



# CLPX-Ground: ISA Soil Moisture Measurements, Version 1

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## USER GUIDE

### How to Cite These Data

As a condition of using these data, you must include a citation:

Cline, D. and K. Elder. 2005. *CLPX-Ground: ISA Soil Moisture Measurements, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. <https://doi.org/10.5067/3XE38KNUZX0A>. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT [NSIDC@NSIDC.ORG](mailto:NSIDC@NSIDC.ORG)

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/NSIDC-0178>



National Snow and Ice Data Center

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# 1 DETAILED DATA DESCRIPTION

## 1.1 Format

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ASCII data in all files other than the met\_sites file are presented in 35 columns in comma-separated value format. Double quotes are used to delimit text within fields, and commas contained within the double quotes do not indicate a new field. Column headers are included in row 1 and are as follows:

Sample Number  
 Sample ID  
 Date  
 Time (MDT)  
 Latitude (DD)  
 Latitude (MM)  
 Latitude (SS)  
 Longitude (DDD)  
 Longitude (MM)  
 Longitude (SSS)  
 Latitude (DD.DDDD)  
 Longitude (DD.DDDD)  
 UTM east  
 UTM North  
 Remarks / Comments  
 Flight line 1  
 Flight line 2  
 Flight line 3  
 Principal Collector  
 Partner  
 Photo (south facing & north facing)  
 Sample A container weight or bag weight (g)  
 Sample A Wet Weight (g)  
 Sample A Dry Weight (g)  
 Sample A moisture (g)  
 Sample A dry soil (g)  
 Sample A Gravimetric (g H<sub>2</sub>O/g soil)  
 Sample depth (cm unless otherwise stated)  
 Sample B container weight or bag weight (g)  
 Sample B Wet Weight (g)  
 Sample B Dry Weight (g)  
 Sample B moisture (g)  
 Sample B dry soil (g)  
 Sample B Gravimetric (g H<sub>2</sub>O/g soil)  
 Sample depth (cm unless otherwise stated)

ASCII data in the Soil\_moisture\_met\_sites file are presented in 12 columns in comma-separated value format. Double quotes are used to delimit text within fields, and commas contained within the double quotes do not indicate a new field. Column headers are included in row 1 and are as follows:

Sample ID  
UTM east  
UTM North  
Date  
Time (MDT)  
Total sample wet mass (g)  
Total sample dry mass (g)  
Bulk density (g/cm<sup>3</sup>)  
Sample gravimetric water content (g H<sub>2</sub>O/g soil)  
Sample volumetric water content (g H<sub>2</sub>O/g soil)  
Sample depth (cm unless otherwise stated)  
Remarks / Comments

**Sample Number** is determined by

Sept2001: MSA sample number.

IOP3: either (1) location, or (2) replicate number / sample number.

IOP 4: replicate number and sample number.

IOP1, IOP2, and Sept2002 have no sample numbers; only sample IDs

**Sample IDs** use the following conventions:

**Sept2001:** MQQXXX where M = MSA indicator (e.g., F = Fraser), QQ = Quadrant (i.e., NE, NW, SE, SW), and XXX = Quadrant sample number).

**Sept2001:** MQQXXR where M = MSA indicator (e.g., F = Fraser), QQ = Quadrant (i.e., NE, NW, SE, SW), XX = Quadrant sample number, and R = Sample replicate (i.e., A or B).

**IOP1 & IOP2:** one of three options:

1. MISPXX where M = MSA indicator (e.g., F = Fraser), I = ISA indicator (e.g., A = Alpine), SP = snow pit, and XX = snow pit number in which the sample was taken
2. nameX where name = surveyor name, and X = surveyor sample number
3. LSOSXR where LSOS = sampling location, X = LSOS sample number, and R = Sample replicate (i.e., a or b).

**IOP3:** one of four options:

1. name of MSA (e.g., Fraser)
2. MIMET where M = MSA indicator (e.g., F = Fraser), I = ISA indicator (e.g., A = Alpine), and MET = Main meteorological site at which the sample was taken

3. MISIP where M = MSA indicator (e.g., F = Fraser), I = ISA indicator (e.g., A = Alpine), and SP = snow pit
4. LSOS = sampling location.

**IOP4:** one of three options:

1. MISIP where M = MSA indicator (e.g., F = Fraser), I = ISA indicator (e.g., A = Alpine), and SP = snow pit
2. LSOS = sampling location
3. MIMET where M = MSA indicator (e.g., F = Fraser), I = ISA indicator (e.g., A = Alpine), and MET = Main meteorological site at which the sample was taken

**met\_sites:** MI-X where M = MSA indicator (e.g., F = Fraser), I = ISA indicator (e.g., A = Alpine), and X is the position of the meteorological tower within the ISA (i.e., C = center, NW = northwest corner, NE = northeast corner, SW = southwest corner and SE = southeast corner).

FHQ indicates a met tower located close to the LSOS outside of other Fraser ISAs.

**Date** follows the following conventions:

IOP1: YYYYMMDD  
 IOP2: YYYYMMDD  
 IOP3: MM-DD-YY  
 IOP4: YYYYMMDD  
 met\_sites: DD/M/YYYY  
 Sept2001: YYMMDD  
 Sept2002: M/DD/YYYY

## 1.2 File and Directory Structure

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The directory structure is as follows:

```
IOP1/
  Soil_moisture_IOP1_v1.csv
IOP2/
  Soil_moisture_IOP2_v1.csv
IOP3/
  Soil_moisture_IOP3_v1.csv
IOP4/
  Soil_moisture_IOP4_v1.csv
Met_Sites/
  Soil_moisture_met_sites_v1.csv
Sept_2001/
  Soil_moisture_Sept2001_v1.csv
Sept_2002/
  Photos/
  Soil_moisture_Sept2002_v1.csv
```

## 1.3 File Naming Convention

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The data files are named `Soil_moisture_###_v1.csv` where:

`###` = IOP1, IOP2, IOP3, IOP4, met\_sites, Sept2001, Sept2002

`v1` = version number

Photos of sample sites taken during the Fall background data collection in 2002 are named `MQQ###S.jpg` where:

`M` = MSA

`QQ` – Quadrant of MSA (i.e. NE, NW, SE or SW)

`###` = three digit sample number

`S` = sample replicate (A or B)

The location of photographs is determined using the label of a soil sample container placed in the foreground of photograph. If the clarity of the label in the photograph prevents an accurate identification of the location, the photograph is included in the directory but not labeled in the manner described above.

## 1.4 File Size

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Data files range from 16 to 129 KB. Photos are appx 600-700 KB each.

## 1.5 Spatial Coverage

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Three data sampling programs contributed to the overall soil moisture data set:

1. Fall background data
2. Snow pit data
3. Meteorological tower installation data

### 1.5.1 Fall Background Data

Soil moisture data were collected during September of 2001 and 2002 to provide measurements of soil moisture prior to the beginning of the winter snow accumulation season. Soil samples were collected at between 77 and 146 separate sites within each MSA. The location of each sample within each MSA is recorded in latitude and longitude to four decimal places. Where possible, samples were located within MSAs to intersect the ground path of the gamma data collection flight lines, thereby allowing calibration of background gamma data. The ID number of the gamma flight

lines are listed where appropriate intersections occur. Photographs were taken at each site during 2002 to record the nature of the terrain and vegetation surrounding the point samples.

### 1.5.2 Snow Pit Data

Soil samples were taken at the base of snow pits that were excavated at up to 16 locations within each ISA during IOP1, IOP2, IOP3, and IOP4. The location of each pit within a 1 km x 1 km ISA was consistent between ISAs. The following figure shows the location of snow pits (see blue crosshair style pit markers; e.g., NMSP1) in the example ISA.

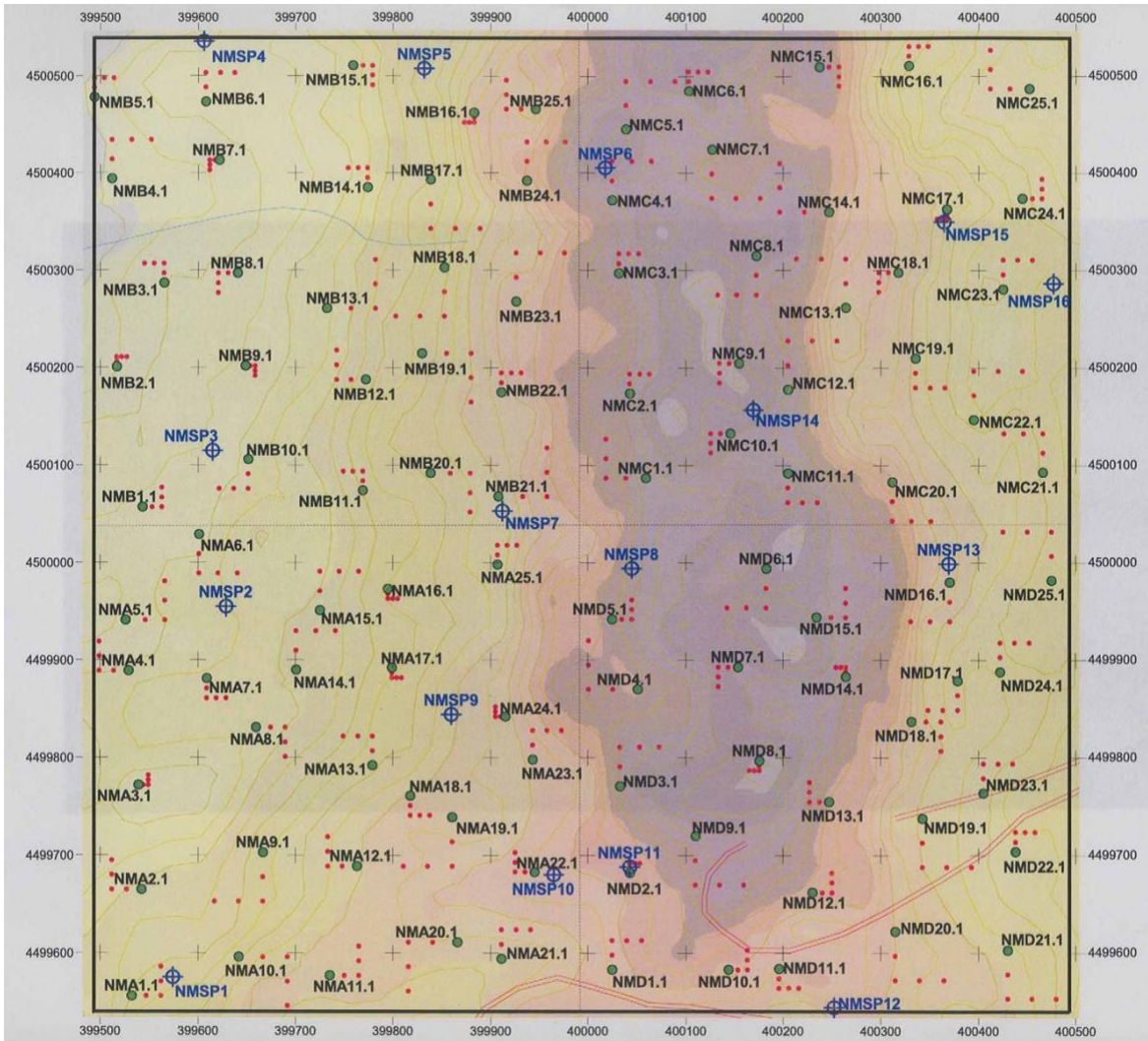


Figure 1. Example ISA showing the location of snow pits.

The location of snow pits in the LSOS in 2002 are indicated below. Soil samples were taken at the base of each pit during IOP1 in February and IOP2 in March.

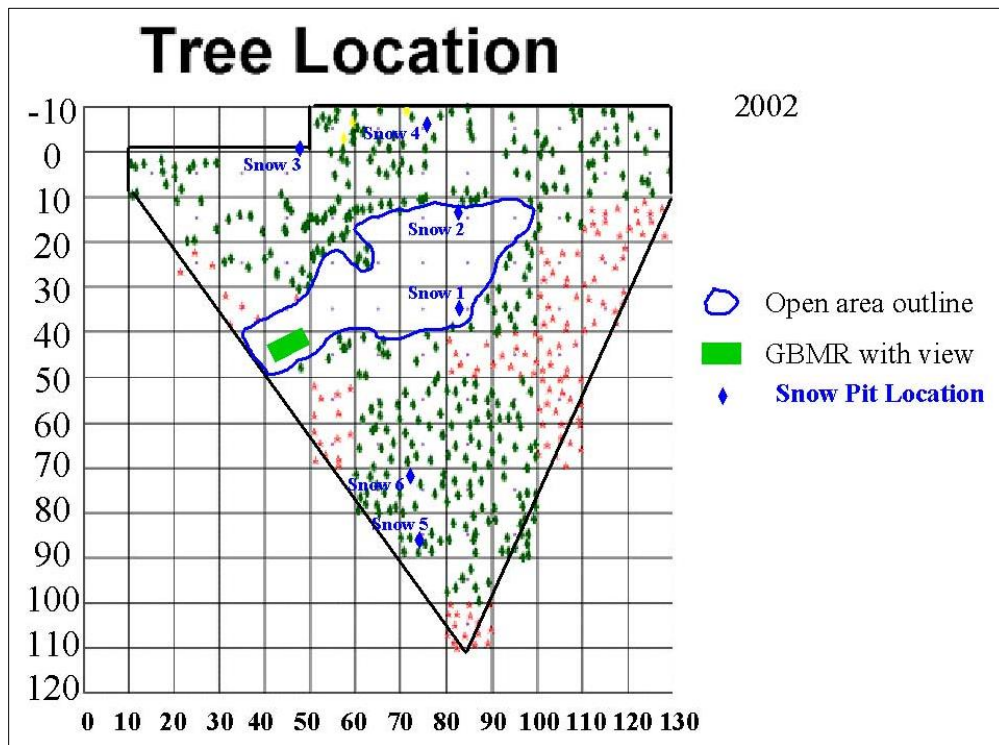


Figure 2. 2002 LSOS Snow Pit Locations

The location of snow pits in the LSOS in 2003 are indicated below. Soil samples were taken at the base of each pit during IOP3 in February and IOP4 in March.

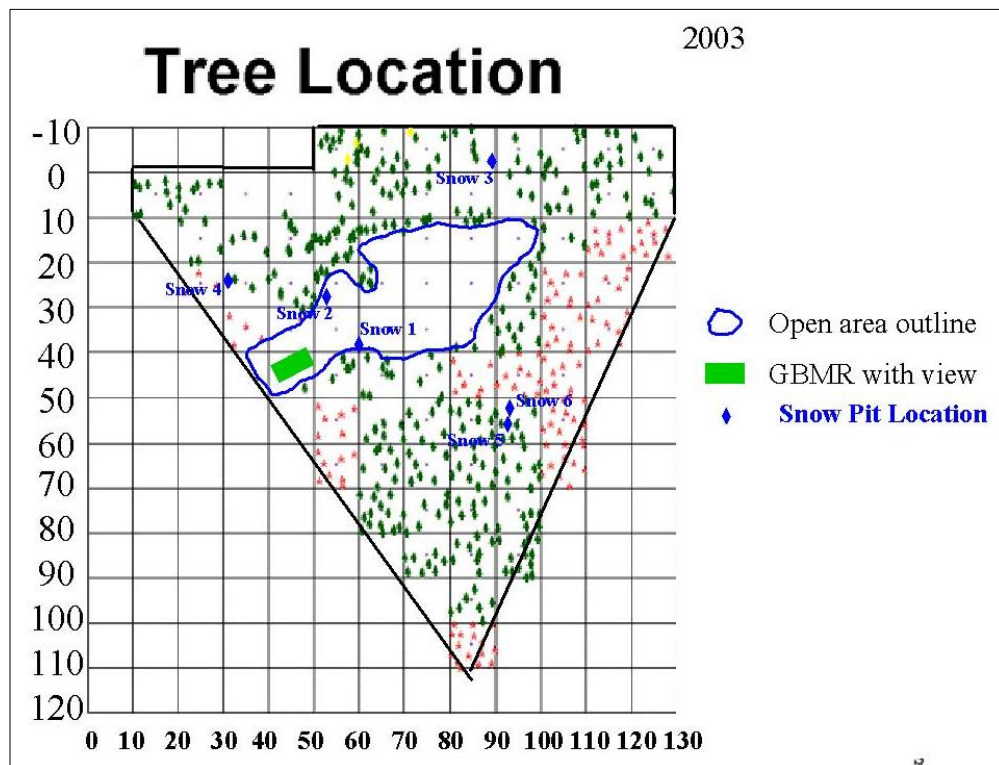


Figure 3. 2003 LSOS Snow Pit Locations



In the North Park MSA, additional samples were collected throughout the entire MSA, where possible, to intersect the ground path of the gamma data collection flight lines. Exact locations of each sample are recorded as UTM east and UTM north, datum WGS84, zone 13.

### 1.5.3 Meteorological Tower Installation Data

Soil samples were collected during the installation of soil probes near the base of meteorological towers during August and September 2002. Five towers were located in each ISA, one close to each of the four corners and one close to the center. Exact locations are recorded as UTM east and UTM north, datum WGS84, zone 13.

### 1.5.4 Spatial Coverage Map

The following map shows the CLPX study area:

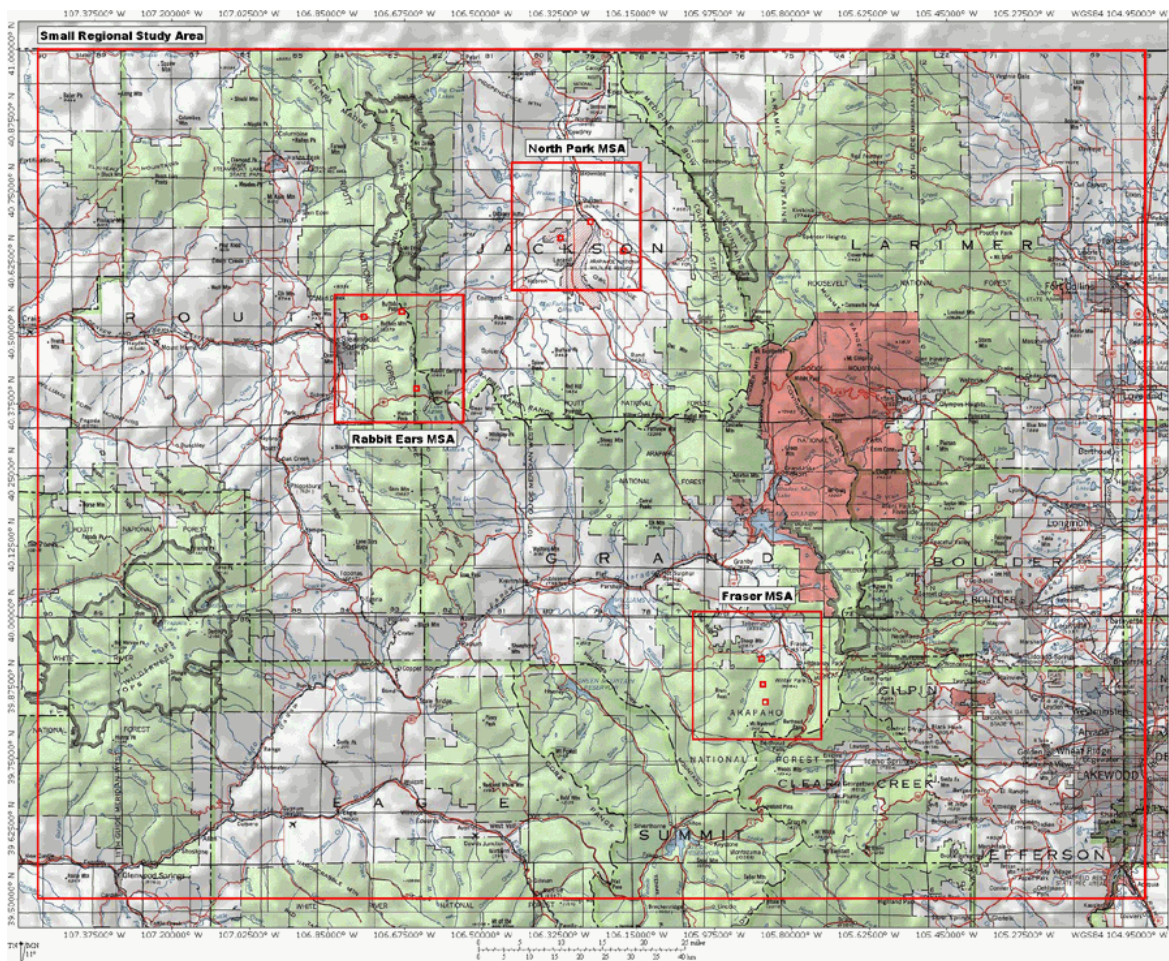


Figure 4. CLPX Study Area

## 1.6 Temporal Coverage

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The IOP1 and IOP2 (2002) sampling schedules were:

Feb. 19, 21 and 23: Pits 1, 3, and 5

Feb. 20, 22 and 24: Pits 2, 4, and 6

Mar. 25, 27 and 29: Pits 2, 4, and 6

Mar. 26, 28 and 30: Pits 1, 3, and 5

The IOP3 and IOP4 (2003) sampling schedules were:

Feb. 19, 21 and 23: Pits 2, 4, and 6

Feb. 20, 22 and 24: Pits 1, 3, and 5

Mar. 25, 27 and 29: Pits 2, 4, and 6

Mar. 26, 28 and 30: Pits 1, 3, and 5

Soil moisture data were collected during September of 2001 and 2002 to provide measurements of soil moisture prior to the beginning of the winter snow accumulation season. Soil samples were collected during the installation of soil probes near the base of meteorological towers during August and September 2002. Photographs were taken at each site during 2002 to record the nature of the terrain and vegetation surrounding the point samples.

## 1.7 Parameter or Variable

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Parameters presented in this data set are bulk density (g/cm<sup>3</sup>), gravimetric water content (g H<sub>2</sub>O/g soil), and volumetric water content (g H<sub>2</sub>O/g soil) at meteorological sites, and gravimetric water content (g H<sub>2</sub>O/g soil) at all other sites.

Not all of the sampling programs collected information for each of the 35 parameters. To maintain consistency, for all files other than the met\_sites file, all 35 parameters are included in each file whether data were collected or not. The met\_sites file introduced two new parameters and did not use 25 other parameters previously used. The following table provides an overview of which parameters are available for the different sampling programs and shows an 'x' where a parameter was collected, a blank where a parameter was not collected, and an 'N/A' where the parameter is not present in the file.

Table 1. Parameters of Sampling Programs

Parameter	Sep 2001	Sep 2002	IOP1	IOP2	IOP3	IOP4	met_sites
Sample Number *	x				x	x	N/A
Sample ID *	x	x	x	x	x	x	x
Date *	x	x			x		x
Time (MDT)	x	x					x
Lat (DD)	x						N/A
Lat (MM)	x						N/A
Lat (SS)	x						N/A
Long (DDD)	x						N/A
Long (MM)	x						N/A
Long (SSS)	x						N/A
Latitude (DD.DDDD)	x	x					N/A
Longitude (DD.DDDD)	x	x					N/A
UTM east			x	x			x
UTM North			x	x			x
Remarks / Comments	x	x					x
Flight line 1	x						N/A
Flight line 2	x						N/A
Flight line 3	x						N/A
Principal Collector	x	x	x	x	x	x	N/A
Partner	x	x			x	x	N/A
Photo (south facing & north facing)		x					N/A
Sample A container weight or bag weight (g)		x	x	x	x	x	N/A
Sample A Wet Weight (g)	x	x	x	x	x	x	x
Sample A Dry Weight (g)	x	x	x	x	x	x	x
Sample A moisture (g)		x			x	x	N/A
Sample A dry soil (g)		x			x	x	N/A
Sample A Gravimetric (g H <sub>2</sub> O/g soil)	x	x	x	x	x	x	x
Sample depth (cm unless otherwise stated)		x			x		x
Sample B container weight or bag weight (g)		x	x	x	x	x	N/A
Sample B Wet Weight (g)	x	x	x	x	x	x	N/A

Parameter	Sep 2001	Sep 2002	IOP1	IOP2	IOP3	IOP4	met_sites
Sample B Dry Weight (g)	x	x	x	x	x	x	N/A
Sample B moisture (g)		x			x	x	N/A
Sample B dry soil (g)		x			x	x	N/A
Sample B Gravimetric (g H <sub>2</sub> O/g soil)	x	x	x	x	x	x	N/A
Sample depth (cm unless otherwise stated)		x					N/A
Bulk density (g/cm <sup>3</sup> )	N/A	N/A	N/A	N/A	N/A	N/A	x
Sample volumetric content (g H <sub>2</sub> O/g soil)	N/A	N/A	N/A	N/A	N/A	N/A	x

\*For more information, see the Format section of this document.

Some inconsistencies exist in the format in which parameters were recorded.

## 1.8 Quality Assessment

Any missing values in the data were replaced by a default value of 9999.

Remarks in the original data sheets had commas and speech marks that may be confused for column delimiters. The following punctuation was changed:

Table 2. Punctuation Changes

,	changed to	-
"	changed to	inches
@	changed to	at
;	changed to	-

## 2 DATA ACQUISITION AND PROCESSING

Two types of soil samples were taken. At all sites other than meteorological sites, soil samples were made vertically into the ground surface to a depth of 20 cm using a 2.3-cm-diameter hand auger. If the auger was not able to penetrate 20 cm into the ground, the depth of the sample was recorded separately. The sample was then removed from the auger and transferred into an airtight container. A second, replicate sample was made at each site where samples were collected using an auger. Only gravimetric soil moisture measurements were made on samples collected using an auger.

At meteorological sites, permanent soil moisture/temperature probes were installed at 5 cm, 20 cm and 50 cm below the ground surface. During installation of these probes, soil moisture samples were taken at each of these levels, and also at 2.45 cm from the surface. Soil samples were made by forcing a circular ring (4.90 cm in diameter and 2.45 cm deep) into the pit wall, with the center point of the ring at each of the four depth levels. The plug of soil within the ring was then removed along with the ring and sealed in an airtight can. Gravimetric measurements of soil moisture were made for each sample by dividing the difference between the weight of the dry and wet samples by the weight of the dry sample. Volumetric measurements of soil moisture were also made by multiplying the gravimetric moisture content by the ratio of the bulk density of an undisturbed soil sample and the density of water.

The following equations describe how gravimetric and volumetric soil moisture content are calculated:

$$w = \frac{M_w - M_d}{M_d} \quad \text{Equation 1}$$

$$\theta = w \frac{\rho_b}{\rho} \quad \text{Equation 2}$$

w = gravimetric moisture content

M<sub>w</sub> = mass of the wet sample

M<sub>d</sub> = mass of the dry sample

θ = volumetric moisture content

ρ = density of water

ρ<sub>b</sub> = bulk density of sample

## 3 REFERENCES AND RELATED PUBLICATIONS

### 3.1 Related Data Collections

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[CLPX-Snow Measurements at the Local Scale Observation Site \(LSOS\)](#)

## 4 CONTACTS AND ACKNOWLEDGMENTS

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## 5 DOCUMENT INFORMATION

### 5.1 Publication Date

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### 5.2 Date Last Updated

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