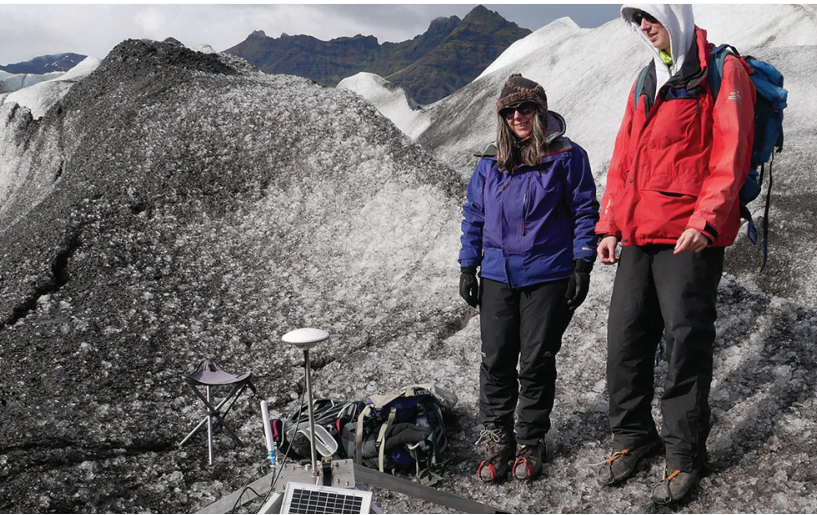


## CASE STUDY | THE GLACSWEB PROJECT

UNIVERSITY OF SOUTHAMPTON



“  
Thanks to its high-accuracy and affordable price, Piksi Multi not only helps to track glacier activity with centimeter-level accuracy but has profound implications to help us monitor climate change across the globe.  
”

—Professor Jane Hart

### CONSUMER

University of Southampton

### PRODUCT

Piksi Multi

### USE CASE

Glacier Tracking

[Glacsweb](#) is a project at the University of Southampton in the United Kingdom focused on studying glacier behavior and its impact on climate change and sea level rise. It is known that glaciers are impacted by climate change and influence rising sea levels; however, glacial behavior is poorly understood. The melting of West Antarctica’s ice is controlled by the melting of snowfall and surface ice, as well as less understood processes occurring beneath the ice. Glacsweb—led by Professor Kirk Martinez, Electronics and Computer Science, and Professor Jane Hart, Geography—is using technological advances to carry out glaciology research with a primary focus on subglacial activity.

## Challenge

Traditional data recordings from glaciers have been made utilizing a moving GPS and a fixed base. Data are then processed offline to calculate precise positions. However, receiving data for long periods of time and transmitting data offsite using radio communications requires considerable battery power. Glacsweb’s previous GPS solution had to run for 20 minutes, requiring a lot of energy. Instead, Glacsweb sought a centimeter-accurate 60-second-fix solution that could save 19 minutes of battery power. The team had to design a system of sensors that could perform on minimal battery power for a whole year, placed anywhere in the world. An added challenge was to gather data autonomously into a web-accessible database.

## Solution

To meet these challenges, the Glacsweb team designed the first radio-linked sensor probes to place in/under glaciers. The 'Subglacial Probes'—beneath the glacier—communicate to the surface via radio links. They contain various sensors and their position and orientation is sensed by the surface system. Collected data helps the team understand how glaciers respond to climate change. Custom [sensor probes](#) were placed in, on and under glaciers and data was collected from them by a base station on the surface. Measurements include temperature, pressure, stress, weather and subglacial movement.

To make a successful sensor network for this application, the technologies used had to address communication, low-power, robustness and adaptability issues. To bypass traditional GPS challenges, Glacsweb chose to utilize real-time kinematic (RTK) GPS—specifically Swift Navigation's [Piksi® Multi](#)—due to its multi-band feature and ability to deliver accurate results while avoiding large data volumes or long recording periods. Using Piksi Multi, an RTK fix was achieved in a matter of minutes with an accuracy of roughly 2 centimeters. The Glacsweb team also found that the Piksi Multi receiver could be turned on solely to take a reading, and then turned off again to help to preserve battery power.

## Results

A low power microcontroller was used to control and schedule the Piksi Multi units and fetch a GPS fix once it was available. The units were powered-up at the same time, so an accurate real-time clock could be used. The gathered data was sent once per day back to the project's server using Iridium short text messaging. Piksi's centimeter-level accuracy was achievable in under ninety seconds, which saved power, and the precision was found to be sufficient to track the moving glacier. To date, the project has deployed on four glaciers: one in [Norway](#), and three in [Iceland](#); the probes have been trialed in [Tijuana](#) to monitor landslides. The information gathered has been, and will be, important in understanding the dynamics of glaciers and global warming. The project to date has produced useful new data in addition to contributing to fundamental research in glaciology and wireless sensor networks.

In addition to its high-accuracy, the low cost of Piksi Multi allowed for more sites across the globe to be monitored and contributed to providing a clearer picture of how humans are changing our environment.

**Contact Swift Navigation to see what Piksi Multi can do for your next project.**