XT-DTS™, ruggedized distributed temperature sensor, improves scientific understanding of processes governing melt rates at the Thwaites Glacier in Antarctica

Client: International Thwaites Glacier Collaboration

Background Information

Climate change has accelerated melt rates of glaciers across the globe which will have a significant impact to society worldwide through changes in sea level affecting coastal cities.

The 192,000 square kilometer Thwaites Glacier drains a vast portion of the West Antarctic Ice Sheet and has experienced a doubling of the amount of ice flowing out of the region over the past 30 years. To better understand the changes to Thwaites Glacier and their implications, the International Thwaites Glacier Collaboration (ITGC) was established through joint funding from the US National Science Foundation and UK Natural Environmental Research Council and is the largest joint US-UK project undertaken in Antarctica in 70 years.

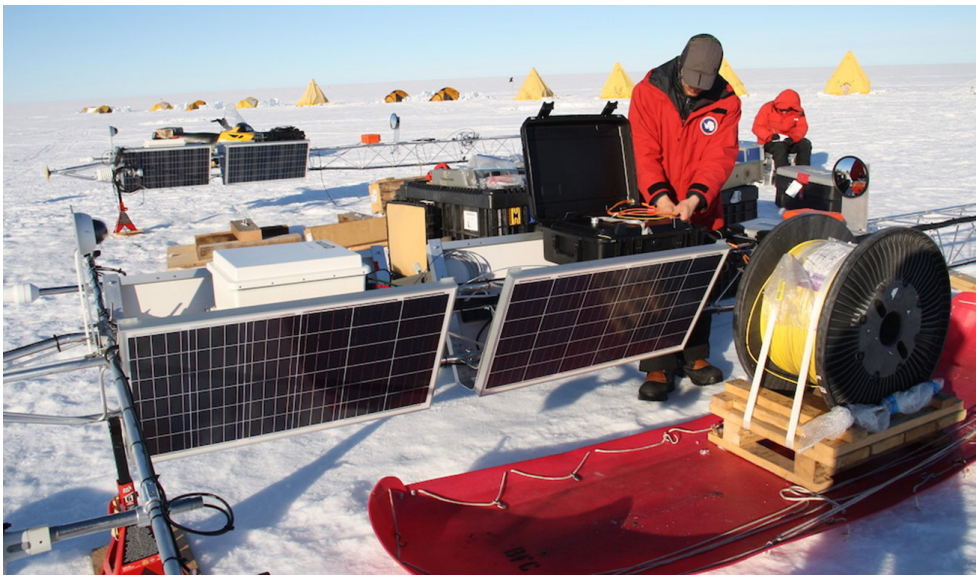

Figure 1. Silixa's XT-DTS and Specialty Terminated Fiber Optic Cable prepped for installation

Researchers are studying in detail glacial dynamics using a multi-physics approach to understand interconnected oceanic and atmospheric processes across neighboring ice shelves. Multiple sensory platforms including fiber optic distributed temperature sensing (DTS) were installed on Thwaites Glacier to provide datasets for conceptual model refinement and predictive and historical model development in order to improve the scientific understanding of processes governing melt rates in the Antarctic.

Challenge Providing datasets for conceptual model refinement and predictive and historical model development to improve the scientific understanding of processes governing melt rates in the Antarctic.

Solution Deploy Silixa's ruggedized XT-DTS to monitor the ice-seawater and to collect data continuously. A customized armored steel tube fiber optic cable was installed via thermal drilling through the ice sheet and into the ocean below.

Results Detailed temperature profiles have been reliably collected at multiple mooring sites since early 2020 when the installations were completed and the DTS instruments began collecting data. Continued acquisition will allow for comparison between the selected sites to determine the local processes driving basal melt and will provide climate researchers with critical input data for model refinement.

The solution

Field data acquisition platforms included moorings with customized armored steel tube fiber optic cable installed via thermal drilling through the ice sheet and into the ocean below to monitor the ice-seawater interface for basal melt using the ruggedized XT-DTS.

In addition to the unit's class-leading measurement performance capabilities and ambient temperature operating range from -40 to +65 °C, it incorporates a novel hibernation mode that consumes only 2 milliwatts between measurements. This feature enables the solar-powered XT-DTS to continue operation through the dark winter months in the Antarctic when lack of sunlight significantly reduces the availability of power.

The DTS system was configured to continuously and autonomously transfer data back to the research team in the United States over the duration of the multi-year deployment.

Value creation to client

Detailed temperature profiles have been reliably collected at multiple mooring sites since early 2020 when the installations were completed and the DTS instruments began collecting data.

Early data show the post-drilling cooling response as the borehole temperatures come into equilibrium with the surrounding ice. The ice-ocean interface is easily monitored using the sharp temperature transition between the much colder ice and seawater, with spatial resolution on the order of a few centimeters by utilizing the thermal gradient.

Continued acquisition will allow for comparison between the selected sites to determine the local processes driving basal melt and will provide climate researchers with critical input data for model refinement. The installations will also be used for distributed acoustic sensing (DAS) based seismic surveys for monitoring interfaces as well as intra ice sheet structure.

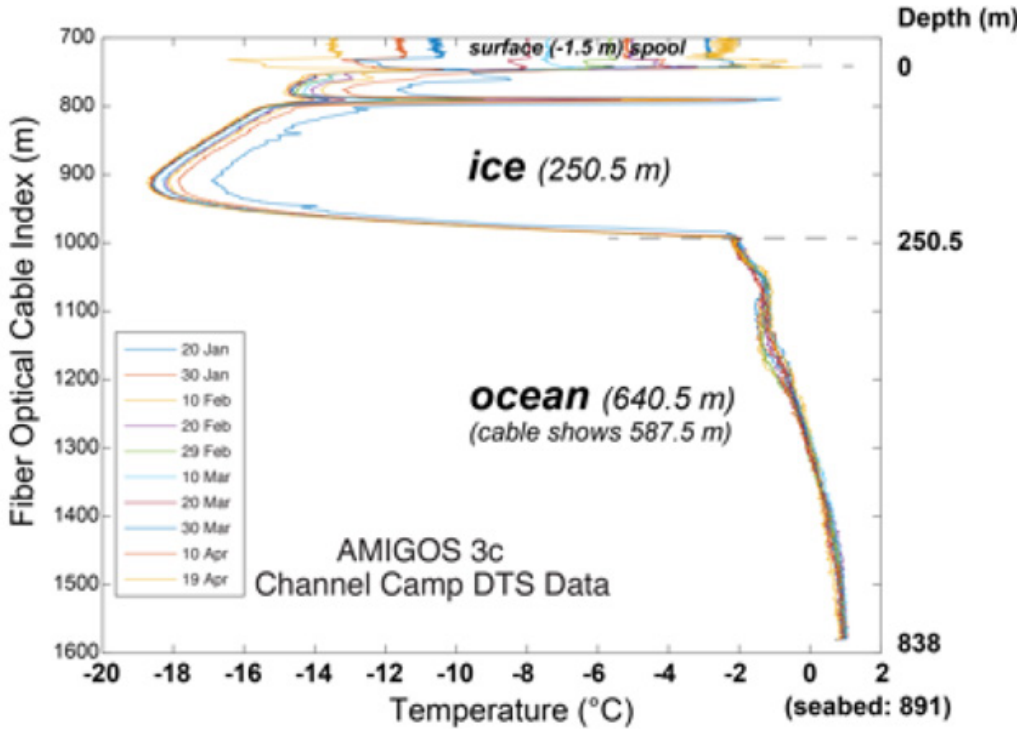

Figure 2: Temperature profiles through the ice sheet and ocean collected at Channel Camp with XT-DTS

Silixa Ltd
230, Centennial Park, Elstree, Hertfordshire
WD6 3SN, UK
t: +44 (0) 20 8327 4210
f: +44 (0) 20 8953 4362

Silixa LLC
16203 Park Row, Suite 185, Houston
TX 77084, USA
t: +1 832 772 3333
f: +1 832 772 3530

Silixa LLC
3102 W Broadway St, Suite A, Missoula,
MT 59808, USA
t: +1 406 204 7298
f: +1 406 204 7499

silixa.com