

Near Surface Instrumentation

Mark Nixon

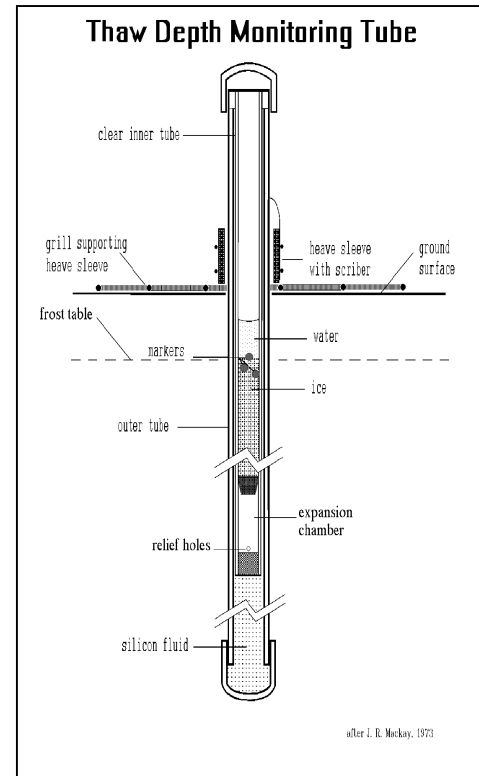
Geological Survey of Canada

Thaw Tubes:

Components: -access tube
-grill, heave sleeve and scribe
-observation tube, material, expansion
chamber, water level

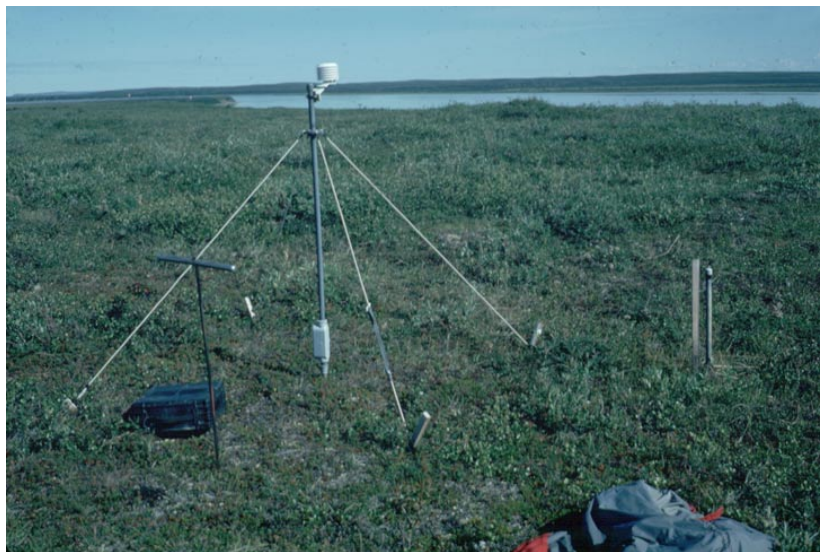
Installation: -3.5 to 4 meter depth
-water jet boring
-minimize disturbance with light equipment,
surface protection, clean up

Observations: -scribe heave, subsidence and current position
-height of tube and scribe
-depth to water, ice and marker beads
-change in expansion chamber
-add new marker bead
-thaw probing, soil moisture
-repaint tube and make scribe reference mark
-dump or replace temperature loggers



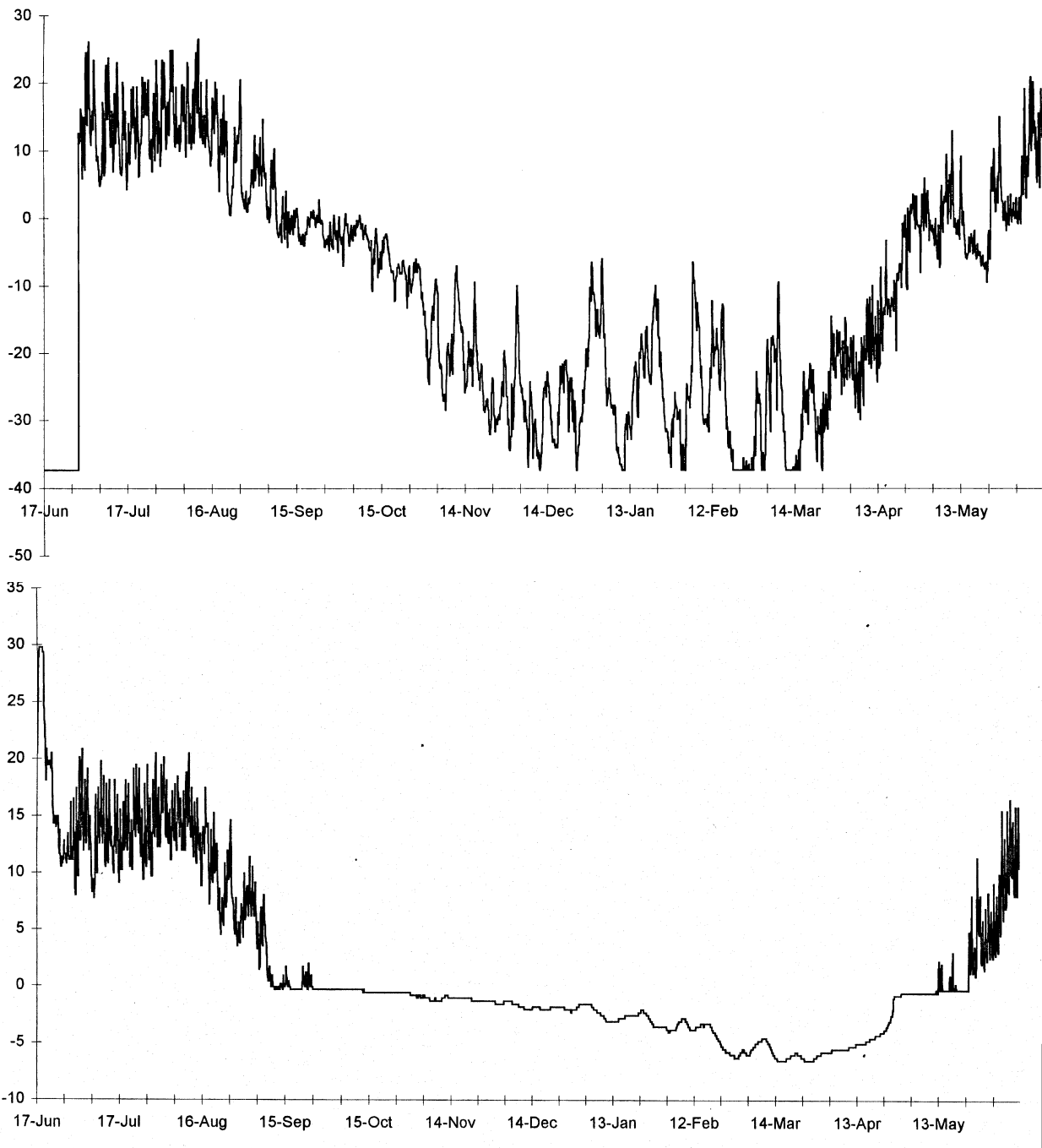
Mini Loggers:

Original Hobos: Problem with
sealing, inflexible programming
and battery capacity in cold



Nixon Instrumentation

Vemcos: Have switched to Vemcos at most sites. Solve first two problems but still affected by cold. Protection required.



Taglu Air and Ground Temperature From Hobo Dataloggers

Logger characteristics:

Logger	Power	Memory	Precision	Range	Communication	Environment	Cost
XL 800	8AA lith + lith bkup / 1 yr + 5 yr	28000 readings or 3500 8 chl. records	13 bit A/D resolution	Sensor dependent	RS 232 serial interface	Sealed to 1000 m.	\$2500
Vemco	Sealed 5 year replaceable	8064 readings nonvolatile 20yr (expand - 64K	8 bit A/D "0.5 ° C. (expnd - 12bit "0.2°	-30 to+40 °C (custom ranges available)	Optical to serial	Sealed to 1000 m.	\$165
Tidbit	Sealed 5 year nonreplaceable	7944 readings nonvolatile (expand - 32K	"0.4°C.	-20 to+50°C	Optical to serial	Sealed to 300 m	\$135
Stowaway optical	Sealed 10 year replaceable	7944 or 32520 readings	"0.4°C.	-39 to+75°C	Optical to serial	Sealed to 30 m.	\$175-255
Shuttle	Sealed 10 year replaceable	130000 points			Optical interim from logger, optical to serial dump to PC	Sealed to 10 m.	\$270?
Stowaway XTI	3.6 volt wafer lithium, 1 year	1800 readings nonvolatile (expnd to 32K	0.5 @-40 "1°@-40	-37 to+46°C	RS 232 serial	Not Waterproof	\$160-240
Hobo pro	3 year replaceable	64K	12 bit A/D "0.2°C.	-40 to100°C	Shuttle or serial	Waterproof	\$175

Cables and multi-channel loggers

Soil probes:

- close spaced near surface profiles, 8 x 2.5 K Ω sensors
- wash bore or auger holes, problem with sensor failure in frozen soil
- install in dry or oil filled access tube or keep sensors inside probe tube
- sealed marine type multi pin connector to avoid connector faults and data lose

Cables:

- manufactured multi sensor cables, 2.5 K Ω sensors, tough cable sheath, ridged molded sealed sensor nods, braided stainless steal protection for lead-in, sealed marine type connector

Logger:

- XL 800, see table for specs. note custom 8 battery pack
- Some discussion of Campbell and Lakefield loggers



- Installation:*
- cored and cased boreholes filled with silicon oil is ideal, to acquire as much subsurface information as possible, allow retrieval, adjustment or replacement, avoid freeze back and thermal stress, give non convective contact with walls
 - many cables installed by wash boring 1" steel pipe up to 30 meters, lined inside with 3/4" poly tubing sealed at base to protect from freezing stress and allow adjustment, recover or replacement
 - keep loggers as warm as possible by using buried plastic silos.