GPS ON ICE

GLOBAL POSITIONING SYSTEM (GPS) TECHNOLOGY IS PLAYING AN IMPORTANT ROLE IN THE STUDY OF GLACIERS. DIMITRI LAMBERMONT DESCRIBES HOW THE TECHNOLOGY IS BEING USED.

Built to last! Even under the most extreme conditions! Phrases many companies use. Well how about being left on a melting glacier, falling into a crack in the ice and eventually ending up on the bottom of an ice lake? Read more about the Topcon receiver that survived being a bit 'too cool'. In the glacier of Briksdalsbreen in Norway a team of British researchers is looking for answers to the problem of global warming… from inside the ice.

Kirk Martinez is Senior Lecturer at the School of Electronics and Computer Science at the University of Southampton, UK and leads a team of researchers who carry out groundbreaking research on the melting of glaciers. "We use two receivers from Topcon (Legacy) to precisely measure the location of the base station. This works by recording signals simultaneously on both, then using their software in order to calculate the position. This can be as accurate as 5mm. Each unit has a 256MByte compact flash card which acts as a data backup in case we were not able to retrieve the data." The glacier and foreland were mapped with a Topcon GPS rover set. "This way we could pick the study sites on the glacier and see exactly where they were in relation to the previous years on a FC100 handheld."

Down a deep crack

"After the summer of 2006 we found images online (taken on August 28th) which showed that all was OK on the ice and we could see the base station on it. Then we received an email which told us the base had fallen down a deep crack of the glacier. In November we went on a 'rescue mission' - when the base had been seen floating in the lake at the foot of the glacier. The whole ice front had fallen into the lake - a catastrophic loss of glacier ice." The base station lives permanently on the ice and had fallen in the lake along with most of the ice. "The base station is responsible for fetching data from the probes, recording local data, a GPS file and weather station data. It also transmits data, either via radio down the valley

or by mobile-phone text messages. A special tripod was designed to hold the antennas and sensors; this was anchored to the ice (15m down a borehole) and rocks on the base."

All is intact

"A BBC News film crew came with us on the rescue mission to follow our story and see what it said about global warming. Although the base station had fallen into the lake attached to a huge section of ice we had attached it to, it was already 400m along the lake when we found it. We used a boat to pull it out of the lake, which was starting to freeze, so we had to push against small icebergs to move the boat along. The ripping off of cables had damaged a few connectors on the case so water had managed to get in. Amazingly the compact flash card in the computer was intact (after a night over the log fire!). And so was the Topcon GPS receiver."

100 metres a year

The GLACSWEB project, undertaken jointly by the School of Electronics and Computer Science and the School of Geography at the University of Southampton, has been monitoring the behaviour of glaciers in response to climate change. Deep within the Briksdalsbreen glacier in Norway, Europe's largest ice sheet, the Southampton scientists maintain a network of wireless sensors which report data back to Southampton continuously on measurements including movement, pressure, and temperature. Over the last three years the glacier has been retreating at approximately 100 metres a year, and the warm autumn temperatures of the last few months have contributed to a retreat of around 50 metres since July.

How it works

The probes are embedded deep within the glacier. "Six times a day they record environmental observations such as temperature, tilt and pressure. The probes also register strain, which shows how much they are squeezed by the surrounding environment. Every day at noon the probes transmit the data to a receiver that sits inside a deep crater on the glacier. From the receiver, the data flows through a wire to the base station. This contains a computer that can withstand very low temperatures, powered by lead-acid batteries, which are recharged by a wind generator and solar panels mounted outside the box. The base station's computer verifies the integrity of the received data packets and relays them via a radio connection to another computer, 2.5 km away at the campsite. It's through this connection that the probes' data finally reach a server in Southampton."

Rapidly melting

The rapid melting of the ice means that the glacier has become too steep and dangerous to work on, so the project will have to move to another glacier. However, the results from Briksdalsbreen provide much more general indications of glacier behaviour: "By charting the dramatic break-up of Briksdalsbreen we can predict what may happen to other rapidly melting glaciers", says Dr Martinez. And it has given Topcon a chance to prove how sturdy their equipment is.

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For more information:

http://envisense.org/glacsweb and http://www.topcon.eu