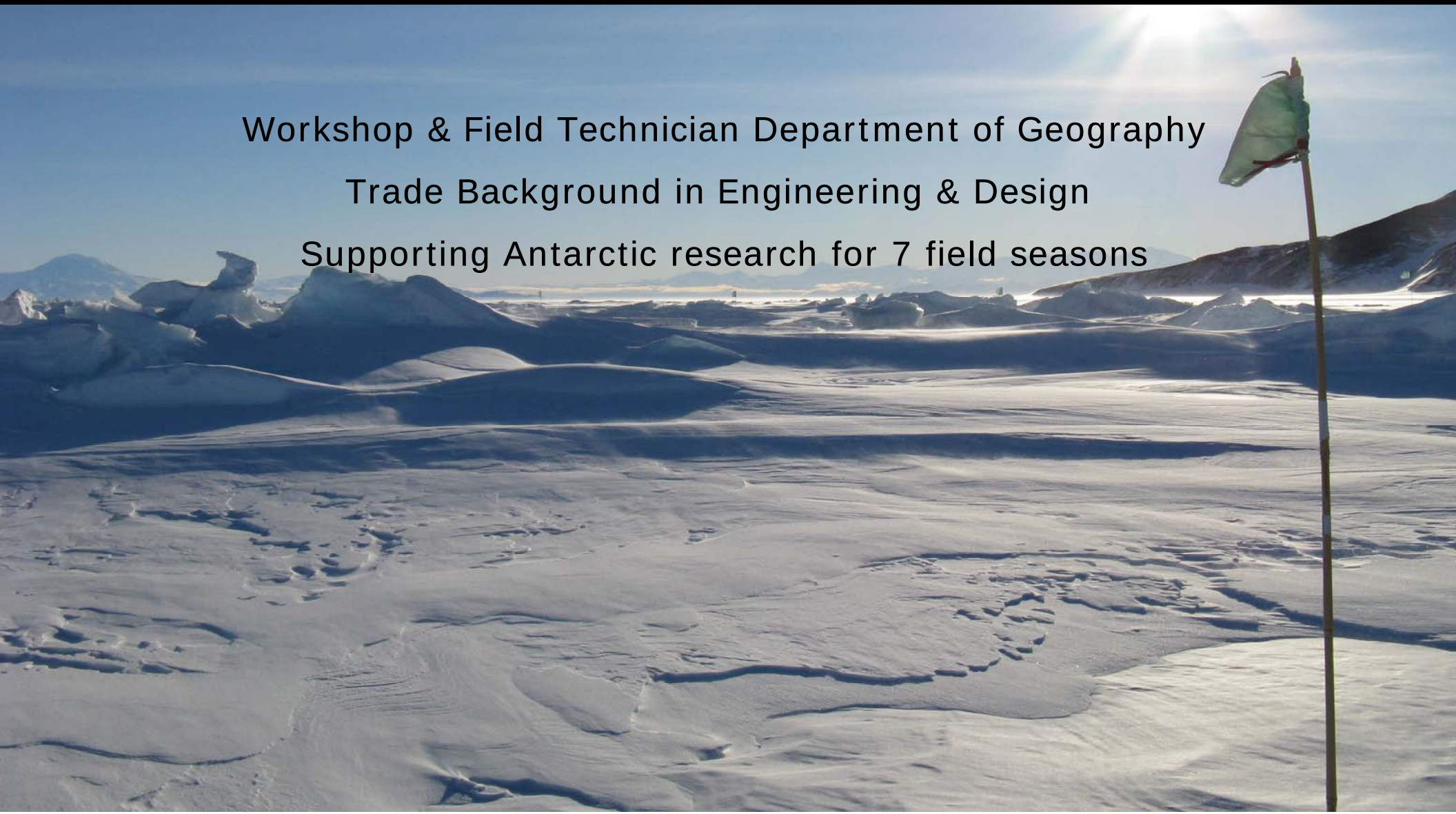
Surface observations on the Darwin & Hatherton Glaciers Antarctica

Nick Key

Department of Geography

University of Canterbury

Introduction



Workshop & Field Technician Department of Geography

Trade Background in Engineering & Design

Supporting Antarctic research for 7 field seasons

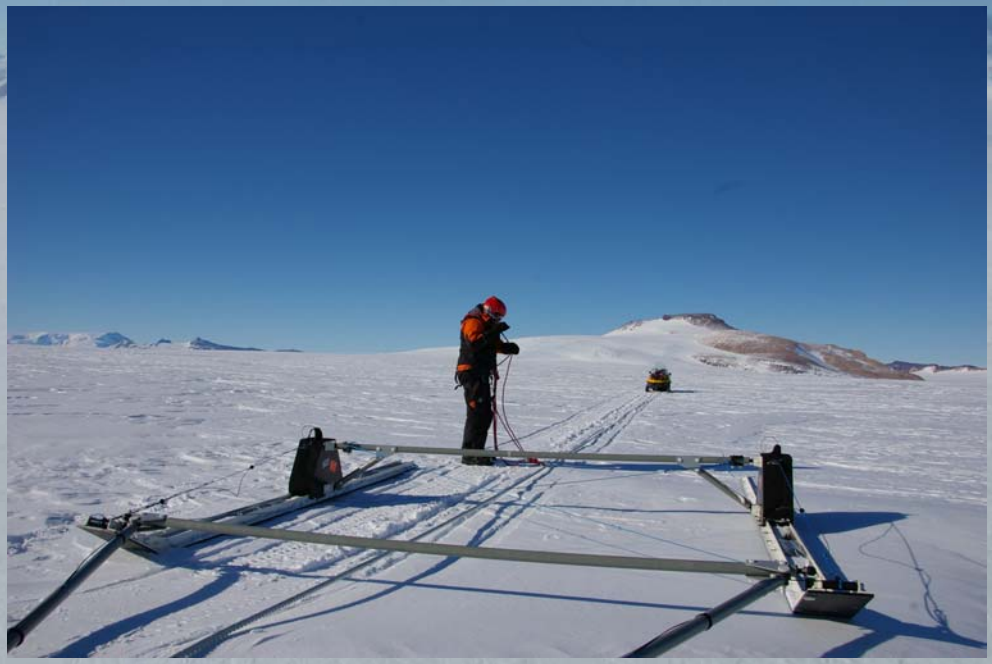
UC Department of Geography

- Located Christchurch New Zealand – US Antarctic Program
- 5 min drive to Christchurch International Airport

Overview of Research Support

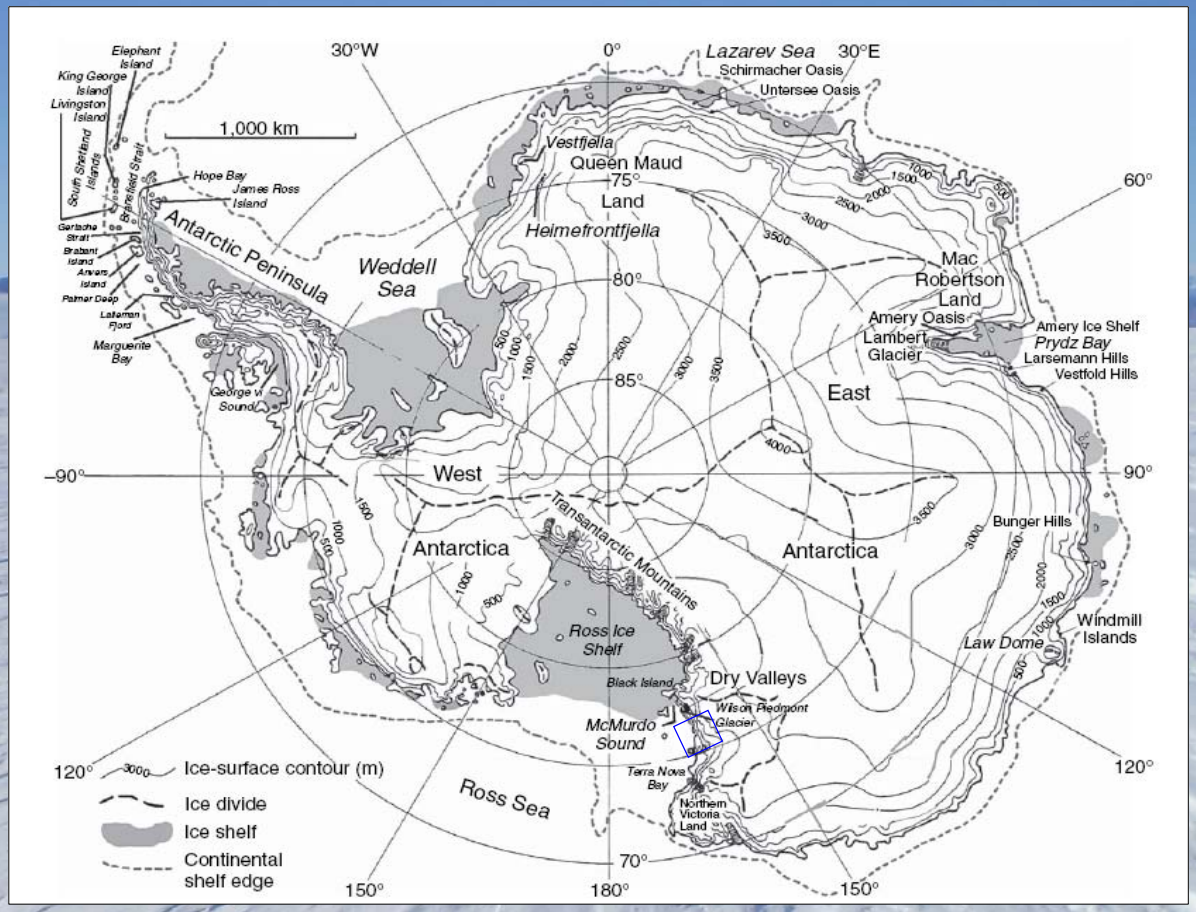
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Automatic Weather Stations (AWS)



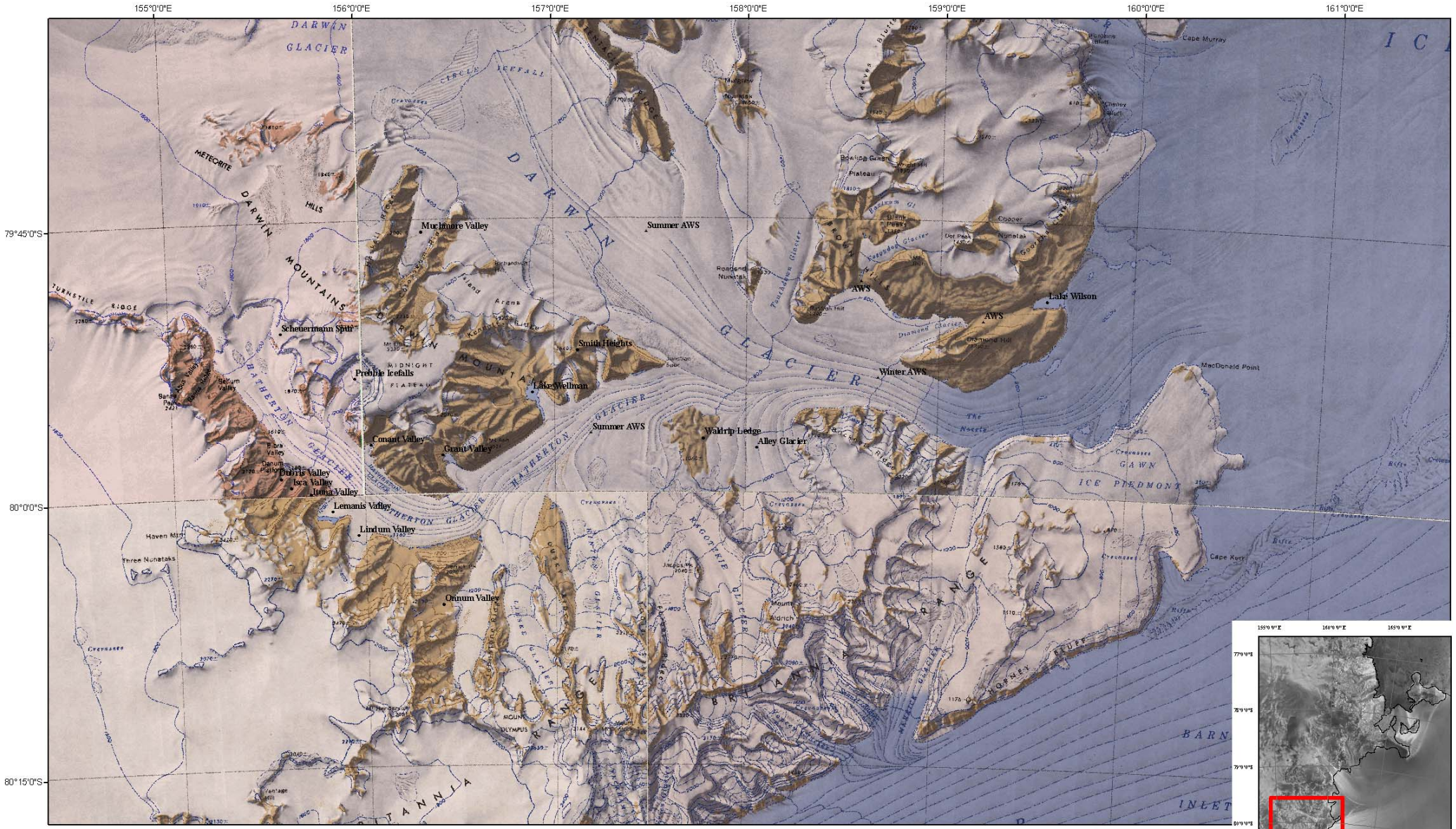
Ground Penetrating Radar (GPR)

Location of Darwin & Hartherton Glaciers



Dynamics and change of the Darwin – Hatherton Glacial System

Features Around the Darwin and Hatherton Glaciers



Scale: 1:250,000

N 0 10 20 Km

0 5 10 Mi

Projection: South Polar Stereographic with Central Meridian at 157°
Contour Interval: 200m, Datum: Mean Sea Level

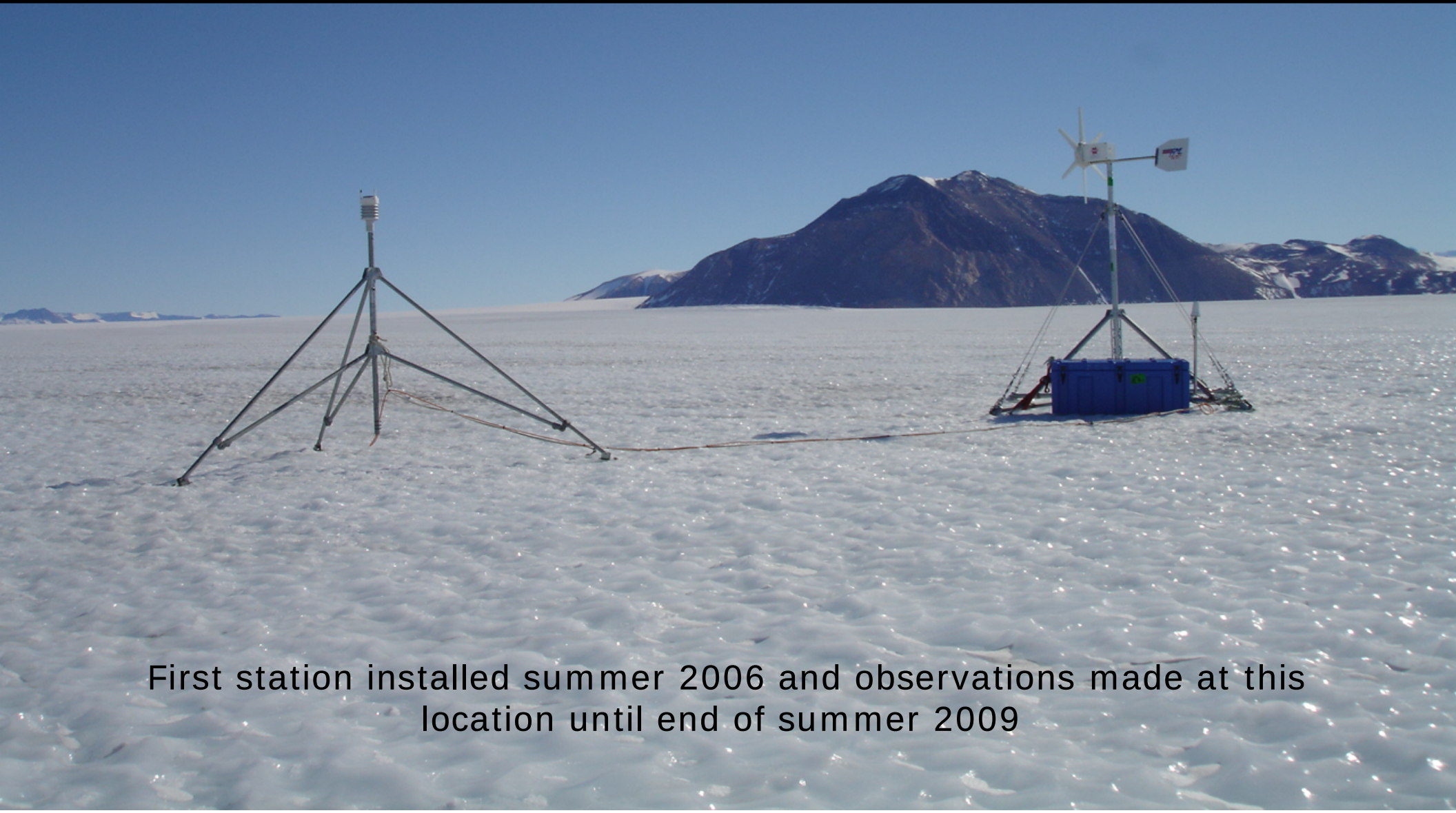
Background Maps: USGS 1:250,000 - Turnstile Ridge, Cape Selborne, Mount Olympus and Carlyon Glacier

Note: Labelled features are approximately located

Automatic Weather Stations

Lower Darwin Winter Site

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND



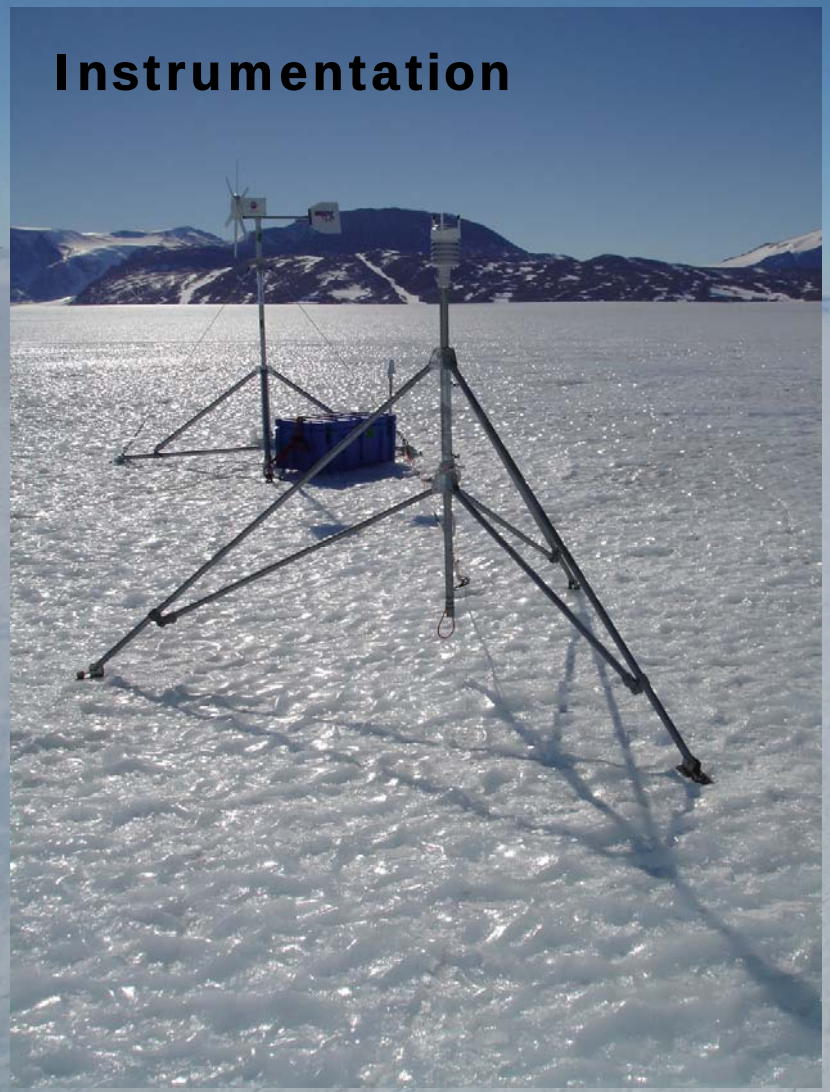
First station installed summer 2006 and observations made at this location until end of summer 2009

Automatic Weather Stations

Winter Site Technical Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Instrumentation

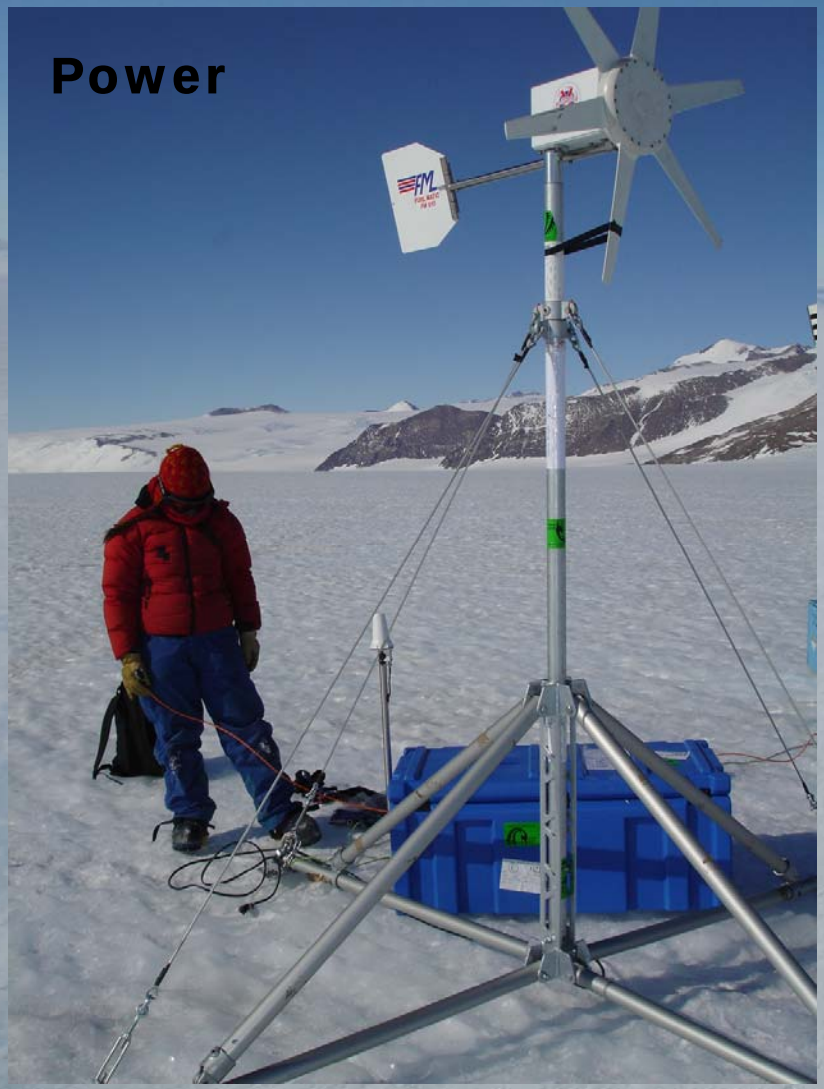


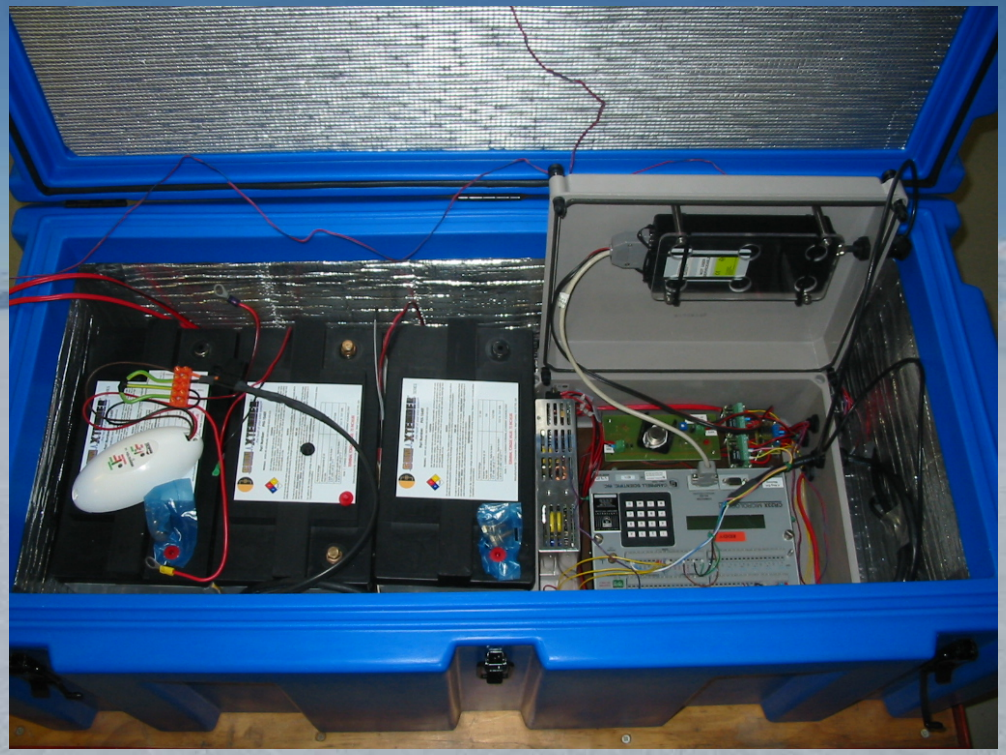
- Vailsala WXT510 Multi Sensor
- Campbell CR23X Data Logger
- Iridium Satellite Modem Communication

Automatic Weather Stations

Winter Site Technical Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND





- Rutland 910-3 Furling Wind Generator (12vdc 72 watt)
- Marlec HRS Charge Regulator
- 3 x 105 amp/hr Concorde Batteries

Automatic Weather Stations

Lower Darwin Winter Site Results & Performance

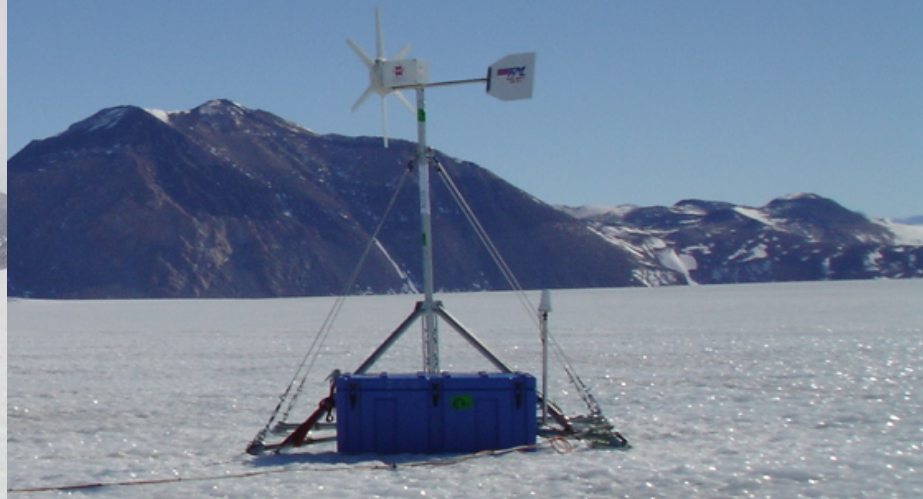
UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

- Vaisala WXT 510 sensor gone!
- Campbell Data Logger failed!
- Comms power supply failed
- About 4 months of summer data collected

Wind generator still operating!

Automatic Weather Stations

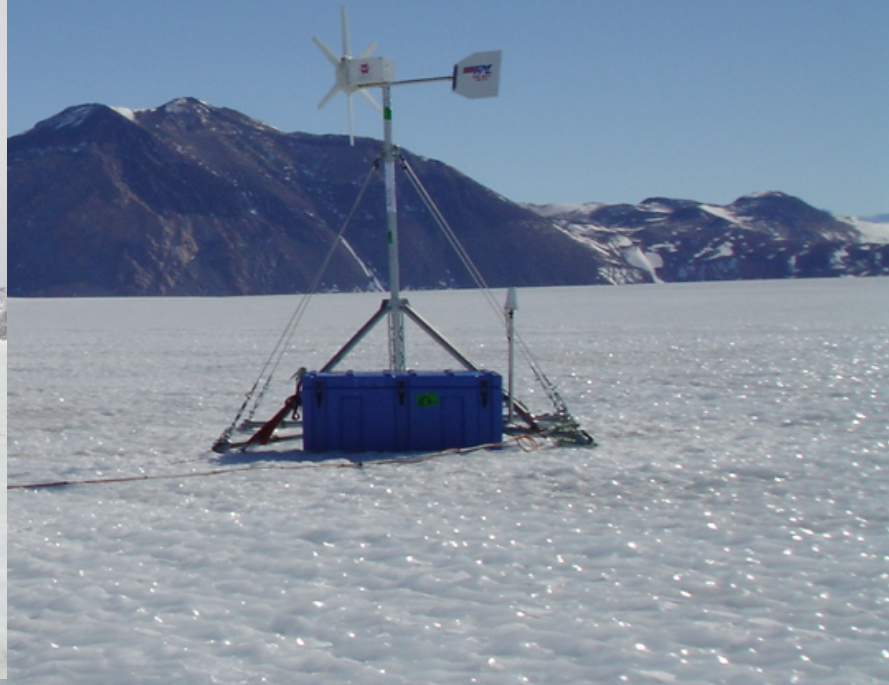
Lower Darwin Winter Site – Back up AWS



- Basic back-up AWS installed
- Campbell CR10X logger
- Vector Anemometer & Vane
- 12 amp/hr Battery & 5 watt panel

Automatic Weather Stations

Lower Darwin Winter Site – Back up AWS



- Basic back-up AWS installed was to be replaced by a repaired winter system but was left out over winter due to poor landing conditions for aircraft.
- Site was revisited 2008, the station was intact and the data reveled that that station had lost power but had come back online with springtime sun.

Automatic Weather Stations

Upper Darwin & Hatherton Summer Sites

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

AWS summer time observations undertaken 2007- 2009
installed on Darwin & Hatherton Glaciers

Automatic Weather Stations

Summer Sites Technical Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Instrumentation

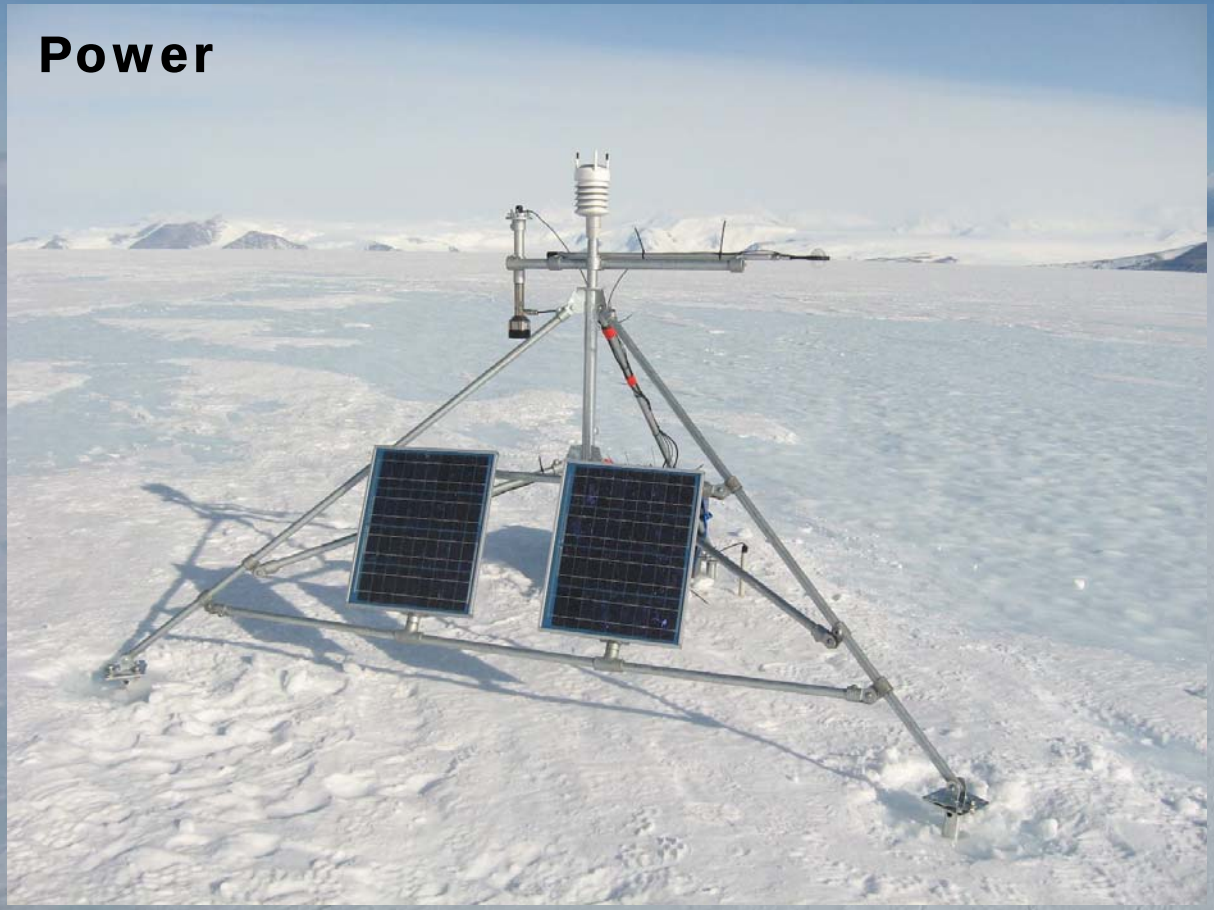
- Vaisala WXT510 Multi Sensor
- Pyranometer
- Net Radiometer
- UDG for ablation
- Campbell 107b for ice temp

Automatic Weather Stations

Summer Sites Technical Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Power



- 2 x BP 20 watt solar panels
- Morningstar 6amp Sunkeeper Temp Compensating Regular
- 1 x Concorde 105amp/hr Battery

Automatic Weather Stations

Winter Site Replacement Technical Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Winter Site Replacement AWS

- Vaisala WXT520 Multi Sensor
- Campbell CR23XData Logger
- BP 65 watt Solar Panel
- Morningstar 12amp Sunkeeper temp compensating regulator
- 4 x 105amp/hr Concorde Batteries
- No External Communications

Removed end summer 09 as no air support to the Darwin region for 2010 season

Automatic Weather Stations

Structures & Anchors

Structures

- Laser cut components allows fast and accurate fabrication
- Structures are designed in CAD then DXF files created for laser cutting

- One size allen key/hex key tool only required to assemble 95% of the AWS
- Light Galv tube tripods ultilising Key Clamp fittings makes structures quick & versatile

Automatic Weather Stations

Structures & Anchors

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

•**Ice Anchor Platform Screw** – 650mm long Aluminium anchor for tripod feet

•Screws into a 50mm Kovac pilot hole & allows for ablation around tripod feet.

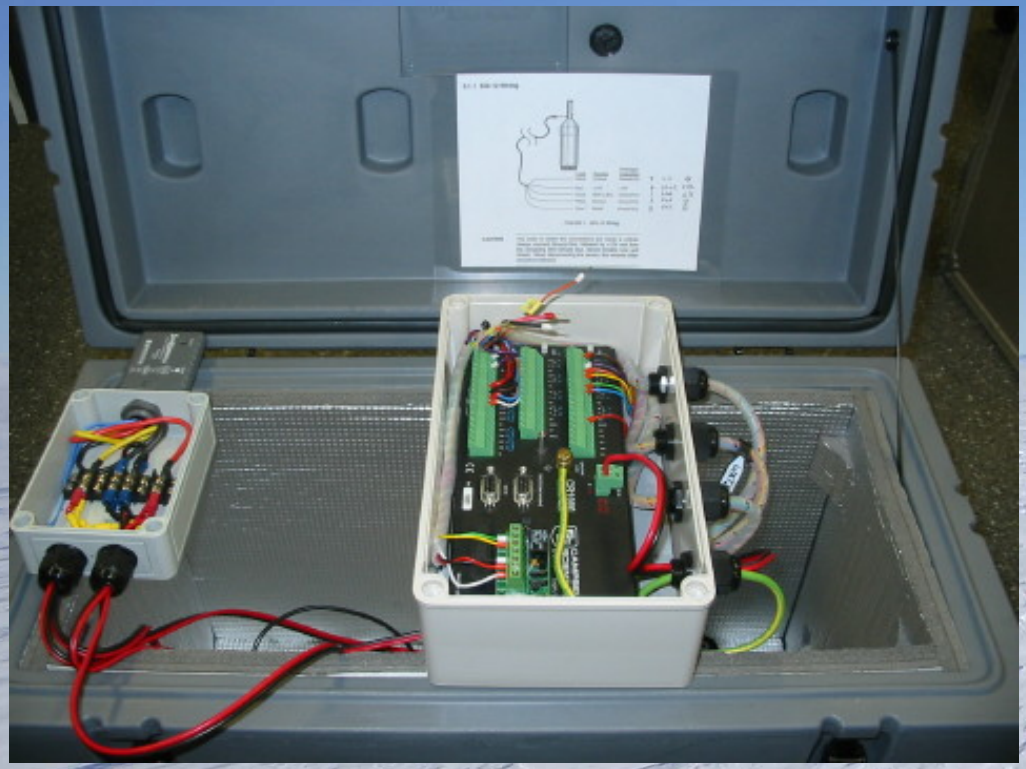
•**Waratah Anchor** – 800mm long steel picket with 25mm curve offset

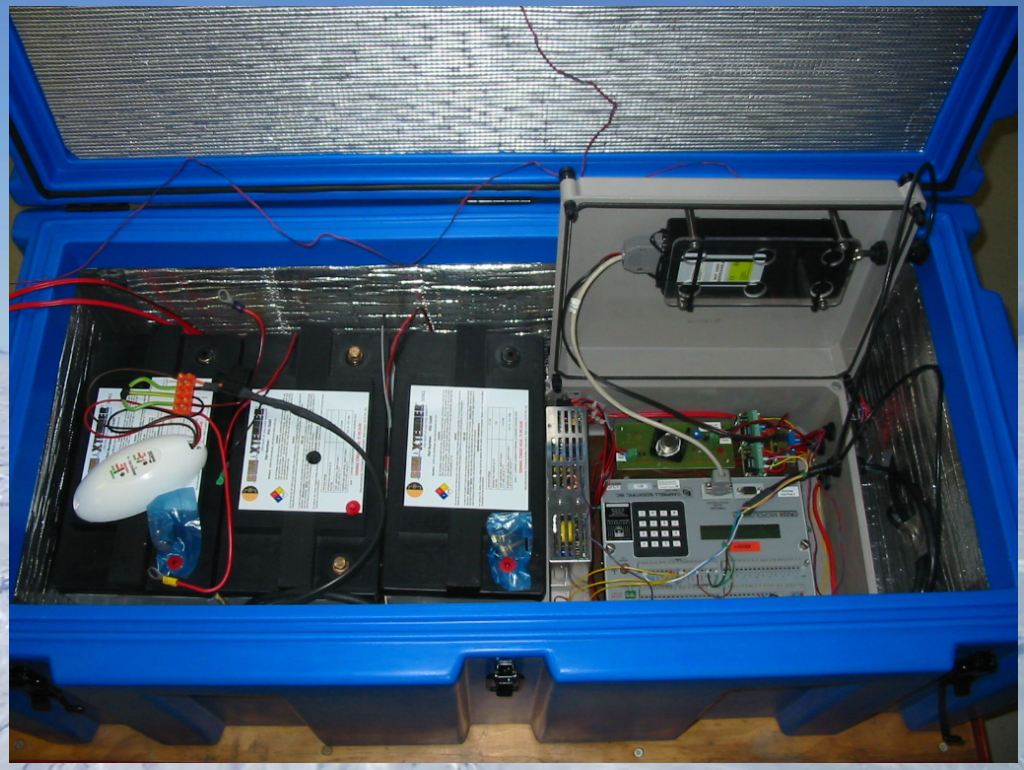
•Hammers into a 50mm Kovac drilled hole & secured to tripod with wire cable

Automatic Weather Stations

Equipment Housings

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND





- **Housing** – Spacecase Mil Spec case, UV Stabilised Polyethylene
- **Insulation** – 40mm Centurylon closed cell foam insulation with reflective foil

Automatic Weather Stations

Summer Sites - Results & Performance

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

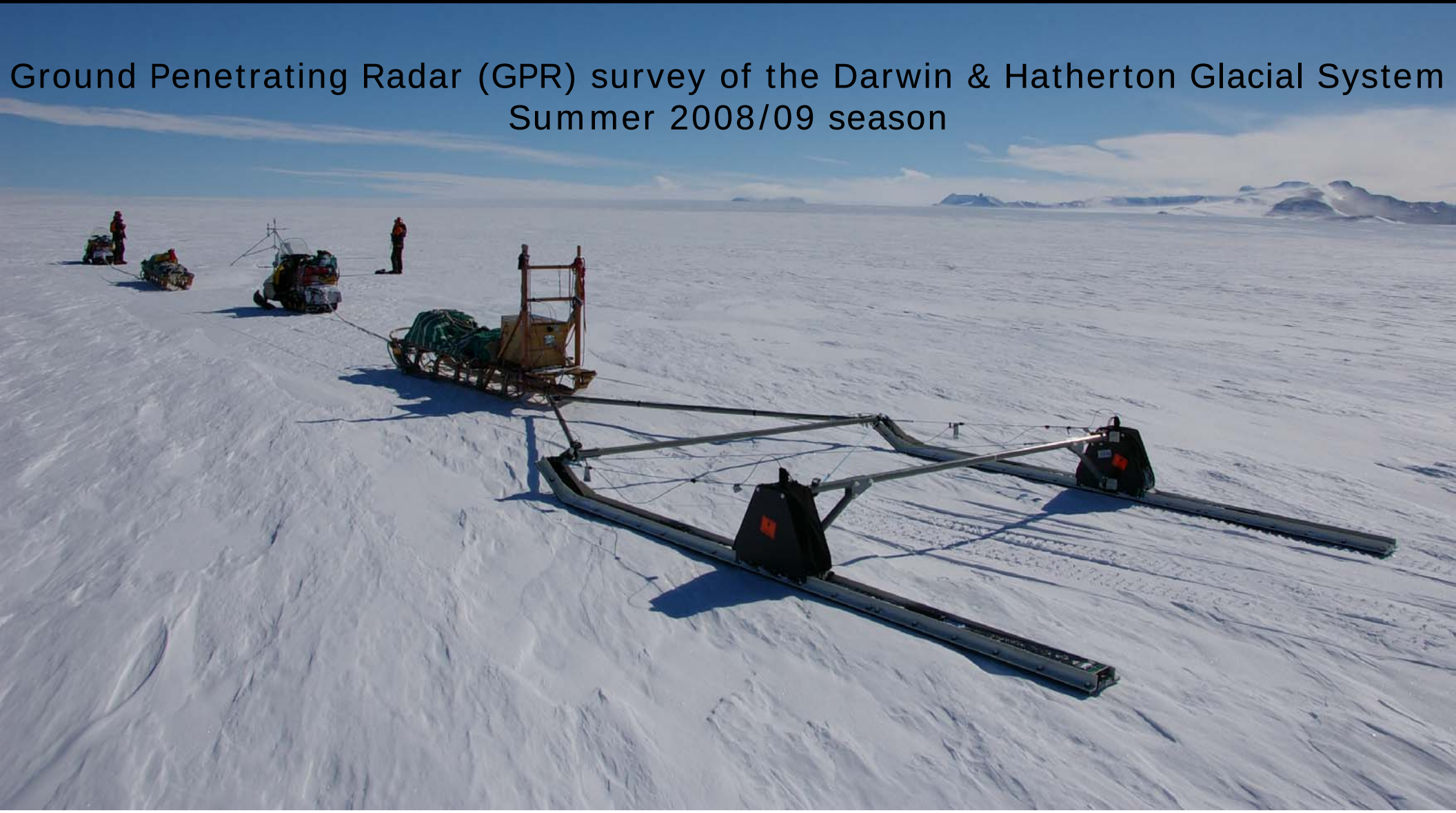
- 100% of data collected from 3 sites
- No Damage or faults
- Power system well maintained
- Ice Anchor platforms successful
- Happy Academics!

*Diurnal wind patterns detected in the glacial system

Ground Penetrating Radar (GPR)

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

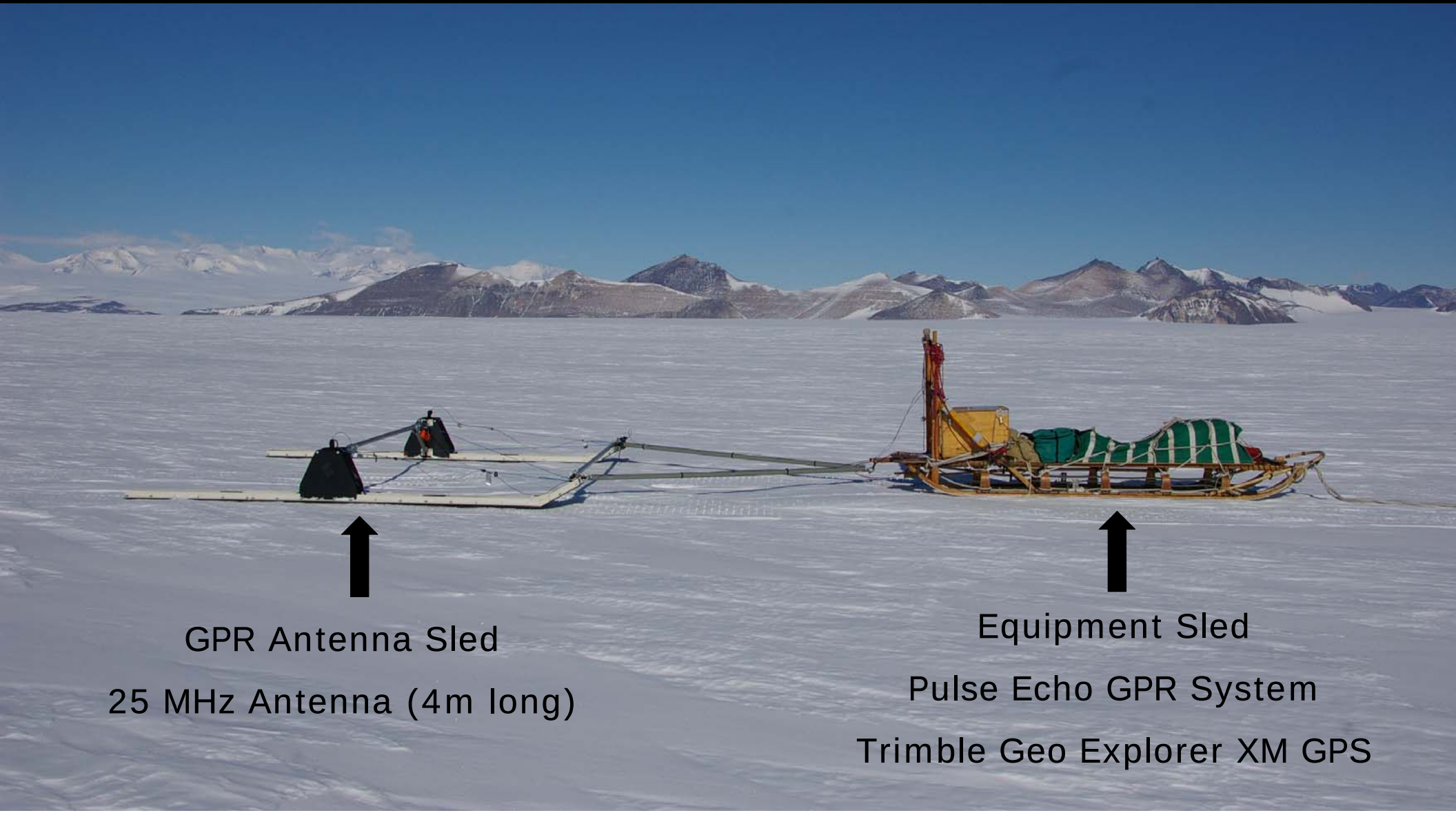
Ground Penetrating Radar (GPR) survey of the Darwin & Hatherton Glacial System
Summer 2008/09 season



Ground Penetrating Radar (GPR)

GPR Sled - General Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND



GPR Antenna Sled

25 MHz Antenna (4m long)

Equipment Sled

Pulse Echo GPR System

Trimble Geo Explorer XM GPS

Ground Penetrating Radar (GPR)

GPR Sled - Technical Description

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

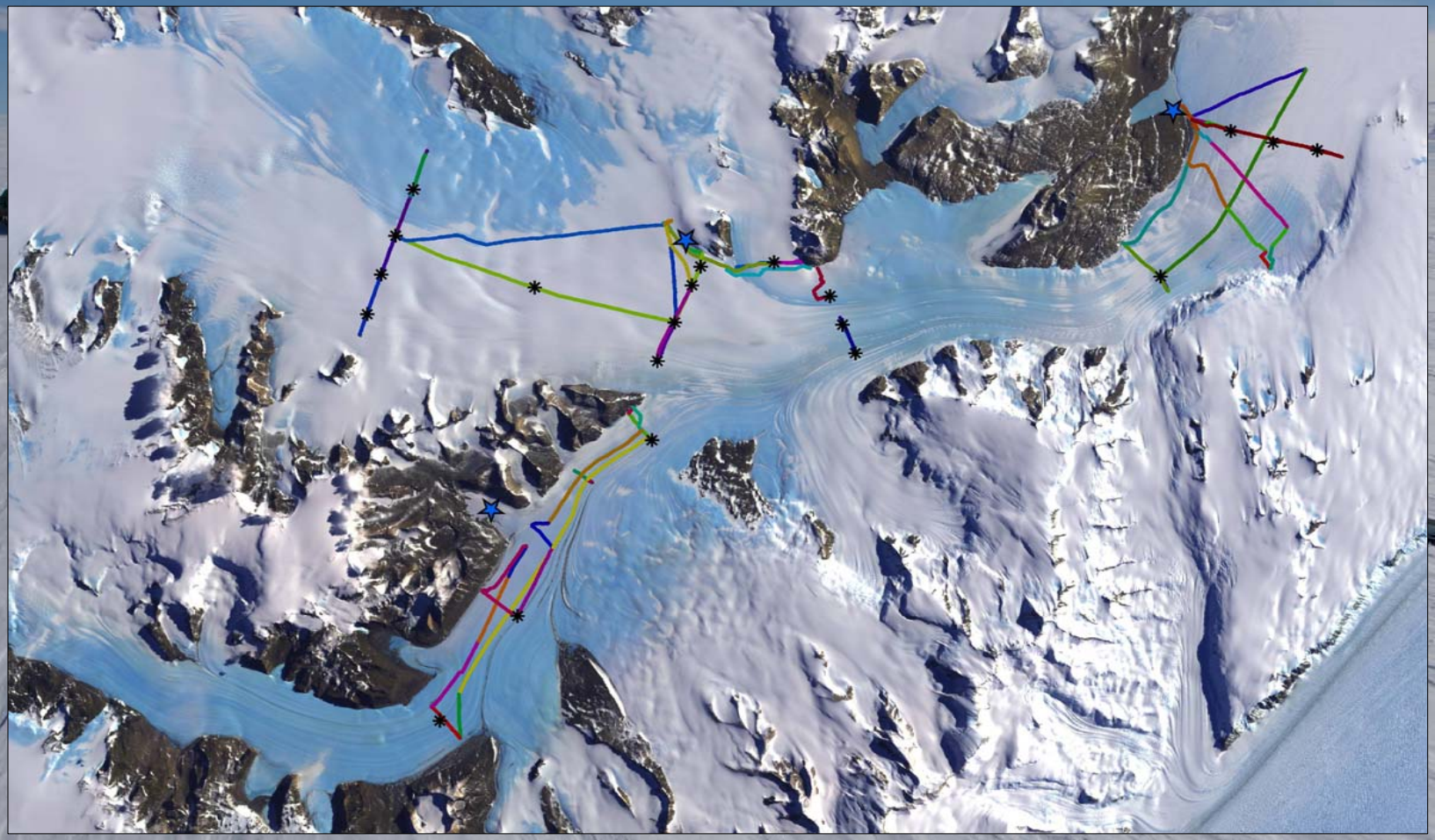
- No Metal used in construction
- UHMWPE skis with fibreglass angle runners
- Fibreglass tube spreaders & tow frame
- Nylon Ball Joints & Fasteners
- Insulated GPR transmitter housing

Ground Penetrating Radar (GPR)

Radar Field Work 24th Nov-18th Dec 08

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

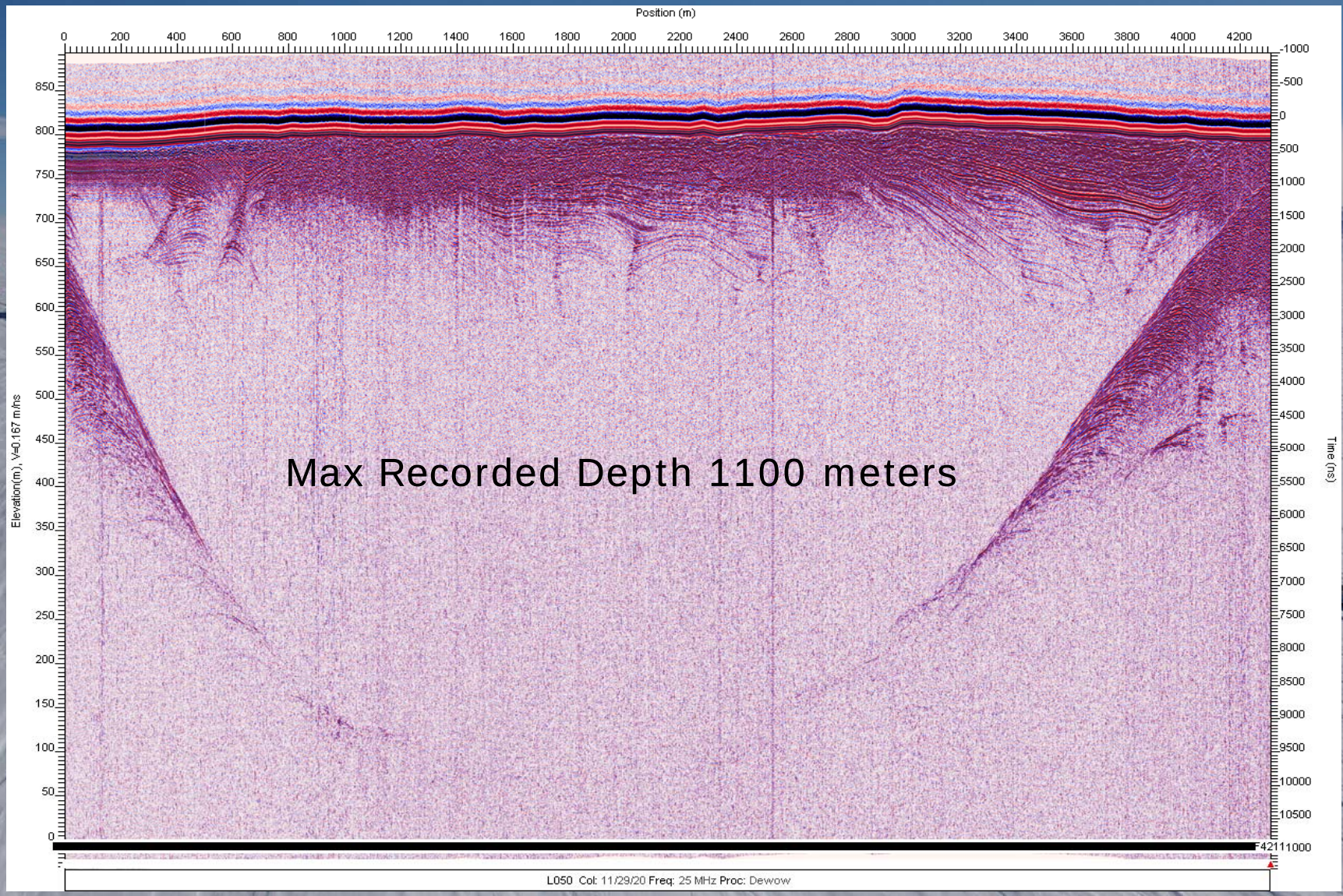
300km of Radar Data Collected



Ground Penetrating Radar (GPR)

Radar Field Work – Touchdown Glacier

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

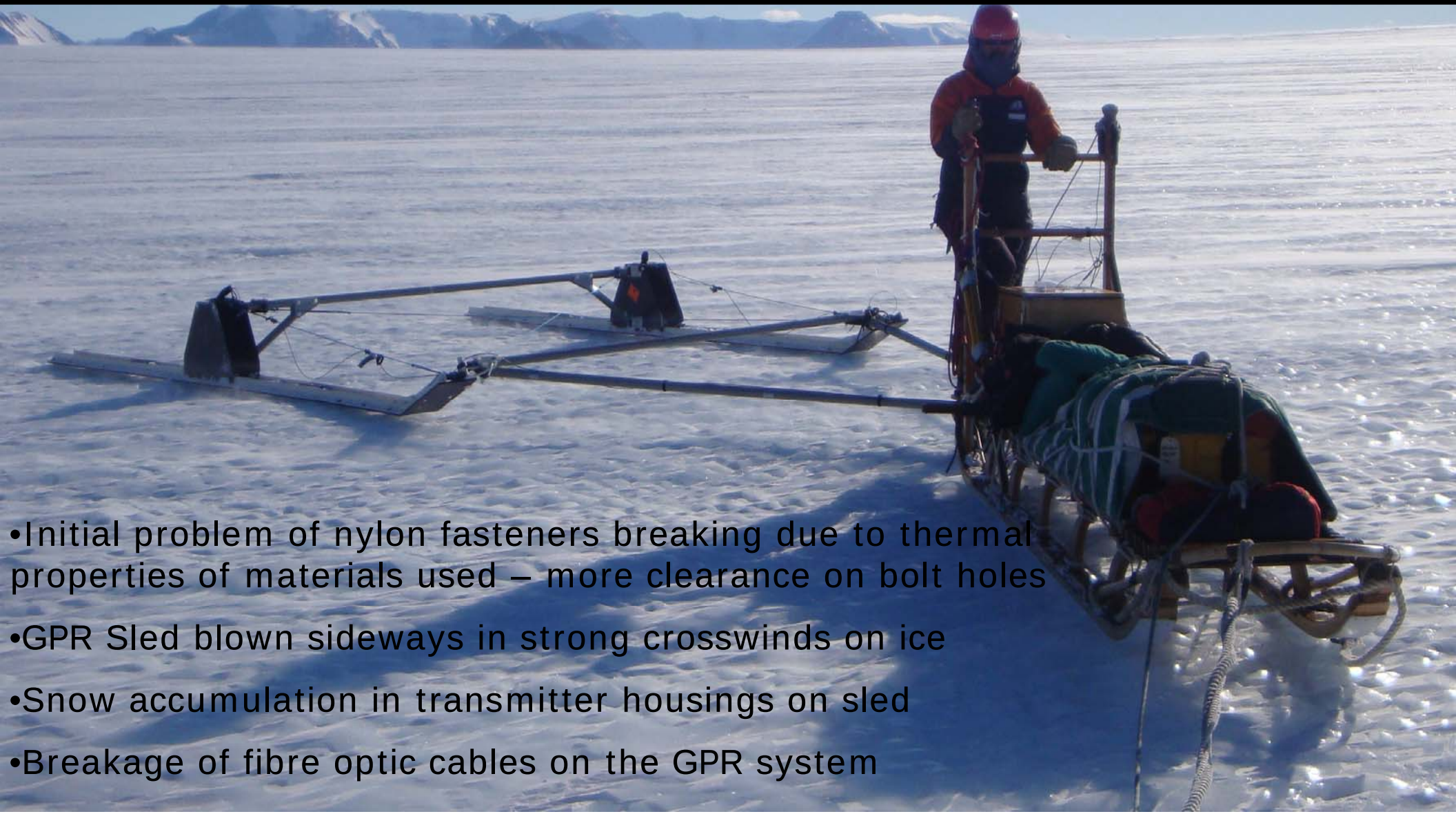


Max Recorded Depth 1100 meters

Ground Penetrating Radar (GPR)

Radar Field Work – Issues

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND



- Initial problem of nylon fasteners breaking due to thermal properties of materials used – more clearance on bolt holes
- GPR Sled blown sideways in strong crosswinds on ice
- Snow accumulation in transmitter housings on sled
- Breakage of fibre optic cables on the GPR system

Questions?

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND