SMAP L3 Radar Northern Hemisphere Daily 3 km EASE-Grid Freeze/Thaw State, Version 2

This Level-3 (L3) product provides a daily global composite of Northern Hemisphere landscape freeze/thaw conditions retrieved by the Soil Moisture Active Passive (SMAP) radar from 6:00 a.m. descending and 6:00 p.m. ascending half-orbit passes. Input SMAP L-band backscatter data used to derive freeze/thaw are resampled to an Earth-fixed, global cylindrical 3 km Equal-Area Scalable Earth Grid, Version 2.0 (EASE-Grid 2.0).

Note: These data are Beta-release quality, meaning that they have not undergone full validation and may still contain significant errors.

Overview

Platform	SMAP Observatory
Sensor	SMAP L-Band Radar
Spatial Coverage	Northern Hemisphere
Spatial Resolution	3 km
Temporal Coverage	13 April 2015 – 07 July 2015
Temporal Resolution	Daily
Parameters	Freeze/Thaw State Transition Direction Sigma Nought
Data Format	Hierarchical Data Format, Version 5 (HDF5)
Metadata Access	View Metadata Record
Version	V2. Refer to the SMAP Data Versions page for version information. **Maturity State:** Beta **Note:** These data are Beta-release quality, meaning that they have not undergone full validation and may still contain significant errors.
Error Sources	Radio Frequency Interference (RFI) Freeze/Thaw ambiguity due to landscape characteristics Classification errors resulting from differences between two satellites, the SMAP Observatory and the Satélite de Aplicaciones Científicas (SAC-D) Environmental factors and abrupt changes in vegetation biomass
Get Data	FTP HTTPS Reverb | ECHO Worldview

Table of Contents

Citing These Data

As a condition of using these data, you must cite the use of this data set using the following citation. For more information, see our Use and Copyright Web page.

Dunbar, S., X. Xu, A. Colliander, C. Derksen, K. McDonald, E. Podest, E. Njoku, J. Kimball, and Y. Kim. 2015. *SMAP L3 Radar Northern Hemisphere Daily 3 km EASE-Grid Freeze/Thaw State.* Version 2. [Indicate subset used]. Boulder, Colorado USA: NASA National Snow and Ice Data Center Distributed Active Archive Center. doi:http://dx.doi.org/10.5067/GO4QPNEM0BKF. [Date accessed].

1. Detailed Data Description

Format

Data are in HDF5 format. For software and more information, including an HDF5 tutorial, visit the HDF Group's HDF5 Web site.

File Structure

As shown in Figure 1, each HDF5 file is organized into the following main groups, which contain additional groups and/or data sets:

- `Ancillary_Data`
- `Freeze_Thaw_Retrieval_Data`

- Metadata
- Radar_Data

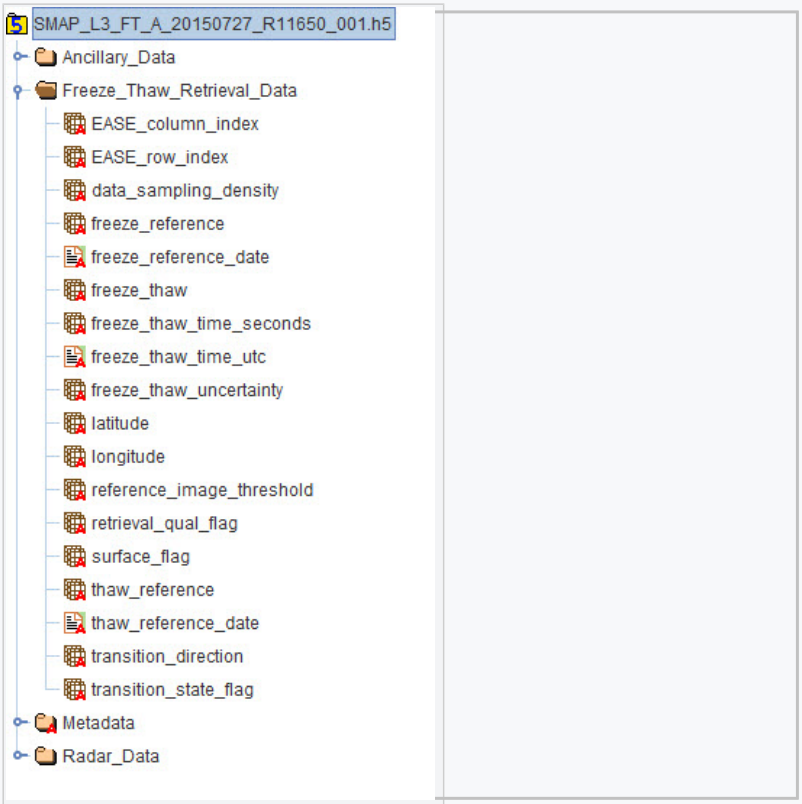

Figure 1. Sample of the HDF5 File Structure

Data Fields Overview

Each Level-3 freeze/thaw file contains the following:

Ancillary Data

Includes all ancillary data, such as landcover classification and open water body fraction.

Freeze/Thaw Retrieval Data

Includes freeze/thaw data and quality assessment flags.

Metadata

Includes all metadata that describe the full content of each file. For a description of all metadata fields for this product, refer to the Metadata Fields document.

Radar Data

Includes all radar data, such as cross-polarized sigma nought (σ0, also referred to as sigma0) data, and quality assessment flags.

Data Fields

Most data element arrays are three dimensional with 6000 rows and 6000 columns in each a.m. or p.m. layer. For the a.m./p.m. index of the array, the a.m. layer is assigned to the index value 0 and the p.m. layer is assigned to index value 1.

For a complete list and description of all data fields, refer to the Data Fields document.

File Naming Convention

Files are named according to the following convention, which is described in Table 1:

`SMAP_L3_FT_A_yyyymmdd_RLVvvv_NNN.[ext]`

For example:

`SMAP_L3_FT_A_20141225_R12130_002.h5`

Where:

Table 1. File Naming Conventions

Variable	Description
`SMAP`	Indicates SMAP mission data
`L3_FT_A`	Indicates specific product (`L3`: Level-3; `FT`: Freeze/Thaw; `A`: Active)
`yyyymmdd`	4-digit year, 2-digit month, 2-digit day; date in Universal Coordinated Time (UTC) of the first data element that appears in the product.
`RLVvvv`	Composite Release ID, where: `R` — Release `L` — Launch Indicator (`1`: Post-launch standard data) `V` — 1-Digit Major Version Number `vvv` — 3-Digit Minor Version Number **Example:** `R12130` indicates a standard data product with a version of 2.130.
`NNN`	Number of times the file was generated under the same version for a particular date/time interval (`002`: 2nd time)
`.[ext]`	File extensions include: `.h5` — HDF5 data file `.qa` — Quality Assurance file `.xml` — XML Metadata file

File Size/Volume

The daily data volume is approximately 673 MB using HDF compression.

Spatial Coverage

Coverage for this data set spans the Northern Hemisphere, including all land regions north of 45°N latitude, and from 180°W to 180°E. The gap in coverage at both the North Pole, called a pole hole, has a radius of approximately 400 km. The swath width is 1000 km.

Spatial Coverage Map

Figure 2 shows the spatial coverage of this data set.

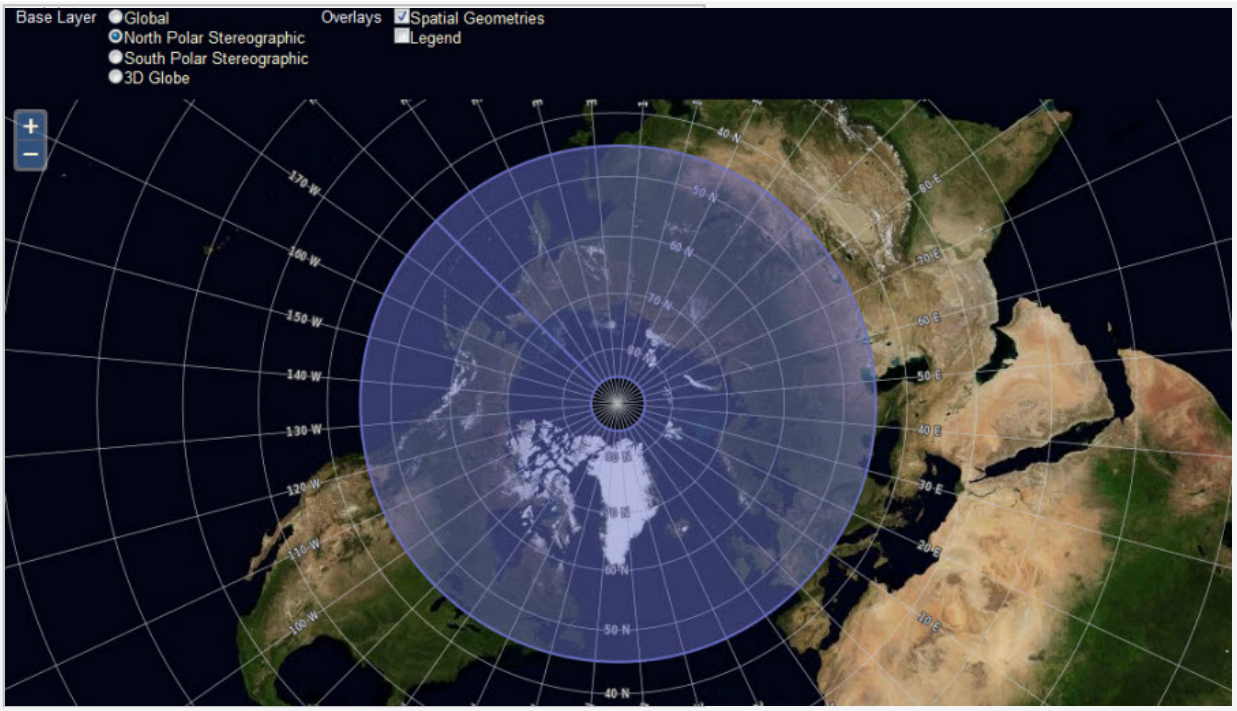

Figure 2. Spatial Coverage Map. The map was created using the Reverb | ECHO tool.

Spatial Resolution

The native spatial resolution of the radar footprint is 1 km. Data are then gridded using the 3 km EASE-Grid 2.0 projection.

Projection and Grid Description

EASE-Grid 2.0

These data are provided on the north polar EASE-Grid 2.0 (Brodzik et al. 2012). Each grid cell has a nominal area of approximately 3 x 3 km^2 regardless of longitude and latitude. Using this projection, all data arrays have dimensions of 6000 rows and 6000 columns.

EASE-Grid 2.0 has a flexible formulation. By adjusting a single scaling parameter, a family of multi-resolution grids that nest within one another can be generated. The nesting can be adjusted so that smaller grid cells can be tessellated to form larger grid cells. Figure 3 shows a schematic of the nesting.

This feature of perfect nesting provides SMAP data products with a convenient common projection for both high-resolution radar observations and low-resolution radiometer observations, as well as for their derived geophysical products.

For more on EASE-Grid 2.0, refer to the EASE-Grid 2.0 Format Description.

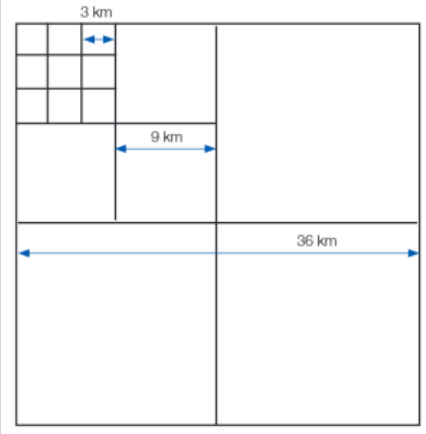

Figure 3. Perfect Nesting in EASE-Grid 2.0

Temporal Coverage

Data were collected from 13 April 2015 through 07 July 2015.

Note: Temporal coverage for this data set is limited due to the premature failure of the SMAP L-Band Radar. On 07 July 2015, the radar stopped transmitting due to an anomaly involving the instrument's high-power amplifier (HPA). For details, refer to the SMAP News Release issued 02 September 2015 by the Jet Propulsion Laboratory (JPL).

Temporal Resolution

Each Level-3 file is a daily composite of half-orbit granules/swaths.

Parameter Description

Freeze/thaw state derived from the SMAP radar is output on a fixed 3 km EASE-Grid 2.0. The SMAP radar measures the backscatter coefficient, or sigma nought (sigma0), which is the normalized measure of the strength of a radar signal reflected back to the antenna. Sigma nought measurements are derived using Synthetic-Aperture Radar (SAR) processing.

Refer to the Data Fields document for details on all parameters.

2. Data Access and Tools

Get Data

Data are available via FTP and HTTPS.

Data are also available through the services listed in Table 2.

Table 2. Data Access Services

Service	Description
Reverb | ECHO	NASA search and order tool for subsetting, reprojecting, and reformatting data.
Worldview	NASA visualization tool for browsing full-resolution imagery and downloading the underlying data.

Software and Tools

For tools that work with SMAP data, refer to the Tools Web page.

3. Data Acquisition and Processing

Sensor or Instrument Description

For a detailed description of the SMAP instrument, visit the SMAP Instrument page at the JPL SMAP Web site.

Data Source

SMAP Level-3 radar freeze/thaw data (SPL3FTA) are derived from SMAP High-Resolution Radar Sigma Nought, Version 1 (SPL1CS0) data.

Theory of Measurements

The SPL3FTA product is derived using a temporal change detection approach that has been previously developed and successfully applied using time-series satellite remote sensing radar backscatter and radiometric brightness temperature data from a variety of sensors and spectral wavelengths. The approach is to identify the landscape Freeze/Thaw (F/T) transition by identifying the temporal response of backscatter to changes in the dielectric constant of the landscape components that occur as the water within the components transitions between frozen and non-frozen conditions.

Classification algorithms assume that the large changes in dielectric constant occurring between frozen and non-frozen conditions dominate the corresponding backscatter temporal dynamics across the seasons, rather than other potential sources of temporal variability such as changes in canopy structure and biomass or large precipitation events. This assumption is valid for most areas of the terrestrial cryosphere.

Derivation Techniques and Algorithms

This section has been adapted from Dunbar et al. (2015), the Algorithm Theoretical Basis Document (ATBD) for this data set.

SMAP Level-3 radar freeze/thaw data set is a daily gridded composite of the SMAP High-Resolution Radar Sigma Nought, Version 1 (SPL1CS0) data set. The derivation of freeze/thaw from SMAP sigma nought measurements occurs during an intermediate Level-2 processing step of the input Level-1 sigma nought data. During the Level-2 processing step, the F/T algorithm utilizes a seasonal threshold approach to convert SMAP sigma nought measurements to F/T state.

Baseline Algorithm

The seasonal threshold baseline algorithm for SPL3FTA examines the time-series progression of the remote sensing signature relative to signatures acquired during seasonal reference frozen and thawed states. A seasonal scale factor $D(t)$ is defined for an observation acquired at time t as:

Dt= s(t) - sfr/sth - sfr

where *s(t)* is the measurement acquired at time *t*, for which a F/T classification is sought, and *sfr* and *sth* are backscatter measurements corresponding to the frozen and thawed reference states, respectively. A major component of the SMAP baseline algorithm development involved the application of existing satellite L-band radar measurements from the Aquarius/SAC-D mission over the F/T domain to develop pre-launch maps of *sfr* and *sth*. The thaw reference (*sth*) was replaced with the average of the last ten days of SMAP radar data (27 June through 6 July 2015). The new freeze reference (*sfr*) was derived based on the assumption that the *sth* reference difference between SMAP and the pre-launch Aquarius values is the same for the freeze case.

A threshold level *T* is then defined such that:
D(t) > T
D(t) <=T
defines the thawed and frozen landscape states, respectively. This series of equations will be run on a cell-by-cell basis for unmasked portions of the F/T domain. The output is a dimensionless binary state variable designating either frozen or thawed condition for each unmasked grid cell. The parameter *T* will be fixed at 0.5 across the entire F/T domain at the start of the SMAP mission. Given the short operating period of the SMAP radar, post launch optimization experiments will be limited to the spring 2015 freeze to thaw transition, and will be evaluated using in situ measurements from the cal/val network.

Ancillary Data

Ancillary data sets are used to:

1. support initialization of the thresholds employed in the algorithm,
2. set flags that indicate potential problem regions, and
3. define masks where no retrievals should be performed.

Ancillary data for SPL3FTA processing includes surface soil temperature and air temperature from the NASA Global Modeling and Assimilation Office (GMAO) for optimization of the retrieval thresholds. Measurements from dense and sparse in situ networks will be utilized for error analysis and Calibration/Validation (Cal/Val), and described further in Dunbar et al. (2015). In addition, ancillary data sets of inland open water, permanent ice and snow, and urban areas will be used to derive masks so that no retrievals occur over these regions. Ancillary data sets of mountainous areas, fractional open water cover, and precipitation will be used to derive flags so that a confidence interval can be associated with the retrieval. A primary source for each of the above ancillary parameters has been selected. This data set is common to all algorithms using that specific parameter. For SPL3FTA Beta-quality data, the lake fraction was set to 50%. Determination of a physically-based lake fraction will be finalized for the SPL3FTA Validated-quality data release. Table 3 lists the ancillary data employed in support of the SPL3FTA product.

Table 3. Acronyms and Abbreviations

Data Type	Data Source	Frequency	Resolution	Extent	Use
Vegetation Type	MODIS-International Geosphere Biosphere Programme (IGBP)	Once	250 m	Global	Sensitivity Analysis
Land Surface Temperature	MERRA and Station Data	Daily or close to time of acquisition	25 km and point data	Global	Algorithm Parameterization
Precipitation	ECMWF Forecasts	Time of acquisition	0.25 degrees	Global	Sensitivity Analysis
Static Water Bodies	MODIS44W	Once	250 m	Global	Flag
Transient Water Bodies	SMAP L2_SM_A	As processed	3 km	Global	Flag
Mountainous Areas	NASA Global DEM	Once	30 m	Global	Flag
Permanent Ice and Snow	MODIS-IGBP Permanent Ice and Snow Class	Once	500 m	Global	Flag
Urban Areas	Global Urban Mapping Project (GRUMP)	Once	1 km	Global	Flag

For more information, refer to the ATBD, Section 4: Retrieval Algorithms.

Processing Steps

This product is generated by the SMAP Science Data Processing System (SDS) at the Jet Propulsion Laboratory (JPL) in Pasadena, California USA. To generate this product, the processing software ingests one day's worth of Level-2 granules/files and creates individual global composites as two-dimensional or three-dimensional arrays for each output parameter defined in the intermediate Level-2 data. Wherever data overlap occurs (typically at high latitudes), data which were acquired closest to 6:00 a.m. and 6:00 p.m. local solar times are chosen. The intermediate Level-2 data distinguish four levels of freeze/thaw conditions determined from the ascending (6:00 a.m.) and descending (6:00 p.m.) SPL1CS0 data, including frozen (from both a.m. and p.m. overpass times), non-frozen (a.m. and p.m.), transitional (a.m. frozen; p.m. non-frozen) and inverse-transitional (a.m. non-frozen; p.m. frozen) states.

For more information on each portion of the algorithm processing flow, refer to the ATBD for this product, Section 2.2: L3_FT_A Production.

Error Sources

Anthropogenic Radio Frequency Interference (RFI), principally from ground-based surveillance radars, can contaminate both radar and radiometer measurements at L-band. Early measurements and results from ESA's Soil Moisture and Ocean Salinity (SMOS) mission indicate that in some regions RFI is present and detectable. The SMAP radar and radiometer electronics and algorithms include design features to mitigate the effects of RFI. The SMAP radar utilizes selective filters and an adjustable carrier frequency to tune to predetermined RFI-free portions of the spectrum while on orbit. The SMAP radiometer implements a combination of time and frequency diversity, kurtosis detection, and use of T4 thresholds to detect and, where possible, mitigate RFI.

The landscape freeze/thaw state retrieval represented by the SPL3FTA algorithm and product characterizes the predominant frozen or non-frozen state of the land surface within the sensor Field of View (FOV) and does not distinguish freeze/thaw characteristics among different landscape elements, including surface snow, soil, open water or vegetation. The low frequency L-band SAR retrievals from SMAP are expected to have greater sensitivity to surface soil freeze/thaw conditions under low to moderate vegetation cover, but effective radar penetration depth and microwave freeze/thaw sensitivity is strongly constrained by intervening vegetation biomass, soil moisture levels, and snow wetness. Ambiguity in relating changes in the radar signal to these specific landscape components is a challenge to validation of the F/T product.

The SMAP seasonal threshold freeze/thaw classification algorithm requires the establishment of accurate and stable frozen and non-frozen reference state backscatter conditions for each 3-km resolution grid cell. Initial reference conditions were established pre-launch from relatively coarse (approximately 100km) resolution Aquarius/SAC-D satellite L-band scatterometer measurements. The Aquarius data have a different sensor geometry and sampling, and a much coarser FOV than SMAP. While hybrid SMAP/Aquarius-derived references were utilized for this Beta release, the resulting freeze/thaw reference conditions determined from these data may cause significant SMAP freeze/thaw classification error, especially for areas with substantial sub-grid scale freeze/thaw heterogeneity relative to the coarse Aquarius FOV.

A major assumption of the seasonal threshold based temporal dB change freeze/thaw classification is that the major temporal shifts in radar backscatter are caused by land surface dielectric changes from temporal freeze/thaw transitions. This assumption generally holds for higher latitudes and elevations where seasonal frozen temperatures are a significant part of the annual cycle and a large constraint to land surface water mobility and ecosystem processes (Kim et al. 2012). However, freeze/thaw classification accuracy is expected to be reduced where other environmental factors may cause large temporal shifts in radar backscatter, including large rainfall events and surface inundation, and abrupt changes in vegetation biomass such as phenology, disturbance and land cover change.

More information about error sources is provided in the ATBD for this product.

Quality Assessment

These Version 2 data are Beta-quality, which means they employ preliminary algorithms that are still being validated and are thus subject to uncertainties. For in-depth details regarding the quality of these Version 2 Beta data, refer to the Beta Assessment Report.

Quality Overview

SMAP products provide multiple means to assess quality. Each product contains bit flags, uncertainty measures, and file-level metadata that provide quality information. For information regarding the specific bit flags, uncertainty measures, and file-level metadata contained in this product, refer to the Data Fields document.

Each HDF5 file contains metadata with Quality Assessment (QA) metadata flags that are set by the Science Data Processing System (SDS) at the JPL prior to delivery to the National Snow and Ice Data Center Distributed Active Archive Center (NSIDC DAAC). A separate metadata file with an `.xml` file extension is also delivered to NSIDC DAAC with the HDF5 file; it contains the same information as the HDF5 file-level metadata.

A separate QA file with a `.qa` file extension is also associated with each data file. QA files are ASCII text files that contain statistical information in order to help users better assess the quality of the associated data file.

If a product does not fail QA, it is ready to be used for higher-level processing, browse generation, active science QA, archive, and distribution. If a file/granule fails QA, the SDS does not send the granule to NSIDC DAAC until it is reprocessed. Level-3 products that fail QA are never delivered to NSIDC DAAC. Only a QA file is produced when there are no data that qualify for retrieval.

4. References and Related Publications

Brodzik, M. J., B. Billingsley, T. Haran, B. Raup, and M. H. Savoie. 2012. EASE-Grid 2.0: Incremental but significant improvements for Earth-gridded data sets. *ISPRS Int. J. Geo-Inf.* 1(1):32-45. http://dx.doi.org/10.3390/ijgi1010032.

Brodzik, M. J., B. Billingsley, T. Haran, B. Raup, and M. H. Savoie. 2014. Correction: Brodzik, M. J. et al. EASE-Grid 2.0: Incremental but significant improvements for Earth-gridded data sets. *ISPRS Int. J. Geo-Inf 2012*. 1(1):32-45 *ISPRS Int. J. Geo-Inf.* 3(3):1154-1156. http://dx.doi.org/10.3390/ijgi3031154.

Entekhabi, D. et al. 2014. SMAP Handbook–Soil Moisture Active Passive: Mapping Soil Moisture and Freeze/Thaw from Space. Pasadena, CA USA: SMAP Project, JPL CL#14-2285, Jet Propulsion Laboratory.

Derksen, C., X. Xu, S. Dunbar, A. Colliander, J. Kimball, and Y. Kim. 2015. Calibration and Validation for the L3_FT_A Beta-Release Data Product. SMAP Project, D-93983. Jet Propulsion Laboratory, Pasadena, CA. (http://nsidc.org/data/docs/daac/smap/sp_l3_fta/pdfs/SMAP L3_FT_A Beta-Level Assessment Report FINAL2.pdf, 7.7 MB)

Dunbar, S., X. Xu, A. Colliander, C. Derksen, K. McDonald, E. Podest. E .Njoku, J. Kimball, and Y. Kim. 2015. Algorithm Theoretical Basis Document (ATBD): SMAP level 3 radar freeze/thaw data product (L3_FT_A). SMAP Project, Jet Propulsion Laboratory, Pasadena, CA. (https://nsidc.org/sites/nsidc.org/files/files/274_L3_FT_A_RevA_web.pdf, 4.8 MB)

Dunbar, S. 2015. SMAP Level 3 Freeze-Thaw (L3_FT_A) Product Specification Document. SMAP Project, JPL D-72549. Jet Propulsion Laboratory, Pasadena, CA. (http://nsidc.org/data/docs/daac/smap/sp_l3_fta/pdfs/D-72549_SMAP L3_FT_A PSD_10122015_wo-sigs.pdf, 0.5 MB)

Frolking S., K. McDonald, J. Kimball, R. Zimmermann, J.B. Way and S.W. Running. 1999. Using the space-borne NASA Scatterometer (NSCAT) to determine the frozen and thawed seasons of a boreal landscape. Journal of Geophysical Research, 104(D22), 27,895-27,907.

Kim, Y., J. S. Kimball, K. Zhang, and K. C. McDonald, 2012. Satellite detection of increasing northern hemisphere non-frozen seasons from 1979 to 2008: implications for regional vegetation growth. Remote Sensing of Environment, 121, 472â€“487.

Kim, Y., J. S. Kimball, J. Glassy, and K. C. McDonald. 2014. MEaSUREs Global Record of Daily Landscape Freeze/Thaw Status. Version 3. [indicate subset used]. Boulder, Colorado USA: NASA National Snow and Ice Data Center Distributed Active Archive Center. http://dx.doi.org/10.5067/MEASURES/CRYOSPHERE/nsidc-0477.003.

Kim, Y., J.S. Kimball, K.C. McDonald and J. Glassy, 2011. Developing a global data record of daily landscape freeze/thaw status using satellite passive microwave remote sensing. IEEE Transactions on Geoscience and Remote Sensing 49, 949-960.

Kimball, J., K. McDonald, A. Keyser, S. Frolking, and S. Running. 2001. Application of the NASA Scatterometer (NSCAT) for Classifying the Daily Frozen and Non-Frozen Landscape of Alaska, Remote Sensing of Environment, 75, 113-126.

Kimball, J.S., K.C. McDonald, S.W. Running, and S. Frolking. 2004a. Satellite radar remote sensing of seasonal growing seasons for boreal and subalpine evergreen forests. Remote Sensing of Environment, 90, 243-258.

Kimball, J.S., M. Zhao, K.C. McDonald, F.A. Heinsch, and S. Running. 2004b. Satellite observations of annual variability in terrestrial carbon cycles and seasonal growing seasons at high northern latitudes. In Microwave Remote Sensing of the Atmosphere and Environment IV, G. Skofronick Jackson and S. Uratsuka (Eds.), Proceedings of SPIE â€“ The International Society for Optical Engineering, 5654, 244-254.

McDonald, K.C., J.S. Kimball, E. Njoku, R. Zimmermann, and M. Zhao. 2004. Variability in springtime thaw in the terrestrial high latitudes: Monitoring a major control on the biospheric assimilation of atmospheric CO2 with spaceborne microwave remote sensing. Earth Interactions, 8(20), 1-23.

Podest, E., K.C. McDonald, and J.S. Kimball. 2014. Multi-sensor microwave sensitivity to freeze-thaw dynamics across a complex boreal landscape. Transactions in Geoscience and Remote Sensing, 52, 6818-6828.

Rawlins, M.A, K.C. McDonald, S. Frolking, R.B. Lammers, M. Fahnestock, J.S. Kimball, C.J. Vorosmarty. 2005. Remote Sensing of Pan-Arctic Snowpack Thaw Using the SeaWinds Scatterometer, Journal of Hydrology, 312/1-4, 294-311.

Rignot E., and Way, J.B. 1994. Monitoring freeze-thaw cycles along north-south Alaskan transects using ERS-1 SAR, Remote Sensing of Environment, 49, 131-137.

Rignot, E., Way, J.B., McDonald, K., Viereck, L., Williams, C., Adams, P., Payne, C., Wood, W., and Shi, J. 1994. Monitoring of environmental conditions in taiga forests using ERS-1 SAR, Remote Sensing of Environment, 49, 145-154.

Way, J. B., R. Zimmermann, E. Rignot, K. McDonald, and R. Oren. 1997. Winter and Spring Thaw as Observed with Imaging Radar at BOREAS, Journal of Geophysical Research, 102(D24), 29673-29684.

Wismann, V. 2000. Monitoring of seasonal thawing in Siberia with ERS scatterometer data. IEEE Transactions on Geoscience and Remote Sensing, 38, 1804–1809.

5. Contacts and Acknowledgments

Investigators

Scott Dunbar, Xiaolan Xu, Andreas Colliander, Eni Njoku,
Kyle McDonald, Erika Podest
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109 USA

Chris Derksen
Climate Research Division
Environment Canada
Toronto, ON M3H 5T4 Canada

John Kimball, Youngwook Kim
Numerical Terradynamic Simulation Group (NTSG)
College of Forestry & Conservation
The University of Montana
Missoula, MT 59812-1049 USA

Technical Contact

NSIDC User Services
National Snow and Ice Data Center
CIRES, 449 UCB
University of Colorado
Boulder, CO 80309-0449 USA
phone: +1 303.492.6199
fax: +1 303.492.2468
form: Contact NSIDC User Services
e-mail: nsidc@nsidc.org

6. Document Information

Document Creation Date

October 2015

Document Revision Date

N/A

Document URL

`http://nsidc.org/data/docs/daac/smap/sp_l3_fta/index.html`