CLPX Airborne Gamma Snow and Soil Moisture Surveys, Version 1

USER GUIDE

How to Cite These Data

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

Cline, D. and T. Carroll. 2005. *CLPX Airborne Gamma Snow and Soil Moisture Surveys, Version 1.* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/38UW2772KQER. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0158

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

A full description of how the airborne gamma radiation data are collected, processed, and presented can be found in the Airborne Gamma Radiation Snow Survey Program User's Guide provided for the airborne gamma radiation snow survey program by the National Operational Hydrologic Remote Sensing Center (NOHRSC).

For each over-snow flight line during the CLPX IOPs, the following information was collected:

- Visual estimates of percent snow cover of flight line made by pilots (%SC)
- SWE (inches) – made using measured estimates of percent soil moisture from background surveys [SWE (in)]
- SWE (inches) – made using an assumed 35 percent soil moisture [SWE(35%)]
- Percent soil moisture used in SWE calculations [%SM(M)]
- Type of estimate for soil moisture:
    - AM = airborne soil moisture measurement
    - AI = interpolated from airborne measurements
    - GM = ground-based soil moisture measurement
    - GI = interpolated from ground measurements
    - SE = subjective estimate [Est Typ]
- Survey date for September background soil moisture survey [Fall Date]
- Percent soil moisture measured / estimated in the background survey [%SM(F)]
- Pilot remarks for flight line [Pilot Remarks].

Data from no-snow flights, or background data collection (in September 2001 and 2002) are incorporated into over-snow files as parameters that are listed above. Background data do not appear as individual data sets.

Location parameters of the mid-point of each flight line include:

- Flight line ID
- CLPX Meso-cell Study Area
- Latitude
- Longitude
- Elevation

Geographic attributes within the Small Regional Study Area (SRSA) include:

- Flight lines
- Elevation
- Rivers (major and minor)
- Lakes
- Cities
- Highways

1.1 Format

SWE and soil moisture parameters are recorded in Standard Hydrometeorological Exchange Format (SHEF), as used by the US National Weather Service to distribute forecasted and point data for use in hydrologic operations. SHEF messages are presented in tab-delimited ASCII format. An example file structure is given below. The first 14 rows are header information (rows 12-13 are column headers). General comments are included after the data (between rows marked '.END' and 'NNNN').

```
SRUS43 KMSR 191627
RRMASP
.BR GAMMA 020219 /SAIRF/SWIRF
:TO ------ Service Hydrologist (Please give HARDCOPY to SH)
:FROM ---- Tom Carroll, (952) 361-6610 ext 225, Minneapolis , Minnesota
:Visit our web page at www.nohrsc.noaa.gov
:SUBJECT - AIRBORNE SNOW WATER EQUIVALENT DATA 020219162753
:-------------------------------------------------------------------------
: Total No. of flight lines sent = 7
:-------------------------------------------------------------------------
:Line Survey %SC SWE SWE %SM Est Fall %SM Pilot
:No. Date (in) (35%) (M) Typ Date (F) Remarks
:=========================================================================
CO102 DY020219 / 100 / 3.1 : 2.2, 20 SE 0 , 20 LARGE SNOW DRIFTS
CO125 DY020219 / 100 / 3.2 : 2.3, 20 SE 0 , 20 MTN OBSCUR.
CO126 DY020219 / 100 / 2.3 : 1.4, 20 SE 0 , 20 DUSTING OF NEW SNOW
EX101 DY020219 / 100 / 3.0 : 1.9, 16 GM 10922 , 16 OLDER SNOW
EX102 DY020219 / 100 / 4.7 : 4.4, 28 GM 10922 , 28 SAGE BRUSH THROUGH S
EX120 DY020219 / 100 / 3.7 : 3.1, 24 GM 10922 , 24 MTN OBSCUR.
EX121 DY020219 / 100 / 3.7 : 2.9, 21 GM 10922 , 21 SOME SNOW IN TREES
.END
There was new snow on most lines. All lakes and most rivers were frozen.
NNNN
```

```
SHEF Message Key
  Line No.       Flight line number
  Survey Date    Survey Date
  %SC            Visual estimate of percent snow cover over flight line
made by pilots
  SWE(in)        SWE, in inches, made using the %SM(M) soil moisture
estimate
  SWE(35%)       SWE, in inches, made using an assumed 35% soil moisture
  %SM(M)         Percent soil moisture used in SWE calculation
  Est type       Type of estimate for %SM(M):
        AM       Airborne soil moisture measurement
        AI       Interpolated from airborne measurements
        GM       Ground-based soil moisture measurement
        GI       Interpolated from ground measurements
        SE       Subjective estimate
  Fall date      Survey date for fall soil moisture survey
  %SM(F)         Percent soil moisture measured/estimated in the fall
Pilot Remarks    Pilot remarks for flight line.
```

Summaries of flight line locations (mid-points of each flight line) are presented in comma-separated value (`.csv`) format.

Geographic attributes are formatted as ESRI shapefiles (`*.shp`, `*.shx` and `*.dbf`) and layer files (`*.lyr`).

1.2 File and Directory Structure

The gamma radiation data are available via HTTPS in the `https://daacdata.apps.nsidc.org/pub/DATASETS/CLP/data/airborne/nsidc0158_gamma_snow/` directory. Within this directory, there are two folders and two files:

- ArcView_shapefiles/
- SWE_SHEFs/
- Flight_lines.csv
- readme.txt

In the ArcView_shapefiles/ folder, there are six shapefiles (.shp), six database (.dbf) files, and six index (.shx) files, plus one GeoTIFF layer (.tif.lyr) file. In the SWE_SHEFs/ folder, there are ten tab-delimited ASCII format (.atw) files.

1.3 File Naming Convention

SWE and soil moisture parameters for groups of flight lines collected during the same day are in files named `wYYMMDDa.atw` where YY is year, MM is month, and DD is day.

The latitude, longitude and elevation of the mid-points of all 129 flight lines are available in the file named Flight_lines.csv.

Geographic attributes are in ArcView shape files named co_####.dbf, co_####.shp, and co_####.shx where #### represents either cities (cities), highways (hways), lakes (lk), major rivers (maj_rivers), minor_rivers (minor rivers), or flight lines (flines).

Terrain elevation data are in the ArcView layer file named elevations_west32.tif.lyr.

1.4 File Size

This data set is 13.6 MB in total. Each flight line consists of less than 8 KB.

1.5 Spatial Coverage

Flight lines were flown throughout Fraser, North Park, and Rabbit Ears MSAs, which are all within the CLPX Small Regional Study Area (SRSA - 41.0°N, 39.5°N; 105.0°E,107.5°E).

Flight lines are of variable length and variable direction. Mid-points of each flight line (latitude, longitude, and elevation) are available in the file Flight_lines.csv. The number of flight lines flown and the dates of data collection are:

MSA	BG1	BG2	IOP1	IOP2	IOP3	IOP4
Fraser	23	23	23	0	23	23
North Park	84	84	84	0	36	84
Rabbit Ears	22	22	22	0	0	22

BG1: 20–22 September 2001
BG2: 17 September 2002
IOP1: 19-23 February 2002
IOP3: 19-21 February 2003
IOP4: 25-31 March 2003

1.5.1 Spatial Coverage Maps

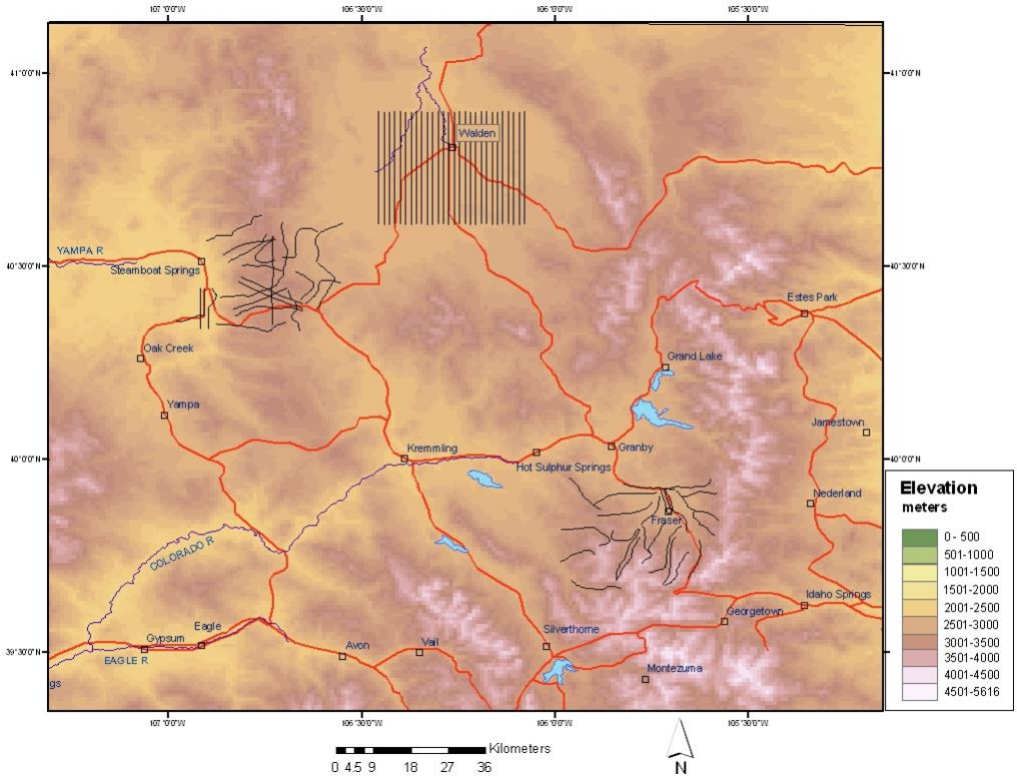

Figure 1. Overview Map

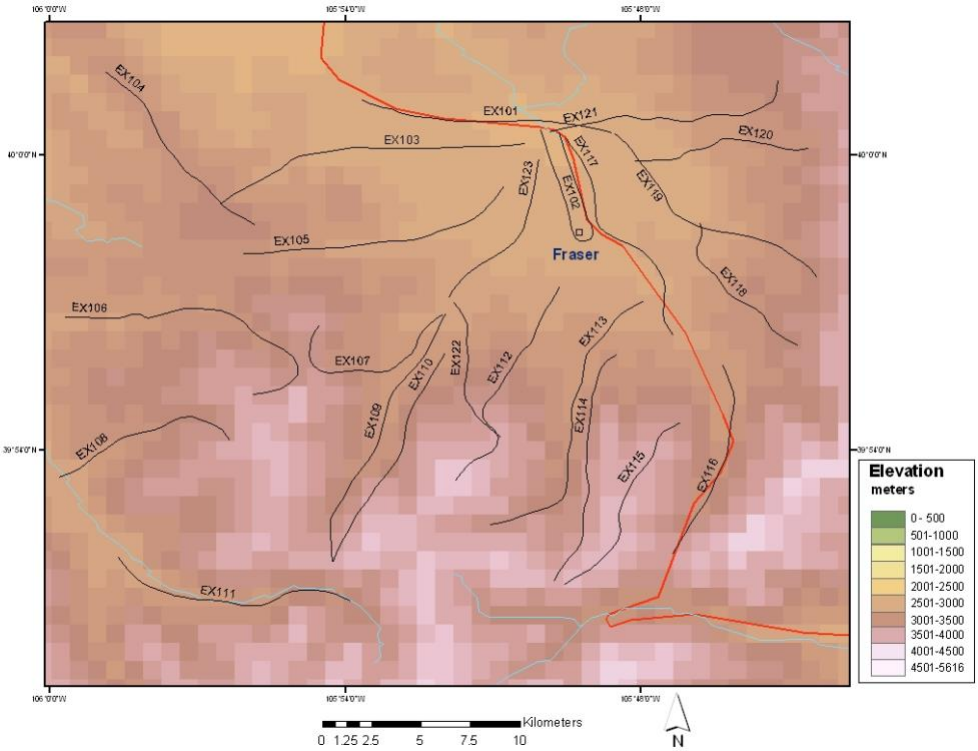

Figure 2. Fraser MSA flight lines

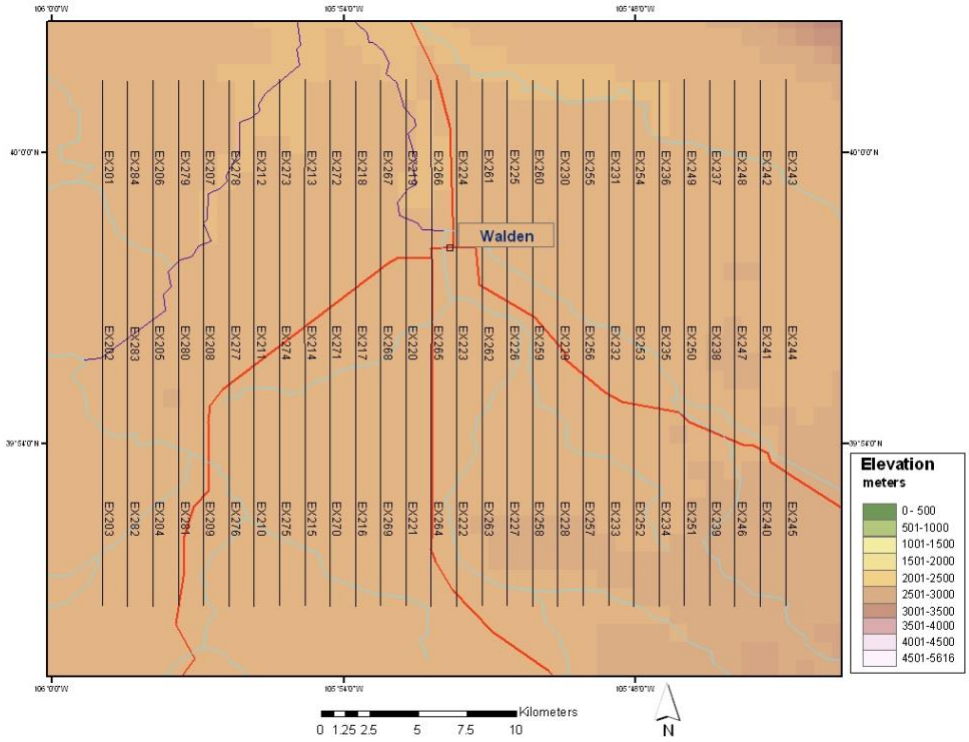

Figure 3. North Park MSA flight lines

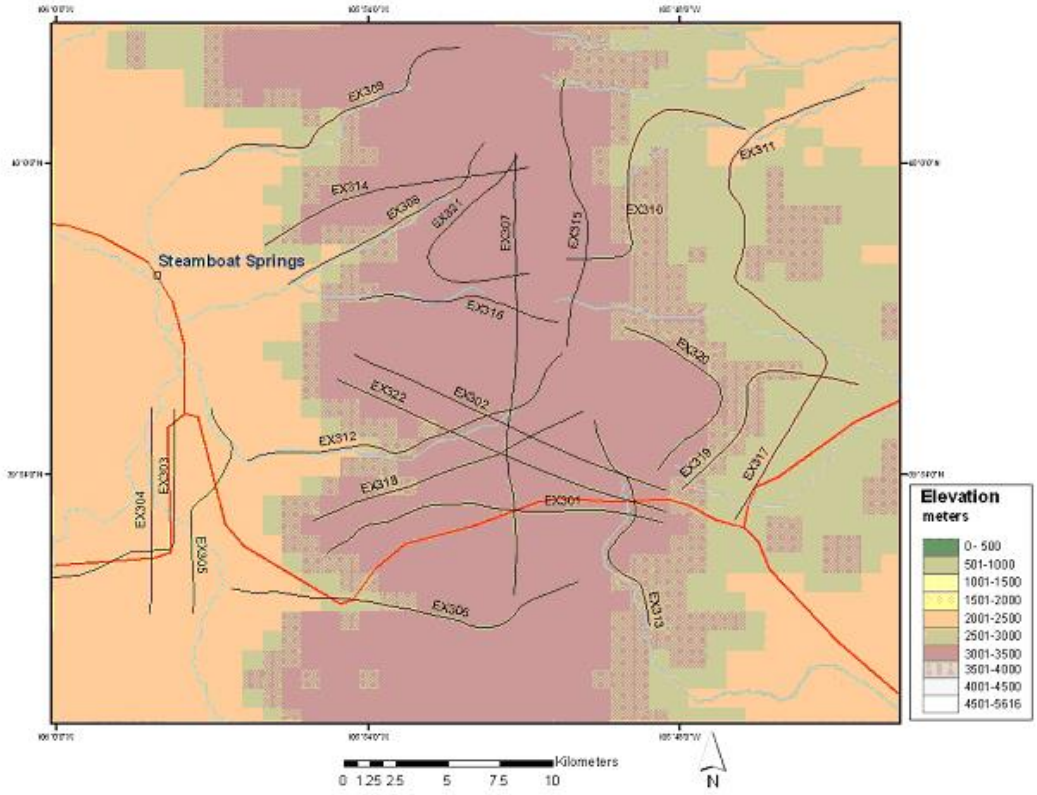

Figure 4. Rabbit Ears MSA flight lines

1.6 Temporal Coverage

Airborne gamma flights were made on the following days:

BG1: 20–22 September 2001
BG2: 17 September 2002
IOP1: 19-23 February 2002
IOP3: 19-21 February 2003
IOP4: 25-31 March 2003

1.7 Parameter or Variable

This data set presents snow water equivalent (SWE) derived from gamma radiation measurements, and snow cover (extent) and soil moisture.

For each over-snow flight line collected during the IOPs, parameters are:

- Visual estimates of percent snow cover of flight line made by pilots (%SC)
- SWE (inches) – made using measured estimates of percent soil moisture from background surveys [SWE (in)]
- SWE (inches) – made using an assumed 35 percent soil moisture [SWE(35%)]
- Percent soil moisture used in SWE calculations [%SM(M)]

2 DATA ACQUISITION AND PROCESSING

For a full description of how the airborne gamma radiation data are collected and processed, please refer to the Airborne Gamma Radiation Snow Survey Program User's Guide provided for the airborne gamma radiation snow survey program by the National Operational Hydrologic Remote Sensing Center (NOHRSC).

2.1 Quality Assessment

All SWE data have been through QC associated with standard SHEF message production.

3 REFERENCES AND RELATED PUBLICATIONS

3.1 Related Data Collections

All CLPX Data Sets

4 CONTACTS AND ACKNOWLEDGMENTS

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5 DOCUMENT INFORMATION

5.1 Publication Date

December 2, 2004

5.2 Date Last Updated

April 22, 2021