SMAPVEX19-22 Massachusetts UAVSAR Mosaics, Version 1

USER GUIDE

How to Cite These Data

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

Kraatz, S., Cosh, M. H., Kim, S., Colliander, A., and X. Xu. 2024. *SMAPVEX19-22 Massachusetts UAVSAR Mosaics, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/7X0YS69Q188Q. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/SV19MA_SAR

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Summary

These data consist of mosaicked Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) images corrected for terrain-flattened gamma. Data image files at different polarization configurations were composited daily between April to July 2022 in the vicinity of Petersham, Massachusetts during the SMAPVEX19-22 (Soil Moisture Active Passive Validation Experiment 2019-2022) field campaign. The location was chosen due to its forested land cover, as SMAPVEX19-22 aims to validate satellite derived soil moisture estimates in forested areas.

1.2 Parameters

Parameters include radar cross section (linear power) in gamma naught scattering plane. By compiling a mosaic of UAVSAR images corrected for terrain-flattened gamma, data image files with three different polarization configurations were composited daily to represent the entire study area.

1.3 File Information

1.3.1 Format

Data provided as `.tif` (Geo Tagged Image Format) files.

1.3.2 Naming Convention

The data files follow the following naming convention with details described in Table 1.

```
SV19MA_SAR_[YYYYMMDD]_[L-band polarization]_v[n.n].[ext]
```

Examples of file names are:

```
SV19MA_SAR_20220428_HHHH_v1.0.tif
SV19MA_SAR_20220506_HVHV_v1.0.tif
SV19MA_SAR_20220725_VVVV_v1.0.tif
```

Table 1. File naming convention

Variable	Description
SV19MA	SMAP Validation Experiment 2019-2022 field campaign in the vicinity of Petersham, Massachusetts

Variable	Description
`SAR`	Synthetic Aperture Radar
`[YYYYMMDD]`	Acquisition date of data as a 4-digit year (YYYY), 2-digit month (MM), and 2-digit day (DD)
`[L-band polarization]`	Direction of L-band polarization, where the signal is transmitted and received twice: horizontal-horizontal; horizontal-vertical; or vertical-vertical `HHHH`: horizontally transmitted waves that return horizontally to the sensor, then horizontally transmitted again that return horizontally again to the sensor `HVHV`: horizontally transmitted waves that return vertically to the sensor, then horizontally transmitted again that return vertically again to the sensor `VVVV`: vertically transmitted waves that return vertically to the sensor, then vertically transmitted again that return vertically again to the sensor
`v[n.n]`	Version number, in this case, `v1.0`
`[ext]`	File extension, in this case, as `.tif`

1.4 Spatial Information

1.4.1 Coverage

Northernmost Latitude: 42.72° N

Southernmost Latitude: 42.32° N

Easternmost Longitude: 71.91° W

Westernmost Longitude: 72.33° W

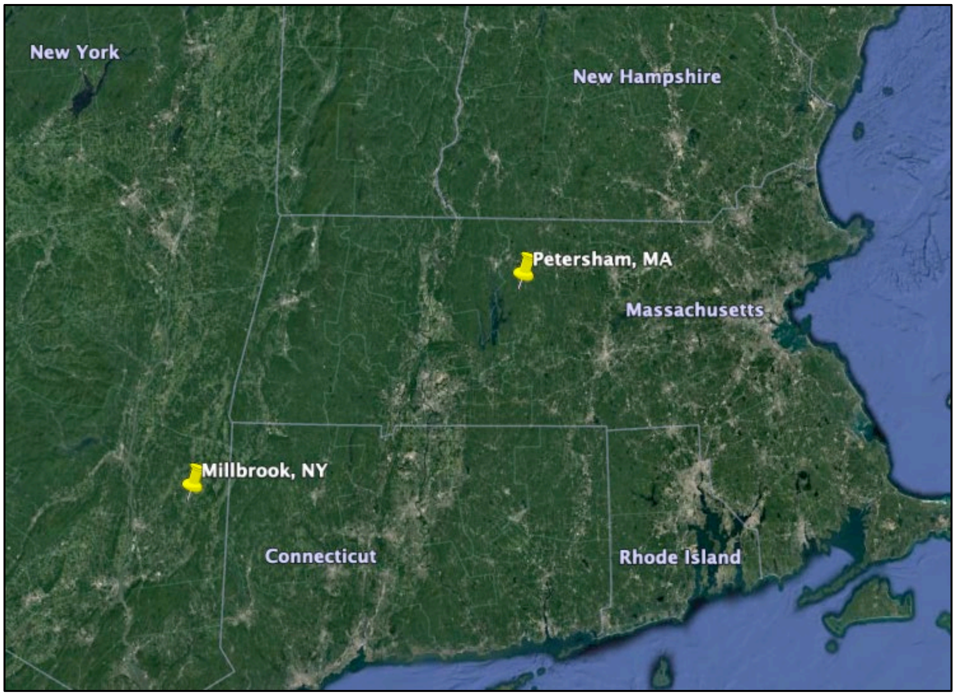

Figure 1. SMAPVEX19-22 Campaign Sites

1.4.2 Resolution

Spatial resolution is 5.55e-5 degrees.

1.4.3 Geolocation

Table 2 provides information for geolocating this data set.

Table 2. Geolocation Details

Geographic coordinate system	WGS 84
Projected coordinate system	N/A
Longitude of true origin	Prime Meridian, Greenwich
Latitude of true origin	N/A
Scale factor at longitude of true origin	N/A
Datum	World Geodetic System 1984
Ellipsoid/spheroid	WGS 84
Units	Degrees

False easting	N/A
False northing	N/A
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs +type=crs
Reference	https://epsg.org/crs_4326/WGS-84.html

1.5 Temporal Information

1.5.1 Coverage

25 Apr 2022 to 25 Jul 2022

1.5.2 Resolution

The data set uses UAVSAR mosaics to flatten and process the terrain. There are multiple images produced daily in different L-band polarization configurations.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition and Processing

Data were collected in support of the SMAPVEX19-22 field campaign. Ultimately, multiple images in different polarization configurations were produced daily. This dataset contains the terrain flattened UAVSAR mosaics following the backscatter conventions, particularly convention 4 regarding sigma naught, established by Small (2011). Small (2011) accounts for ellipsoid-based (σ^0) or sigma naught based incident angle approximations that failed to reproduce the effect of topographic variation and instead establishes new methodology that integrates terrain variations involving gamma naught (γ^0) backscatter, producing a terrain-flattened γ^0 normalization convention. Terrain-flattened gamma arguably produces better images than conventional normalization methods, for example, in one instance brightening back slopes to produce consistently clear visible boundaries between forest and non-forest areas.

Interferometric Synthetic Aperture Radar (InSAR) Scientific Computing Environment (ISCE) Docker Tools was then used to process the terrain flattened UAVSAR images. ISCE was developed for data processing and intended to operate in conjunction with a Docker image. For more information on ISCE Docker Tools, see Kraatz et al. (2020).

Finally, terrain flattened UAVSAR mosaics were composited using GDAL.

3 VERSION HISTORY

Table 3. Version History

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
v01.0	January 2025	25 Apr 2022 to 25 Jul 2022	Initial release

4 RELATED DATA SETS

SMAPVEX19-22 Millbrook UAVSAR Mosaics, Version 1

SMAPVEX19-22 Massachusetts Airborne Lidar, Version 1

SMAPVEX19-22 Massachusetts Lidar Derived Digital Elevation Model, Version 1

SMAPVEX19-22 Massachusetts Lidar Derived Digital Surface Model, Version 1

SMAPVEX19-22 Massachusetts Temporary Soil Moisture Network, Version 1

SMAPVEX19-22 Massachusetts Vegetation Optical Depth, Version 1

SMAPVEX19-22 Millbrook Airborne Lidar, Version 1

SMAPVEX19-22 Millbrook Lidar Derived Digital Elevation Model, Version 1

SMAPVEX19-22 Millbrook Lidar Derived Digital Surface Model, Version 1

SMAPVEX19-22 Millbrook Temporary Soil Moisture Network, Version 1

5 RELATED WEBSITES

SMAP Validation Data

SMAP Overview

6 ACKNOWLEDGMENTS

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Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

7 REFERENCES

Kraatz, S., Siqueira, P., & Rose, S. (2020). ISCE Docker Tools: Automated Radiometric Terrain Correction and Image Coregistration of UAVSAR MLC Data. In IGARSS 2020 - 2020 IEEE International Geoscience and Remote Sensing Symposium (pp. 727–729). IEEE. https://doi.org/10.1109/igarss39084.2020.9324658

Small, D. (2011). Flattening Gamma: Radiometric Terrain Correction for SAR Imagery. In IEEE Transactions on Geoscience and Remote Sensing (Vol. 49, Issue 8, pp. 3081–3093). Institute of Electrical and Electronics Engineers (IEEE). https://doi.org/10.1109/tgrs.2011.2120616

8 DOCUMENT INFORMATION

8.1 Publication Date

January 2025

8.2 Date Last Updated

January 2025