

ASCAT Freeze/thaw test product guide



alanis methane

support to science element



Centre for Ecology and Hydrology



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Scope

The European Space Agency (ESA) has initiated the *Atmosphere-LANd Interactions Study* (ALANIS) in collaboration with the *Integrated Land Ecosystem-Atmosphere Processes Study* (iLEAPS). The overall objective of the ALANIS project is to advance towards the development and validation of novel Earth Observation-based (EO-based) multi-mission products and their integration into suitable land-atmosphere coupled models responding directly to the specific scientific requirements of the iLEAPS community.

One of the three themes in ALANIS considers wetland dynamics and CH₄ emissions ('ALANIS methane'). The main goal of the ALANIS methane project is to produce and use a suite of relevant information derived from Earth Observation (EO) to validate and improve one of the next generation land-surface models and thus reduce current uncertainties in wetland-related CH₄ emissions.

The 'ASCAT Freeze/thaw test product guide' presents the description of test dataset for the initially defined parameters:

- Start of snowmelt,
- End of snowmelt, and
- Freeze up.

Surface status information is provided for each single day instead of a day of year for each of the parameters. This change in product definition has been agreed on for better integration to the JULES model.

The product is delivered in combination with the weekly surface soil moisture product (Version 1) of the DUE Permafrost project.

Applicable Documents

[AD-1] STSE-LAND-EOPG-SW-09-0001 Statement of Work: STSE-ALANIS 2009

[AD-2] STSE ALANIS methane Proposal – Part A: Proposed by CEH et al. 2009

[AD-3] STSE ALANIS methane progress meeting minutes, 10.05.2009

[AD-4] Requirements Baseline (RB): STSE ALANIS methane team 2010

[AD-5] Preliminary Analyses Report (PAR): STSE ALANIS methane team 2010

[AD-6] Technical specifications (TS): STSE ALANIS methane team 2010

[AD-7] Validation plan (VP): STSE ALANIS methane team 2010

List of abbreviations

AD	Applicable document
ALANIS	Atmosphere-LANd Interactions Study
ASCAT	Advanced Scatterometer
CEH	Centre for Ecology and Hydrology
DUE	Data User Element
EO	Earth Observation
ERA	ECMWF Reanalysis
ESA	European Space Agency
iLEAPS	Integrated Land Ecosystem-Atmosphere Processes Study
MetOp	Polar-orbiting satellite dedicated to operational meteorology
QF	Quality Flag
SOW	Statement of Work
SSF	Surface State Flag
SSM	Surface Soil Moisture
SSMI	Special Sensor Microwave Imager
STSE	Support to Science Element
WMO	World Meteorological Organisation

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1 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. (2011). 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 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 and 2010 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.

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 the MetOp ASCAT surface status product.

2 Product Specification

2.1 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"

yyymmdd_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

2.2 Data description

Subject	Specification
Variable	Surface status flag (SSF)
Coverage	Globally above 50° latitude
Time period	2007 - 2008
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-Interim - 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 2-1
Description of the ASCAT surface status information

Table 2-2
*Description of the ASCAT
 surface soil moisture test
 dataset*

Subject	Specification
Variable	Relative surface soil moisture (SSM)
Units	in % * 2 [0 - 200]
Coverage	Globally above 50° latitude
Time period	2007 - Sept. 2010
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)

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

Subject	Specification
Variable	Proportion of measurements used, with respect to the maximal possible acquisitions (QF)
Units	in % * 2 [0 - 200]
Coverage	Globally above 50° latitude
Time period	2007 - Sept. 2010
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

2.3 Examples

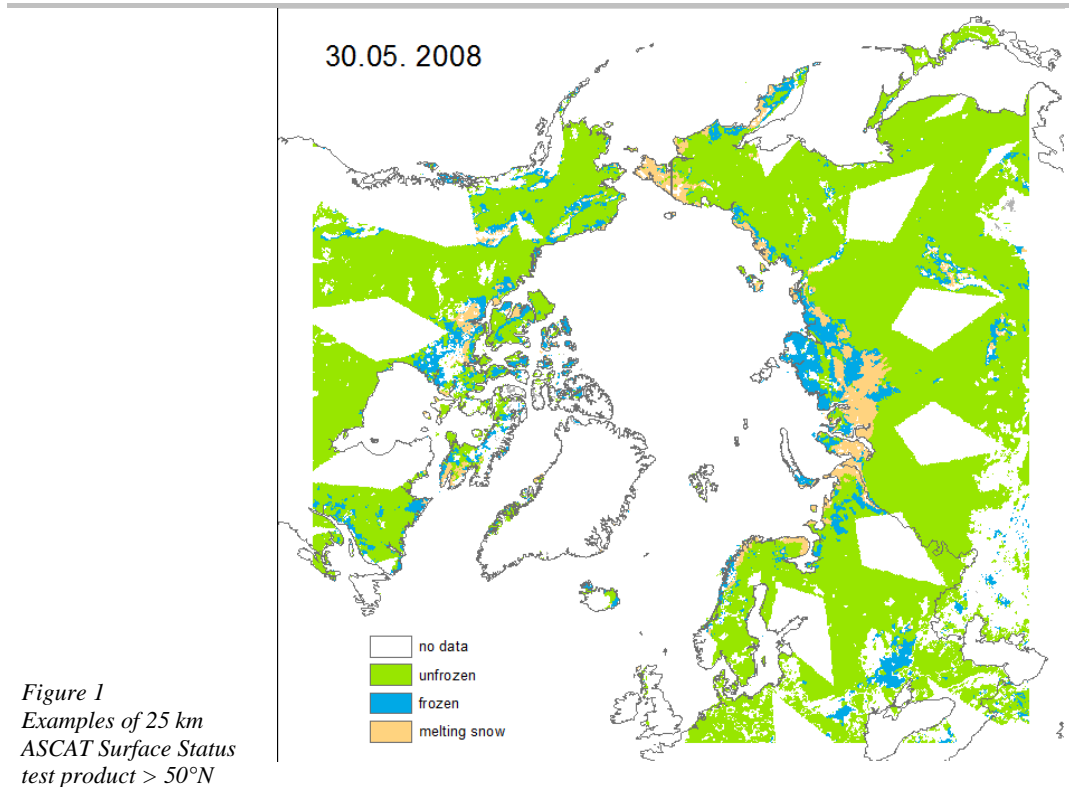


Figure 1
Examples of 25 km
ASCAT Surface Status
test product > 50°N

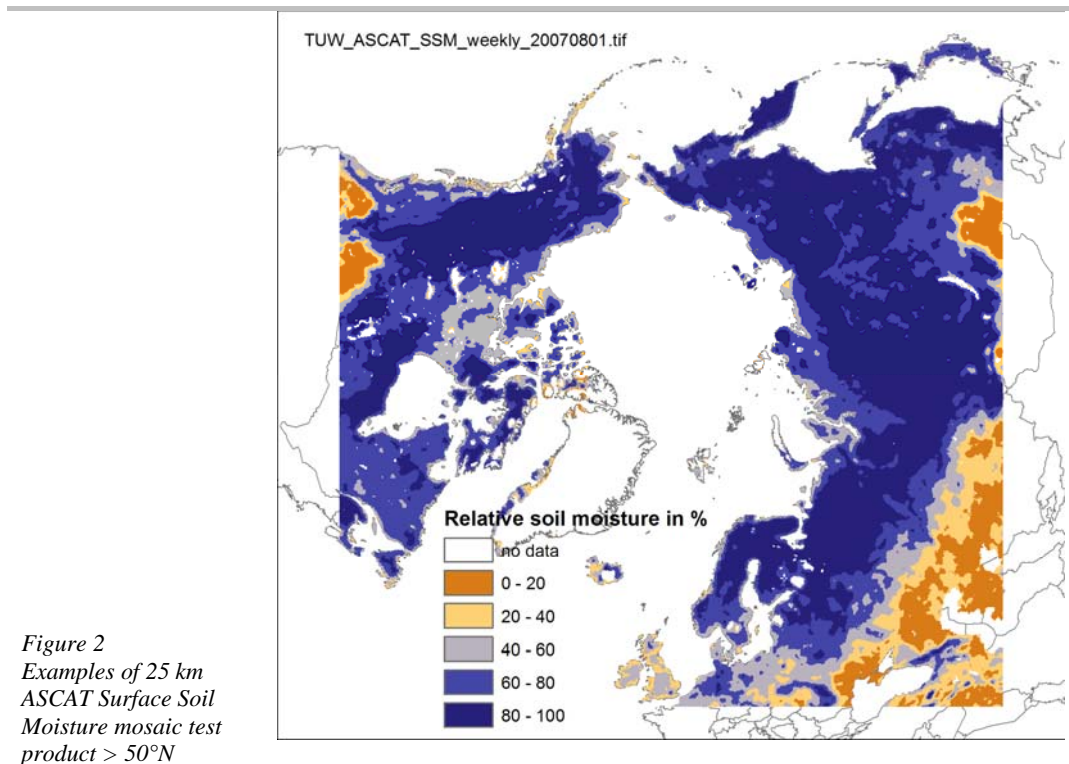


Figure 2
Examples of 25 km
ASCAT Surface Soil
Moisture mosaic test
product > 50°N

3 References

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

Vahid Naeimi, Christoph Paulik, Annett Bartsch, Wolfgang Wagner, Richard Kidd, and Julia Boike (submitted, 2011): 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.

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