Summary of Permafrost Data of T. E. Osterkamp

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History

Site Selection and Drilling

Requirements for siting the holes included a relatively flat topography and constant geomorphology, no obvious changes in geology, an absence of nearby water bodies, relatively uniform vegetation, and an absence of human disturbances. These criteria were normally applied to an area with a radius about five times the depth of the holes (typically 60 m) or about 300 m radius or more around the holes.

Holes were drilled north of the Brooks Range beginning in 1983. West Dock, Deadhorse, Franklin Bluffs, and Happy Valley were drilled in 1983 and Galbraith and Chandalar were drilled in 1985.

The holes were drilled with a rotary air rig using normal circulation (see Table 1 below). Disturbance to the thermal field of the permafrost was minimal using this method. Typical drilling time was a day although mechanical problems or severe weather sometimes extended this to several days.

Current Status

The sites are serviced once each year when permafrost temperature profiles are measured. We have a continuing program of data reduction, analysis, and interpretation including numerical modeling. Users may want to contact the investigator if they plan to work with the data since a lot of work on it has already been done and is continuing.

Table 1. Drilling and site information.

Site	**Location**	**Dates**	**Method**	**Depth**	**Description**
Kaktovik	1 km W of village and S of DEW site	4/23/85	rotary air	77 m	tundra, grass, patterned groun
ANWR (10 holes)	E of village on N-S line from coast to mountains	3/21/85 into 4/85	rotary air	30+ m	tundra, grass, patterned groun

West Dock Well	E of NPB State #1 well, 226 m from beach	5/29/75	auger	10 m	tundra, grass, patterned groun
West Dock Pad	S of pad about 100 m				tundra, grass, patterned ground
West Dock	0.4 km W of pad, 0.1 km N of access road	4/27&28/83	rotary air	56 m	tundra, grass, patterned ground
Deadhorse Airport	N of the runway and W of the tower				tundra, grass, patterned ground
Deadhorse	S of airport about 3 km and 0.5 km W of road	4/02&03/83	rotary air	60 m	tundra, grass, patterned ground, frost boils, a few low shrubs
Deadhorse Virgil's ??	"				
Franklin Bluffs	S of camp about 3 km and 0.7 km W of road	4/30/83 - 5/4/83	rotary air	60 m	tundra, grass, patterned ground, frost boils, low shrubs
Happy Valley	N of camp about 1 km and 0.3 km W of road	5/5-10/83	rotary air	41 m	tundra, patterned ground, shrubs
Galbraith Lake	0.2 km W of tower and 0.1 km S of trail	5/2/85	rotary air	75 m	tundra, grass, patterned ground
Chandalar Shelf	0.2 km E of S end of runway	5/3/85	rotary air	63 m	tundra, grass, high shrubs
Coldfoot	1 km E of camp	12/3/83	rotary air	64 m	tundra, grass, scattered birch and spruce
Old Man	0.3 km N of airport access road	5/6/83	rotary, air	63 m	tundra, grass, patterned ground

Yukon River	0.3 km N of river and E of bridge	5/5 to 5/7/85	rotary, air	61 m	tussocks, shrubs, black spruce
Livengood	0.5 km SE of turn-out	5/3/83	rotary, air	42 m	mixed low birch and spruce forest, thick moss
Poker creek					
Chatanika					
College	UAF, College Peat site	4/11 to 4/14/83	rotary, air	69 m	tussocks, shrubs, black spruce
Engineer Creek					
Farmer's Loop	Farmer's Loop Road across from UAF	11/28/78	augered	32 m	mixed low birch and spruce forest, thick moss, in ice wedge field
UAF #1			augered		
UAF #2			water jet		
UAF #3			water jet		
University Farm (5)			augered		
University Farm Ice Site			augered		
Birch Lake	0.7 km N of hwy, 1.0 km E of lake	5/1 to 5/2/85	rotary, air	62 m	dense black spruce
Bonanza Creek	Bonanza Creek LTER site	3/13 to 3/15/94	air, reverse circulation	45 m	tussocks, shrubs, black spruce
Gulkana	0.3 km N, 0.7 km W of airport	2/2 to 2/3/83	rotary, mud	89 m	tussocks, shrubs, black spruce

Healy	0.5 km S, 0.2 km W of Eight Mile Lake	4/24 to 4/25/85	rotary, air	28 m	tundra, grass
Donnelly	0.3 km S, 0.4 km E of radar access road	4/30/85	rotary, mud	63 m	low, high shrubs, bare gravel
Eagle	0.8 km off W end of airport runway	5/3/85	rotary, air	63 m	tussocks, shrubs, black spruce
Les Viereck	0.2 km S of Les Viereck's house	8/1/02	auger	1m	shrubs and black spruce

Table 2. Thermal data for sites penetrating permafrost and Birch Lake.

Site	Thawed gradient (°C/km)	Frozen gradient (°C/km)	Base of IBP (m)	Temperature at the base of IBP (°C)	Depth of the 0 °C isotherm (m)
Gulkana	72	76	37.28	-0.144	39.24
Birch Lake	-	40	-	-	63.0*
College	105	71	65.2	-0.11	66.14
UAF1	72	42	25.14	-0.106	26.53
UAF2	67	31	38.00	-0.105	39.61
UAF3	42	26	35.47	-0.06	36.74

*Obtained by extrapolation of the temperature profile downwards.

General information

The data consist of two types; data obtained by remote battery-powered computer-controlled automatic temperature loggers and manually measured temperature profiles.

Data from Temperature Loggers

The loggers were Omnidata Easy Loggers model EL 824-GP. Thermistor rods were constructed by installing thermistors in a plastic rod at fixed intervals noted in the files. Calibration of the thermistors and loggers as a unit was checked in an ice bath with adjustments made where necessary so that the loggers recorded 0 C to within a few hundredths of a degree. Thus, the data are most accurate near the ice-point.

Power for the loggers was supplied by two 26 amp-hour Gel-Cell batteries with a blocking diode in the circuit. These supply enough power for at least three years of continuous operation if the internal batteries (D cells) in the logger are changed each year. Batteries and loggers were placed in military ammo containers which were buried in the ground with the lids remaining above ground. The containers were covered by a box insulated with two inches of blue foam.

The thermistor rods were installed in the ground with their bottoms terminating in the permafrost. A large metal washer was bolted to the bottom of the rods, which were frozen in place, to prevent frost heave of the rods.

Temperatures in the air (1.5 m height in a radiation shelter), at the ground surface (using a thermistor in a small metal tube), three temperatures in the active layer, three temperatures at the permafrost table and three temperatures in the permafrost were usually recorded. A logging interval of four hours was used with the logger recording the daily maximum, mean, and minimum air temperatures and the instantaneous and daily mean active layer and permafrost temperatures.

The user is forewarned that some of the thermistors are failing. In most cases, these are indicated by ridiculous values but in some cases the changes are subtle.

New Cambell CR10 data loggers and thermistor rods were installed in 2001-2002 at the University Farm, GI1 (now called UA), College Peat, and Les Viereck's house sites.

Permafrost Temperature Profiles

These profiles were obtained by measuring the resistance of a thermistor sensor on the end of a cable which was lowered into the holes. The accuracy of this method is typically about 0.005 C sensitivity about 0.001 C. Details of the method can be found in Osterkamp (1985).

File Information

Loggers

The data have been saved as ASCII text files (.dat, .txt, or no extension) or MS Excel files (.xls extension), and have been concatenated into master files for each site. A header occupies the first row, and indicates either the actual height (in meters, except for the GI4_8795m.txt file which is in centimeters), or the layer represented by each measurement. Mean or instantaneous temperatures (in degrees C) for each day are shown for the air, ground surface, active layer at 3 levels (Al1, Al2, Al3), permafrost table at 3 levels (Pt1, Pt2, Pt3) and permafrost at 3 levels (Pf1, Pf2, Pf3). Note: the first 1 to 3 columns may not be labeled, but typically contain date information in either MM/DD/YY or DD-MMM-YY format, and as a running total of the number of days from the beginning of the year of record, or the beginning of the 20th century.

A consistent file naming convention has not been developed. A list of file name abbreviations for the sites is given below. Generally numbers in the file names, like 86 through 96, refer to the years contained in the file. For example Wd86-93.dat is a composite file for the West Dock site starting in the fall of 1986 and ending in the summer of 1993.

Possible Site Abbreviations:

BC; Bonanza Creek LTER site
DH; Deadhorse
FB; Franklin Bluffs
GI1; Geophysical Institute site number one
GI4; Geophysical Institute site number four
HH; Hogan Hill
UFAR, UF; University farm
WD; West Dock

Profiles

The data through 1996 were formatted in MS Excel and saved as ASCII text files. Each yearly file contains four columns of data; decimal time, depth (in meters, typically up to 80m), resistance (in ohms, typically 10,000 to 20,000 ohms), and temperature (in degrees C, typically negative e.g. -9.123 C). All measurements were made during the summer months of the year which is indicated in the first line of each file. For some sites composite files have been constructed, consisting of all temperature data for that site through the year stated. These composite file names begin with the letter “I”. For example, Ibir96 refers to the composite file for Birch Lake through 1996. A list of file name abbreviations for the sites is given below.

The data through 2003 are in MS Excel files, and all are composite files containing temperature data (in degrees C) for multiple years. The numbers in the file name list the years contained in the file. For example, DH9301.xls contains data from the

Deadhorse site for 1993 through 2001. A list of file name abbreviations for the sites is given below.

Possible Site Abbreviations:

Donela; Donnelly Dome
Eagle; Eagle
Farm 2, UF2; University farm hole two
GI1-3; Geophysical Institute sites 1 to 3
Wdk, WD; West Dock
Hogan, HH; Hogan Hill
Bir, BL; Birch Lake
Cft, CF; Coldfoot
Cpt, CP; College Peat
Csf, CS; Chandlar Shelf
Dhs, DH; Deadhorse
BC1-2; Bonanza Creek sites 1 to 2
Hpv, HV; Happy Valley
Lgd, LG; Livengood
olm, OM; Old Man
FB; Franklin Bluffs
YR; Yukon River
kotze; Kotzebue
Otrcr; Otter Creek
Robri; Robertson River
Stam, SP; Stampede
GLK, GL; Galbraith Lake
Glk, GK; Gulkana

Additional Information

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Much of the data has already been published in the form of reports, theses, conference abstracts and papers and journal articles. Additional information on the sites, their locations, drilling methods, data gathering, data reduction and methods of data analyses are given in the selected references below.

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