ESA DUE Permafrost/ STSE-ALANIS Methane

ASCAT Surface Soil Moisture/Freeze-Thaw V3 product guide

alanis methane

support to science element

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This document is the Product Guide for the version 3 release of the 25km pan-arctic Surface Soil Moisture (incl. Frozen ground status) product. It has been compiled for the DUE Permafrost project (ESRIN Contract No. 22185/09/I-OL), a project of the Data User Element initiative of the European Space Agency. This update includes improvements which have been part of the STSE ALANIS Methane project (ESRIN Contract No. ESRIN Contract No. 4200023054/10/I-LG), a project of the Support to Science Element initiative of the European Space Agency.

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Issue 1.1	2011-01-31	V1 product guide	AB
Issue 2.0	2011-01-31	V2 product guide – improved surface status	AB
Issue 3.0	2013-07-19	V3– improved surface status and update to 2012	AB,CP
Issue 4.0	2014-02-20	V4 – extension of dataset to end of 2013, update of contact information	CP

1 Contents

2 Product overview

The ASCAT Surface Status as well as the Surface Soil Moisture (SSM) Product is derived from the ASCAT sensor onboard Metop satellite. The surface status (also called freeze/thaw information) is described in Naeimi et al. (2012). The soil moisture derivation algorithm is based on a change detection method initially proposed by Wagner et al. (1999). ASCAT SSM product is the result of an improved SSM retrieval algorithm developed at the Institute for Photogrammetry and Remote Sensing (IPF) of the Vienna University of Technology (Naeimi et al., 2009). The SSM Product as defined in the DUE Permafrost project (Bartsch & Seifert 2012) is delivered as weekly average and with 25km spatial resolution. This average is derived on a daily basis for the preceding week in accordance with the DUE GlobSnow product definitions. The daily surface status information is valid for the given date. The circumpolar dataset covers the years 2007 - 2013 north of 50°N.

The ASCAT Level 2 product including soil moisture data are produced by EUMETSAT in near-real time following the method developed and prototyped for EUMETSAT by the IPF. ASCAT data are distributed primarily via EUMETCast system and are available within about 2 hours after acquisition. Data are also accessible through EUMETSAT Data Centre.

For integration into the Permafrost Information System ASCAT data are resampled to a Discrete Global Grid (DGG). The DGG is an adapted sinusoidal grid using an ellipsoid based on the GEM6 model (Kidd 2005).

The soil moisture product also includes a quality flag which contains the number used measurements. Data are masked for frozen ground conditions also based on MetOp ASCAT. The frozen ground information (surface state flag) has been improved within the ESA STSE ALANIS project (www.alanis-methane.info) and is included in this dataset. Surface status information is provided for each single day.

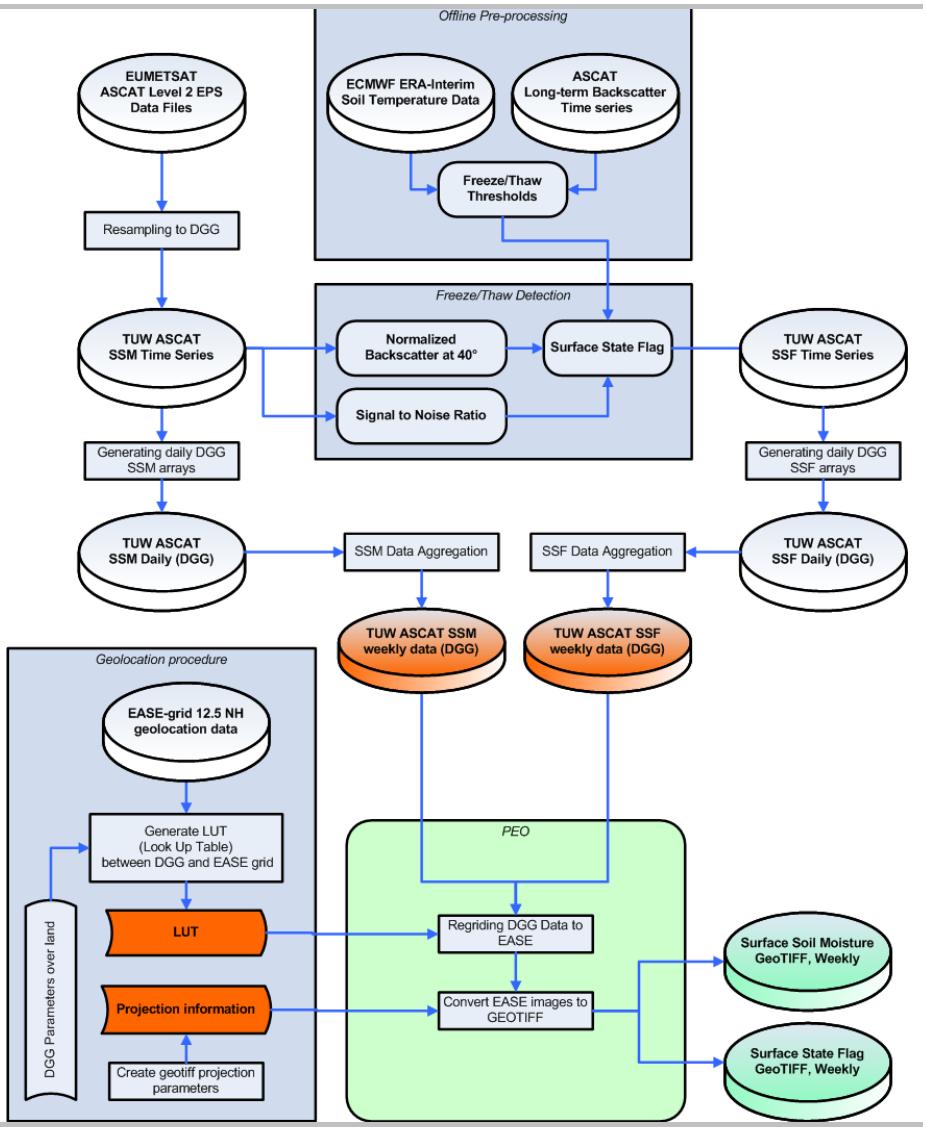

Figure 1
Processing flowchart for the implementation of the 25km ASCAT Surface Soil Moisture product

3 Product specification

3.1 File naming

OOO_SSSSS_PPP_VVV_vvv_yyyymmdd_hhmmss-YYYYMMDD_HHMMSS_RRR_DDD.EEE

Where
OOO="organisation", e.g. TUW
SSSSS="sensor and mode", e.g. ASCAT

PPP="product", e.g. SSF
VVV="product/software version"
vvv="processing index"
yyyymmdd_hhmmss="start date and time" (for period for which the data represents), e.g. 20070409_000000

(if applicable) YYYYMMDD_HHMMSS="end date and time" (same as above if data represents snapshot), e.g. 20070415_235959

RRR="region of interest", e.g. 100 for circum polar, N of 50°

(if applicable) DDD="data type", e.g. avg

EEE="file extension", e.g. tif

3.2 Data Description

The Surface Soil Moisture parameter represents a relative measure of the soil moisture in the top layer of the soil (Wagner et al. 1999).

The v3 product is provided as weekly averaged images north of 50°N in GeoTIFF/NetCDF format and EASE Grid projection. The week is defined by the day of interest and its proceeding 6 days. The data are described in Table 3–1.

The ASCAT Surface Status (SSF, Table 2-3) Product is as well derived from the ASCAT sensor onboard Metop satellite. The surface status (also called freeze/thaw information) is described in Naeimi et al. (2012).

Table 3–1
Description of the ASCAT surface soil moisture test dataset

Subject	Specification
Variable	Relative surface soil moisture
Units	in % * 2 [0 - 200]
Coverage	Globally above 50° latitude
Time period	2007 - Feb. 2013
Temporal frequency of the input data	Irregular, 80% global daily coverage
Temporal aggregation	Weekly (daily files)
Coordinate system	Polar Stereographic (EASE grid)
Spatial resolution	25 km x 25 km
Geometric accuracy	4 km (original ASCAT orbit data localisation accuracy)
Thematic accuracy	0.04-0.08 m^3 water per m^3 soil, depending on land cover and soil type
Data format	GeoTIFF (separate quality flag file) NetCDF (includes quality flag)
Other data codes	-254 for no data or masked (quality flag applied)

Subject	Specification
Variable	Proportion of measurements used, with respect to the maximal possible acquisitions
Units	in % * 2 [0 - 200]
Coverage	Globally above 50° latitude
Time period	2007 - Feb. 2013
Temporal aggregation	Weekly (daily files)
Coordinate system	Polar Stereographic (EASE grid)
Spatial resolution	25 km x 25 km
Data format	GeoTIFF NetCDF (included in SSM file)
Other data codes	0 for no date or masked

Table 3–2
Description of the ASCAT quality flag (QF) dataset

Subject	Specification
Variable	Surface status flag (SSF)
Coverage	Globally above 50° latitude
Time period	2007 - Feb. 2013
Temporal frequency of the input data	Irregular, 80% global daily coverage
Coordinate system	Polar Stereographic (EASE grid)
Spatial resolution	25 km x 25 km
Geometric accuracy	4 km (original ASCAT orbit data localisation accuracy)
Thematic accuracy	Air temperature validation: WMO - 81,93% ERA-Interin - 83,09% GLDAS - 83,86%
Data format	GeoTIFF NetCDF (includes surface status, surface soil moisture and quality flag)
Data codes	0 .. "no data" value 50 unfrozen 100 frozen 150 temporary water of melting 200 permanent ice or frozen water

Table 3–3
Description of the ASCAT surface status information

3.3 Examples

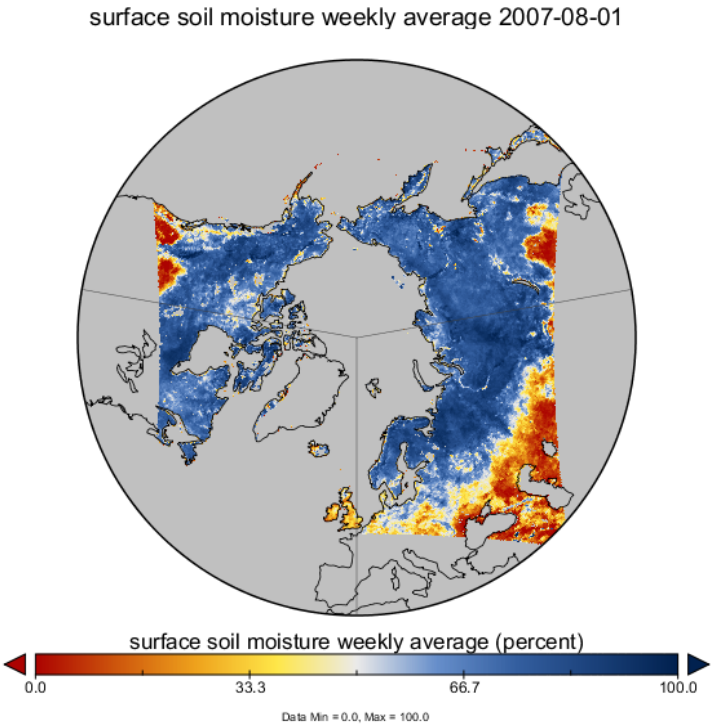

Figure 2
Examples of 25 km SAR Surface Soil Moisture mosaic test product > 50°N

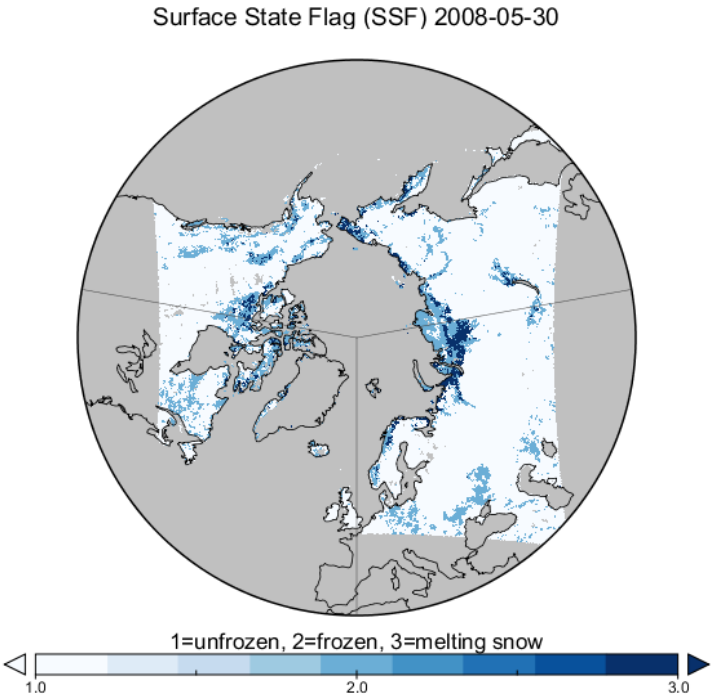

Figure 3
Examples of 25 km ASCAT Surface Status test product > 50°N

4 Known issues

Frozen ground masking has been applied for the v4 SSM product based on the SSF. There are uncertainties during the transition time periods. Very low soil moisture values can occur in cases where the masking has failed.

Masking is also required in case of inundation.

Both issues will be investigated in further detail for later versions.

5 Data access and contact information

The **Version 3** ASCAT SSM and SSF product can be accessed via PANGAEA (http://doi.pangaea.de/10.1594/PANGAEA.818331) and should be cited as:

Paulik, Christoph; Melzer, Thomas; Hahn, Sebastian; Bartsch, Annett; Heim, Birgit; Elger, Kirsten; Wagner, Wolfgang (2014): Circumpolar surface soil moisture and freeze/thaw surface status remote sensing products version 4 with links to geotiff images and netCDF files, Institute of Photogrammetry and Remote Sensing, TU Vienna, doi:10.1594/PANGAEA.818331.

In: DUE Permafrost Project Consortium (2012): ESA Data User Element (DUE) Permafrost: Circumpolar Remote Sensing Service for Permafrost (Full Product Set) with links to datasets. doi:10.1594/PANGAEA.780111

The product is alternatively stored on the Institute of Photogrammetry and Remote Sensing (TU Wien) FTP server which can be accessed via the DUE Permafrost data portal (www.geo.tuwien.ac.at/permafrost). The dataportal includes a WebGIS for visualization. Login information is available on request.

For login access to the dataportal, contact permafrost@tuwien.ac.at

For questions about the product, contact Christoph.Paulik@tuwien.ac.at or Annett.Bartsch@tuwien.ac.at.

For ESA's technical officer, contact Frank.Martin.Seifert@esa.int.

Additional information on the ESA DUE Permafrost project can be found in Bartsch & Seifert (2012) at the web - site: http://www.geo.tuwien.ac.at/permafrost

6 References

Bartsch, A.; Seifert, F.M., "The ESA DUE Permafrost project - A service for high latitude research," Geoscience and Remote Sensing Symposium (IGARSS), 2012 IEEE International , vol., no., pp.5222,5225, 22-27 July 2012. doi: 10.1109/IGARSS.2012.6352432

Kidd, R. (2005): Discrete Global Grid Systems. ASCAT Soil Moisture Report Series N°4, 4, Institute of Photogrammetry and Remote Sensing, Vienna University of Technology, Vienna.

Naeimi, V., Scipal, K., Bartalis, Z., Hasenauer, S. and Wagner, W. (2009): An improved soil moisture retrieval algorithm for ERS and METOP scatterometer observations. IEEE Transactions on Geoscience and Remote Sensing, 47: 555-563.

Naeimi, V., Paulik, C., Bartsch, A., Wagner, W., Kidd, R., Elger K., and Boike, J. (2012): ASCAT Surface State Flag (SSF): ASCAT Surface State Flag (SSF): Extracting Information on Surface Freeze/Thaw Conditions From Backscatter Data Using an Empirical Threshold-Analysis Algorithm. IEEE Transactions on Geoscience and Remote Sensing, 99**:** 1-17.

Wagner, W., Lemoine, G. and Rott, H. (1999). A Method for Estimating Soil Moisture from ERS Scatterometer and Soil Data. Remote Sensing of Environment, 70(2): 191-207.