



SMAPVEX16 Manitoba Station Soil Moisture Data, Version 1

USER GUIDE

How to Cite These Data

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

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SV16M_SSM



National Snow and Ice Data Center

TABLE OF CONTENTS

1	DATA DESCRIPTION	2
1.1	Parameters	2
1.2	File Information.....	2
1.2.1	Format.....	2
1.2.2	File Contents.....	2
1.2.3	Naming Convention	4
1.2.4	File Size	5
1.3	Spatial Information.....	5
1.3.1	Coverage	5
1.3.2	Resolution.....	5
1.3.3	Geolocation.....	5
1.4	Temporal Information	6
1.4.1	Coverage	6
1.4.2	Resolution.....	6
2	DATA ACQUISITION AND PROCESSING.....	6
2.1	Background	6
2.2	Acquisition	6
2.3	Processing.....	7
2.4	Quality, Errors, and Limitations	7
2.5	Instrumentation.....	7
2.5.1	Description.....	7
3	RELATED DATA SETS	8
4	RELATED WEBSITES	8
5	CONTACTS AND ACKNOWLEDGMENTS	8
6	DOCUMENT INFORMATION.....	9
6.1	Publication Date	9
6.2	Date Last Updated.....	9

1 DATA DESCRIPTION

1.1 Parameters

This data set contains soil and meteorological conditions collected at nine Real-time In-Situ Soil Monitoring for Agricultural (RISMA) stations and 50 temporary soil stations. Parameters include, but are not limited to:

- Soil moisture
- Soil temperature
- Air temperature
- Relative humidity
- Wind speed
- Wind direction
- Precipitation

1.2 File Information

1.2.1 Format

Data are available in Comma-Separated Values (.csv) files.

Location information for temporary soil stations and RISMA stations is available in Keyhole Markup language Zipped (.kmz) files.

Extensible Markup Language (.xml) files with associated metadata are also provided.

1.2.2 File Contents

Conditions collected at the temporary soil stations are presented in file SV16M_SSM_RISMAsoilStations_Vers3.csv. Table 1 includes details on this file's contents.

Table 1. RISMA Station File Contents

Column Header	Description
STATION_ID	Unique station ID
TIMESTAMP	Time of sampling in Central Daylight Savings Time, in MM/DD/YY HH:MM format
AIR_TEMP	Average air temperature measured over a 15 minute period and at a height of 1.5 m (°C)
REL_HUM	Average relative humidity measured over a 15 minute period and at a height of 1.5 m (%)

Column Header	Description
WIND_SPEED	Average wind speed measured over a 15 minute period and at a height of 3 m (m/sec)
WIND_MAX	Maximum wind speed observed over a 15 minute period, measured at a height of 3 m (m/sec)
WIND_MIN	Minimum wind speed observed over a 15 minute period, measured at a height of 3 m (m/sec)
WIND_DIRECTION	Average wind direction observed over a 15 minute period, measured at a height of 3 m (cardinal direction)
PRECIP	Total rainfall depth, measured at a height of 2.5 m (mm)
RDC_0_5	Real Dielectric Constant (RDC) averaged across 1-3 sensors at the 0-5 cm depth
SOIL_MOISTURE_0_5	Calibrated volumetric soil moisture averaged across 1-3 sensors at the 0-5 cm depth (cm ³ /cm ³)
SOIL_TEMP_0_5	Soil temperature averaged across 1-3 sensors at the 0-5 cm depth (°C)
RDC_5	Real Dielectric Constant (RDC) averaged across 1-3 sensors at a depth of 5 cm
SOIL_MOISTURE_5	Calibrated volumetric soil moisture averaged across 1-3 sensors at a depth of 5 cm (cm ³ /cm ³)
SOIL_TEMP_5	Soil temperature averaged across 1-3 sensors at a depth of 5 cm (°C)
RDC_20	Real Dielectric Constant (RDC) averaged across 1-3 sensors at a depth of 20 cm
SOIL_MOISTURE_20	Calibrated volumetric soil moisture averaged across 1-3 sensors at a depth of 20 cm (cm ³ /cm ³)
SOIL_TEMP_20	Soil temperature averaged across 1-3 sensors at a depth of 20 cm (°C)
RDC_50	Real Dielectric Constant (RDC) averaged across 1-3 sensors at a depth of 50 cm
SOIL_MOISTURE_50	Calibrated volumetric soil moisture averaged across 1-3 sensors at a depth of 50 cm (cm ³ /cm ³)
SOIL_TEMP_50	Soil temperature averaged across 1-3 sensors at a depth of 50 cm (°C)
RDC_100	Real Dielectric Constant (RDC) averaged across 1-3 sensors at a depth of 100 cm
SOIL_MOISTURE_100	Calibrated volumetric soil moisture averaged across 1-3 sensors at a depth of 100 cm (cm ³ /cm ³)
SOIL_TEMP_100	Soil temperature averaged across 1-3 sensors at a depth of 100 cm (°C)

Conditions collected at the temporary soil stations are presented in file SV16M_SSM_TempSoilStations_Vers3.csv. Table 2 includes details on this file's contents; Figure 1 displays the file's headers and 10 rows of sample data.

Table 2. Temporary Soil Station File Contents

Column Header	Description
SITE_ID	Unique ID of the field site where sampling occurred. Each field had 16 possible sample locations
TIMESTAMP	Time of sampling in Central Daylight Savings Time, in MM/DD/YY HH:MM format
PRECIP	Hourly precipitation totals (mm)
HYDRA1_RDC	Real Dielectric Constant (RDC) measured at a depth of 5 cm (millivolts, mV)
HYDRA1_SM	Calibrated volumetric soil moisture at depth of 5 cm (cm ³ /cm ³)
HYDRA1_TEMP	Soil temperature measured at a depth of 5 cm (°C)
HYDRA2_RDC	RDC measured between 0 and 5 cm
HYDRA2_SM	Calibrated volumetric soil moisture between 0 and 5 cm (cm ³ /cm ³)
HYDRA2_TEMP	Soil temperature measured between 0 and 5 cm (°C)

SITE_ID	TIMESTAMP	PRECIP	HYDRA1_RDC	HYDRA1_SM	HYDRA1_TEMP	HYDRA2_RDC	HYDRA2_SM	HYDRA2_TEMP
101-1	5/24/16 18:00		26.083	0.333	16.8	15.992	0.285	27.5
101-1	5/24/16 19:00		26.258	0.334	17.5	16.678	0.289	30.1
101-1	5/24/16 20:00		26.947	0.337	18.9	16.798	0.29	28.9
101-1	5/24/16 21:00		26.858	0.337	19.3	16.806	0.29	23
101-1	5/24/16 22:00		27.021	0.337	18.4	16.414	0.288	20.3
101-1	5/24/16 23:00		27.372	0.339	17.5	16.399	0.288	19.1
101-1	5/25/16 0:00		26.759	0.336	17	16.338	0.287	21.5
101-1	5/25/16 1:00		26.747	0.336	16.8	16.323	0.287	21.1
101-1	5/25/16 2:00		27.164	0.338	16.5	16.514	0.288	17.7
101-1	5/25/16 3:00		27.517	0.339	16	16.041	0.286	14.7

Figure 1. Temporary Soil Station Sample Data

1.2.3 Naming Convention

File names are:

- SV16M_SSM_RISMSoilStations_Vers3.csv
- SV16M_SSM_RISMSoilStations.kmz
- SV16M_SSM_TempSoilStations.kmz
- SV16M_SSM_TempSoilStations_Vers3.csv

In the file name, SV16M_SSM stands for SMAPVEX16 (Soil Moisture Active Passive Validation Experiment 2016) Manitoba Station Soil Moisture Data.

1.2.4 File Size

CSV files range between approximately 5 and 12 MB.

KMZ files range between approximately 2.1 and 3.6 KB.

1.3 Spatial Information

1.3.1 Coverage

Northernmost Latitude: 49.756438° N

Southernmost Latitude: 49.384164° N

Easternmost Longitude: 97.756385° W

Westernmost Longitude: 98.098416° W

1.3.2 Resolution

Data are point measurements. The distance between measurements varies.

1.3.3 Geolocation

Table 3 provides information on the coordinate reference system for this data set.

Table 3. Coordinate Reference System

Geographic coordinate system	NAD83(CSRS)
Projected coordinate system	NAD83(CSRS) / UTM Zone 14N
Longitude of true origin	-99
Latitude of true origin	0
Scale factor at longitude of true origin	0.9996
Datum	NAD83 Canadian Spatial Reference System
Ellipsoid/spheroid	GRS 1980
Units	meter
False easting	500000
False northing	0
EPSG code	3158
PROJ4 string	+proj=utm +zone=14 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs
Reference	https://epsg.io/3158

1.4 Temporal Information

1.4.1 Coverage

RISMA stations operated from 01 May through 31 August 2016.

Temporary soil stations operated from 23 May through 28 July 2016.

1.4.2 Resolution

Data collected at RISMA stations were measured every 15 minutes.

Data collected at temporary soil stations were measured every hour.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This data set was collected as part of the [2016 Soil Moisture Active Passive Validation Experiment](#) conducted in the Carman/Elm Creek region of Manitoba, Canada. The experiment was designed to calibrate and increase the accuracy of NASA's Soil Moisture Active Passive (SMAP) products. For this data set, soil and meteorological conditions were measured to coincide with SMAP satellite overpasses and Passive Active L- and S-band Sensor (PALS) flights.

2.2 Acquisition

Agriculture and Agri-Food Canada (AAFC) installed nine Real-time In-Situ Soil Monitoring for Agriculture (RISMA) stations in the Carman/Elm Creek region of Manitoba, Canada. The stations collect real dielectric constants (RDC), soil temperature, and meteorological data continuously throughout the year. This data set represents a subset of the larger RISMA database, only including observations from dates around the 2016 SMAPVEX campaign.

Each RISMA station included three Stevens HydraProbe II sensors installed vertically at the surface (0-5 cm) and three installed horizontally at depths of 5 cm, 20 cm, 50 cm, and 100 cm, for a total of 15 sensors. These probes recorded soil temperature and RDC values every 15 minutes. Each station also included a tipping bucket rain gauge to measure precipitation, installed at a height of 2.5 m; an anemometer to measure wind speed and direction, installed at a height of 3 m; and temperature and relative humidity sensors, installed at a height of 1.5 m. Meteorological conditions were also recorded every 15 minutes.

Temporary soil stations were installed at 50 agricultural fields. Prior to the campaign, the location of each field and temporary soil station site was assigned using ArcGIS. During the campaign, sites were identified using Garmin GPS units. The accuracy of each GPS unit was approximately 3 m.

Each temporary station contained two Stevens HydraProbes, one installed horizontally at a depth of 5 cm and another installed vertically at the surface (0-5 cm). Each probe records RDC and soil temperature values every hour. Hydrologic Services tipping bucket rain gauges were also included at 15 of the 50 temporary soil stations.

2.3 Processing

At each sensing depth, volumetric water content was derived from RDC values using either the calibration equation that AAFC developed during the first three years of the RISMA program or site-specific calibration equations developed during the 2016 SMAPVEX campaign. Site-specific calibration equations are described in more detail in the [SMAPVEX16 Manitoba Probe-Based In-Situ Soil Moisture Data Set](#) user guide.

2.4 Quality, Errors, and Limitations

Any erroneous values have been removed.

2.5 Instrumentation

2.5.1 Description

RISMA stations measured weather conditions with tipping bucket rain gauges, anemometers, and temperature/relative humidity sensors.

Temporary soil stations measured precipitation with Hydrologic Services tipping bucket rain gauges. More details about this instrument can be found on the [Hydrological Services America Products](#) website.

RISMA stations and temporary soil stations measured RDC and soil temperature with Stevens Hydra-Probes. More details can be found in Table 4 or on the [HydraProbe](#) website.

Table 4. Stevens HydraProbe Specifications

Measurement	Accuracy	Range	Resolution
Real dielectric permittivity	N/A	1 (air) to 80 (distilled water)	0.001
Soil moisture	± 0.01 for most soils ± 0.03 max for fine textured soils	0% to 100%	0.001
Bulk electrical conductivity	±2.0% or 0.02 S/m (whichever is greater)	0 to 1.5 S/m	0.001
Temperature	±0.3°C	-10°C to 60°C	0.1°C
Inter-sensor variability	3 m-3	N/A	N/A

3 RELATED DATA SETS

[SMAP Data | Overview](#)

4 RELATED WEBSITES

[SMAP at NASA](#)

[SMAPVEX16](#)

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6 DOCUMENT INFORMATION

6.1 Publication Date

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6.2 Date Last Updated

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