017 where an ice jam flood occurred at the outlet into Goose Bay, causing the evacuation of a nearby community. As such, it was recommended to increase the real-time environmental monitoring and to help achieve this, four SIMBA units were deployed to help study the river ice thickness and contribute to the wider River Flood Forecasting System.

Four SIMBA units were deployed at set points along the river and fitted with flotation devices to aid retrieval at the end of each season.

The units autonomously return data every 6 hours, minimising the risk to personnel by reducing the number of visits onto the ice. The SIMBA units work alongside helicopter-mounted ground penetrating radar and manual measurements to determine the river ice thickness throughout the season.

The SIMBA units have been retrieved and reused for multiple winter seasons, with thermistor chains and batteries being replenished as required.

To combat the faster flowing river water a wider thermistor chain was developed, providing additional strength and support. Since its creation, this wider chain has also been successfully used to study lake ice and snowpack properties.



The location of the four SIMBA units can be seen on the map (left). A daily ice thickness (below) for each SIMBA location is derived manually from the thermistor chain data sent to the online data portal.

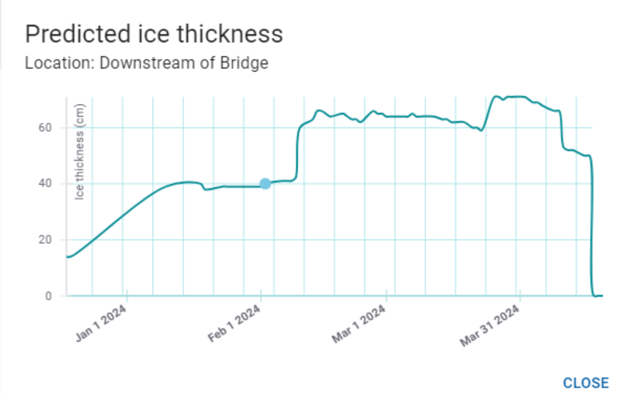


Photo credit: Michael Lynch, C-CORE

To find out more about this project (*Lynch et al, 2021*) and the IceSight app, please use the following links:

https://cripe.ca/docs/lynch-et-al-2021-pdf

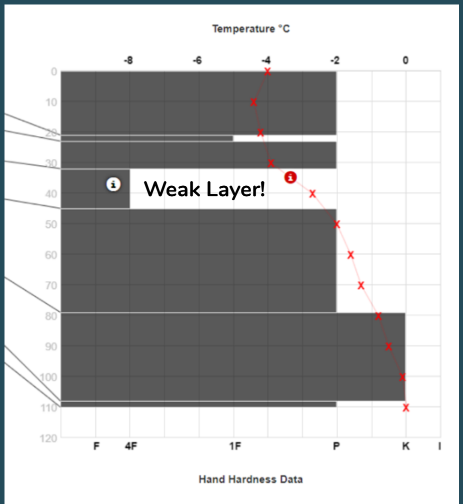
https://www.churchillriver.app/

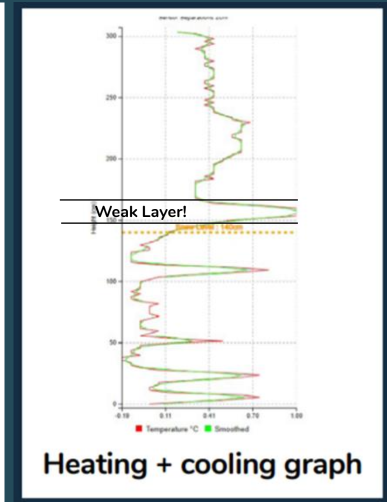
With thanks to C-CORE and the Government of Newfoundland and Labrador IceSight App

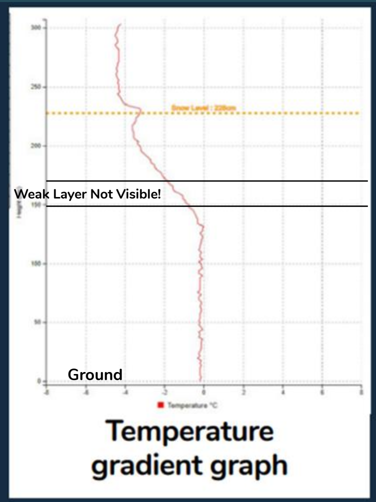
SAMS Enterprise & SAIS Trials Technology to Support Avalanche Forecasting

The following data from SIMBA was recorded during an avalanche event, which occurred during February 2020 in Strath Nethy on the north-east side of Cairngorm, Scotland. Temperature readings were taken every 2 hours at a 2cm resolution and returned via mobile (4G) network to our server for display. This provides high resolution temperature gradients, snow accumulation & degradation, plus variation between wet and dry snow.

A custom computer algorithm was developed to calculate snow depth and basic properties (wet/dry). Using the unique additional feature of SIMBA; the heating/cooling cycle, knowledge of the internal structure of the snowpack can be gained.



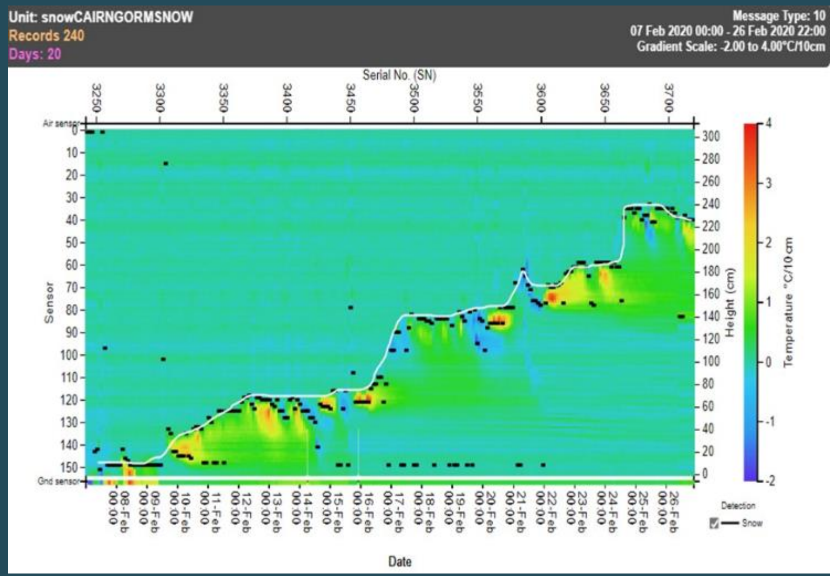




(Left to right): The SAIS snow pit profile at 10am & SIMBA heating and cooling cycle & temperature gradient at 4am on the 26th of February. On the heating & cooling graph, a significant layer between approximately 150cm to 160cm is observed. This corresponds to a low-density layer which is not apparent in the temperature gradient graph taken a few minutes earlier.

In the temperature gradient graph, the main feature is a layer of wet snow seen between the ground and 140cm. Above there is a relatively uniform temperature gradient through the dry snowpack. The softer, low-density layer between about 150cm and 160cm does not appear. Given the snowpack is about 230cm deep at this time, this corresponds to the weak layer being around 70cm below the surface.

Around 7 hours later (11am on the 26th) an avalanche was triggered by a walker about 100 metres off to the side of the SIMBA. The avalanche propagated across the slope, and the debris hit the SIMBA.



The SIMBA temperature differential graph above shows the snow build up from the 10th to the 26th of February. Strong temperature gradients were noted on the 24th, which were then buried by windslab. A size two avalanche was human triggered on the 26th February.

In partnership, and with thanks, to the Scottish Avalanche Information Service (SAIS) and Cairngorm Mountain

https://www.sais.gov.uk/

https://www.cairngormmountain.co.uk/