

*ISO 19131 SMAPVEX16-MB RISMA
Soil Stations Dataset – Data Product
Specifications*

Revision: A

Data product specifications: SMAPVEX16-MB RISMA Soil Stations Dataset

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Data product specifications: SMAPVEX16-MB RISMA Soil Stations Dataset / Spécifications de contenu informationnel

1. Overview

1.1. Informal description

The Soil Moisture Active/Passive Validation Experiment 2016-Manitoba (SMAPVEX16-MB) was conducted in the Carman/Elm Creek region. The purpose of the experiment was to collect a variety of ground measurements with coincident remotely-sensed data to calibrate and increase the accuracy of the National Aeronautics and Space Administration (NASA)'s Soil Moisture Active/Passive (SMAP) soil moisture products.

This dataset contains soil moisture, soil temperature and meteorological data from the Real-time In-Situ Soil Monitoring for Agriculture (RISMA) station network that is located within the SMAPVEX16-MB experimental study area. In support of soil moisture research, Agriculture and Agri-Food Canada (AAFC) has installed a network of 9 permanent stations in the Carman/Elm Creek region. The stations were installed in 2011 and continually collect soil moisture, soil temperature and meteorological data throughout the year. Each station has 3 Stevens Hydra-probe II sensors installed at each depth: vertical 5cm (at surface), 5cm, 20cm, 50cm and 100cm for a total of 15 probes. The probes record soil real dielectric constant (RDC) and soil temperature values on a 15 minute interval. Volumetric water content (VWC) is derived from the RDC values using site specific calibration equations that were developed during the first 3 years of operation.

The stations are also equipped with tipping buckets (precipitation), anemometers (wind speed and direction) and temperature/relative humidity sensors. Total precipitation is recorded every 15 minutes. Average wind speed and wind direction are calculated every 15 minutes. Maximum and minimum wind speeds are recorded every 15 minutes. Average air temperature and relative humidity are calculated for every 15 minutes.

A subset of data from the RISMA database (May 1 – August 31) is contained in this dataset. All data has been quality controlled and any erroneous records/values have been removed/appear as null values.

1.2. Data product specification - metadata

This section provides metadata about the creation of this data product specification

Data product specification – title:	SMAPVEX16-MB RISMA Soil Stations Dataset
Data product specification - reference date:	May 1 – August 31, 2016
Data product specification - responsible party:	AAFC STB
Data product specification – language:	English
Data product specification - topic category:	geoscientificInformation

1.3. Terms and definitions

- Feature attribute
characteristic of a feature

- Class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics [UML Semantics]
NOTE: A class does not always have an associated geometry (e.g. the metadata class).

- Feature
abstraction of real world phenomena

- Object
entity with a well-defined boundary and identity that encapsulates state and behaviour [UML Semantics]
NOTE: An object is an instance of a class.

- Package
grouping of a set of classes, relationships, and even other packages with a view to organizing the model into more abstract structures

1.4. Abbreviations

AAFC	Agriculture and Agri-Food Canada
DLT	Dielectric Loss Tangent
GPS	Global Positioning System
NASA	National Aeronautics and Space Administration
RDC	Real Dielectric Constant
RISMA	Real-time In-Situ Soil Monitoring for Agriculture
SMAP	Soil Moisture Active/Passive
SMAPVEX16-MB	Soil Moisture Active/Passive Validation Experiment 2016-Manitoba
STB	Science and Technology Branch
VWC	Volumetric Water Content

2. SPECIFICATION SCOPE

This data specification has only one scope, the general scope.

NOTE: The term 'specification scope' originates from the International Standard ISO19131. 'Specification scope' does not express the purpose for the creation of a data specification or the potential use of data, but identifies partitions of the data specification where specific requirements apply.

3. DATA PRODUCT IDENTIFICATION

3.1. Data series identification

Title	SMAPVEX16-MB RISMA Soil Stations Dataset
Alternate Title	SMAPVEX16-MB RISMA Soil Moisture Stations Data
Abstract	SMAPVEX16-MB was conducted to assess and increase the overall accuracy of the soil moisture retrievals produced using the SMAP satellite. RISMA stations collected soil moisture, soil temperature and meteorological data throughout the SMAPVEX16-MB campaign to contribute to the overall understanding of ground conditions coincident with SMAP overpasses.
Purpose	This dataset is used to assess and increase the overall accuracy of the SMAP soil moisture product.
Topic Category	geoscientificInformation
Spatial Representation Type	textTable
Spatial Resolution	
Geographic Description	Carman/Elm Creek, Manitoba, Canada
Supplemental Information	Principle Investigators: Heather McNairn - Agriculture and Agri-Food Canada; Tom Jackson - United States Department of Agriculture; Co-Investigators(Canada): Amine Merzouki, Anna Pacheco, Jarrett Powers - Agriculture and Agri-Food Canada; Stephane Belair, Peter Toose - Environment and Climate Change Canada; Monique Bernier - Institut National de la Recherche Scientifique(INRS); Aaron Berg, Tracy Rowlandson - University of Guelph;

	<p>Paul Bullock - University of Manitoba; RoTimi Ojo - Manitoba Agriculture; Alexandre Roy - University of Montreal; Ramata Magagi - University of Sherbrooke; Co-Investigators(United States): Alicia Joseph, Peggy O'Neill - NASA Goddard Space Flight Centre; Andreas Colliander, Sab Kim - NASA Jet Propulsion Lab; Mike Cosh - United States Department of Agriculture; Co-Investigators(International): Giuseppe Satalino - National Research Council of Italy (ISSIA-CNR)</p>
Constraints	<p>SMAPVEX16-MB field data will be placed on the University of Sherbrooke website. Access will be limited by password that will be provided to principle and co-investigators listed below. Principle and Co- Investigators are to ensure that staff, graduate students and post docs respect the terms of the agreement on usage and distribution. Access to the website will be restricted until August 1, 2017 for preliminary research and quality control. After August 1, 2017 all field data will be transferred to the National Snow and Ice Data Centre to be made publically available.</p>
Keywords	<p>SMAPVEX16-MB, RISMA, soil moisture, Hydra- probe, real dielectric constant, volumetric water content, soil temperature, precipitation, air temperature, relative humidity, wind speed</p>
Scope identification	<p>series</p>

3.2. Data product identification

3.2.1. SMAPVEX16-MB RISMA Soil Station Dataset

Title	SMAPVEX16-MB RISMA Soil Stations Dataset
Alternate Title	SMAPVEX16-MB RISMA Soil Moisture Stations Data
Abstract	This dataset contains soil moisture, soil temperature and meteorological data from the RISMA station network that is located within the SMAPVEX16-MB experimental study area.
Purpose	SMAP produces global soil moisture products. This dataset is used to assess and increase the overall accuracy of the SMAP soil moisture product.
Topic Category	geoscientificInformation
Spatial Representation Type	textTable
Spatial Resolution	
Geographic Description	Carman/Elm Creek, Manitoba, Canada
Supplemental Information	<p>Principle Investigators: Heather McNairn - Agriculture and Agri-Food Canada; Tom Jackson - United States Department of Agriculture; Co-Investigators(Canada): Amine Merzouki, Anna Pacheco, Jarrett Powers - Agriculture and Agri-Food Canada; Stephane Belair, Peter Toose - Environment and Climate Change Canada; Monique Bernier - Institut National de la Recherche Scientifique(INRS); Aaron Berg, Tracy Rowlandson - University of Guelph; Paul Bullock - University of Manitoba; RoTimi Ojo - Manitoba Agriculture; Alexandre Roy - University of Montreal; Ramata Magagi - University of Sherbrooke;</p>

	<p>Co-Investigators(United States): Alicia Joseph, Peggy O'Neill - NASA Goddard Space Flight Centre; Andreas Colliander, Sab Kim - NASA Jet Propulsion Lab; Mike Cosh - United States Department of Agriculture;</p> <p>Co-Investigators(International): Giuseppe Satalino - National Research Council of Italy (ISSIA-CNR)</p>
Constraints	<p>SMAPVEX16-MB field data will be placed on the University of Sherbrooke website. Access will be limited by password that will be provided to principle and co-investigators listed below. Principle and Co-Investigators are to ensure that staff, graduate students and post docs respect the terms of the agreement on usage and distribution. Access to the website will be restricted until August 1, 2017 for preliminary research and quality control. After August 1, 2017 all field data will be transferred to the National Snow and Ice Data Centre to be made publically available.</p>
Keywords	<p>SMAPVEX16-MB, RISMA, soil moisture, Hydra-probe, real dielectric constant, volumetric water content, soil temperature, precipitation, air temperature, relative humidity, wind speed</p>
Scope Identification	<p>dataset</p>
Feature Attribute Names	<p>STATION, TIMESTAMP, AIR_TEMP, REL_HUM, WIND_SPEED, WIND_MAX, WIND_MIN, WIND_DIRECTION, PRECIP, RDC_0_5, SOIL_MOISTURE_0_5, SOIL_TEMP_0_5, RDC_5, SOIL_MOISTURE_5, SOIL_TEMP_5, RDC_20, SOIL_MOISTURE_20, SOIL_TEMP_20, RDC_50, SOIL_MOISTURE_50, SOIL_TEMP_50, RDC_100, SOIL_MOISTURE_100, SOIL_TEMP_100</p>

4. DATA CONTENT AND STRUCTURE

4.1. Feature-based application schema

N/A

4.2. Feature catalogue – SMAPVEX16-MB RISMA Soil Stations Dataset

Title	SMAPVEX16-MB RISMA Soil Stations Feature Catalogue
Scope	series
Version Number	1
Version Date	November 30, 2016
Producer	AAFC

System-generated attributes (for example, OBJECTID, Shape, Shape Length and Area) are not defined in the feature catalog.

4.2.1. Feature attributes

4.2.1.1. STATION

Name	RISMA Station (STATION)		
Definition	Unique ID that identifies the station.		
Aliases	STATION		
Producer	AAFC		
Value Data Type	String		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.2. TIMESTAMP

Name	Date and Time (TIMESTAMP)		
Definition	Time of sampling in Central Daylight Savings Time (YYYY-MM-DD HH:MM).		
Aliases	TIMESTAMP		
Producer	AAFC		
Value Data Type	Date and time		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.3. AIR_TEMP

Name	Air Temperature (AIR_TEMP)
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Definition	Average air temperature (°C) over the last 15 minutes measured at the 1.5m height.		
Aliases	AIR_TEMP		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.4. REL_HUM

Name	Relative Humidity (REL_HUM)		
Definition	Average relative humidity (%) over the last 15 minutes measured at the 1.5m height.		
Aliases	REL_HUM		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.5. WIND_SPEED

Name	Wind Speed (WIND_SPEED)		
Definition	Average wind speed (m/sec) over the last 15 minutes measured at the 3m height.		
Aliases	WIND_SPEED		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.6. WIND_MAX

Name	Maximum Wind Speed (WIND_MAX)		
Definition	Maximum wind speed (m/sec) over the last 15 minutes measured at the 3m height.		

Aliases	WIND_MAX		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.7. WIND_MIN

Name	Minimum Wind Speed (WIND_MIN)		
Definition	Minimum wind speed (m/sec) over the last 15 minutes measured at the 3m height.		
Aliases	WIND_MIN		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.8. WIND_DIRECTION

Name	Wind Direction (WIND_DIRECTION)		
Definition	Average wind direction (cardinal direction) in the past 15 minutes measured at the 3m height.		
Aliases	WIND_DIRECTION		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.9. PRECIP

Name	Precipitation (PRECIP)		
Definition	Total amount of rain (mm) in the past 15 minutes measured at the 2.5m height.		
Aliases	PRECIP		
Producer	AAFC		

Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.10. RDC_0_5

Name	Surface RDC Measurement (RDC_0_5)		
Definition	RDC value over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 0-5cm depth.		
Aliases	RDC_0_5		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.11. SOIL_MOISTURE_0_5

Name	Surface Soil Moisture (SOIL_MOISTURE_0_5)		
Definition	Calibrated volumetric soil moisture value (cm3/cm3) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 0-5cm depth.		
Aliases	SOIL_MOISTURE_0_5		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.12. SOIL_TEMP_0_5

Name	Surface Soil Temperature (SOIL_TEMP_0_5)		
Definition	Soil temperature (°C) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 0-5cm depth.		
Aliases	SOIL_TEMP_0_5		

Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.13. RDC_5

Name	RDC 5cm (RDC_5)		
Definition	RDC value over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 5cm depth.		
Aliases	RDC_5		
Producer	AAFC		
Value Data Type	Integer		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.14. SOIL_MOISTURE_5

Name	Soil Moisture 5cm (SOIL_MOISTURE_5)		
Definition	Calibrated volumetric soil moisture value (cm ³ /cm ³) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 5cm depth.		
Aliases	SOIL_MOISTURE_5		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.15. SOIL_TEMP_5

Name	Soil Temperature 5cm (SOIL_TEMP_5)		
Definition	Soil temperature (°C) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 5cm depth.		
Aliases	SOIL_TEMP_5		

Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.16. RDC_20

Name	RDC 20cm (RDC_20)		
Definition	RDC value over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 20cm depth.		
Aliases	RDC_20		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.17. SOIL_MOISTURE_20

Name	Soil Moisture 20cm (SOIL_MOISTURE_20)		
Definition	Calibrated volumetric soil moisture value (cm3/cm3) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 20cm depth.		
Aliases	SOIL_MOISTURE_20		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.18. SOIL_TEMP_20

Name	Soil Temperature 20cm (SOIL_TEMP_20)		
Definition	Soil temperature (°C) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 20cm		

	depth.		
Aliases	SOIL_TEMP_20		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.19. RDC_50

Name	RDC 50cm (RDC_50)		
Definition	RDC value over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 50cm depth.		
Aliases	RDC_50		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.20. SOIL_MOISTURE_50

Name	Soil Moisture 50cm (SOIL_MOISTURE_50)		
Definition	Calibrated volumetric soil moisture value (cm ³ /cm ³) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 50cm depth.		
Aliases	SOIL_MOISTURE_50		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.21. SOIL_TEMP_50

Name	Soil Temperature 50cm (SOIL_TEMP_50)		
Definition	Soil temperature (°C) over the past 15 minutes measured by Stevens		

	Hydra-probes and averaged amongst 1-3 working sensors at the 50cm depth.		
Aliases	SOIL_TEMP_50		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.22. RDC_100

Name	RDC 100cm (RDC_100)		
Definition	RDC value over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 100cm depth.		
Aliases	RDC_100		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.23. SOIL_MOISTURE_100

Name	Soil Moisture 100cm (SOIL_MOISTURE_100)		
Definition	Calibrated volumetric soil moisture value (cm ³ /cm ³) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 100cm depth.		
Aliases	SOIL_MOISTURE_100		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

4.2.1.24. SOIL_TEMP_100

Name	Soil Temperature 100cm (SOIL_TEMP_100)		
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Definition	Soil temperature (°C) over the past 15 minutes measured by Stevens Hydra-probes and averaged amongst 1-3 working sensors at the 100cm depth.		
Aliases	SOIL_TEMP_100		
Producer	AAFC		
Value Data Type	Double		
Value Domain Type	0 (not enumerated)		
Value Domain			
	Feature Attribute Value		
	Label	Code	Definition

5. REFERENCE SYSTEMS

5.1. Spatial reference system

Not applicable.

5.2. Temporal reference system

Gregorian calendar

6. DATA QUALITY

6.1. Completeness

Measure not used at this time.

6.2. Logical consistency

Measure not used at this time.

6.3. Positional accuracy

The location of each RISMA station has been recorded with a handheld Garmin Global Positioning System (GPS) device. The device is accurate to within approximately 3m.

6.4. Temporal accuracy

Measure not used at this time.

6.5. Thematic accuracy

Measure not used at this time.

6.6. Lineage statement

Lineage Statement	The probes record soil RDC and soil temperature values on a 15 minute interval. Total precipitation is recorded every 15 minutes. Average wind speed and wind direction are calculated every 15 minutes. Maximum and minimum wind speeds are recorded every 15 minutes. Average air temperature and relative humidity are calculated for every 15 minutes.
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	A subset of data from the RISMA database (May 1 – August 31) is contained in this dataset.
Scope	

7. DATA CAPTURE

Data from each station was quality controlled in MS Excel before loaded into the dataset. Any erroneous values that were the result of faulty instrumentation, wiring connections and/or power issues were removed. Any records were removed if the soil was frozen, WFV was out of range, DLT >= 1.5, CON >= 0.2 or RDC < 2.4.

Volumetric soil moisture is derived from the RDC values using site specific calibration equations. The RDC value within this dataset is calculated by averaging the RDC value from each of the 3 working Stevens Hydra-probes at a given depth.

8. DATA MAINTENANCE

Unknown.

9. PORTRAYAL

Not applicable.

10. DATA PRODUCT DELIVERY

Csv
 Format name: Comma Delimited
 Format version: 1.0
 Specification: A delimited data format that has fields/columns separated by the comma character.
 Languages: eng
 Character set: utf8

11. METADATA

Not applicable.