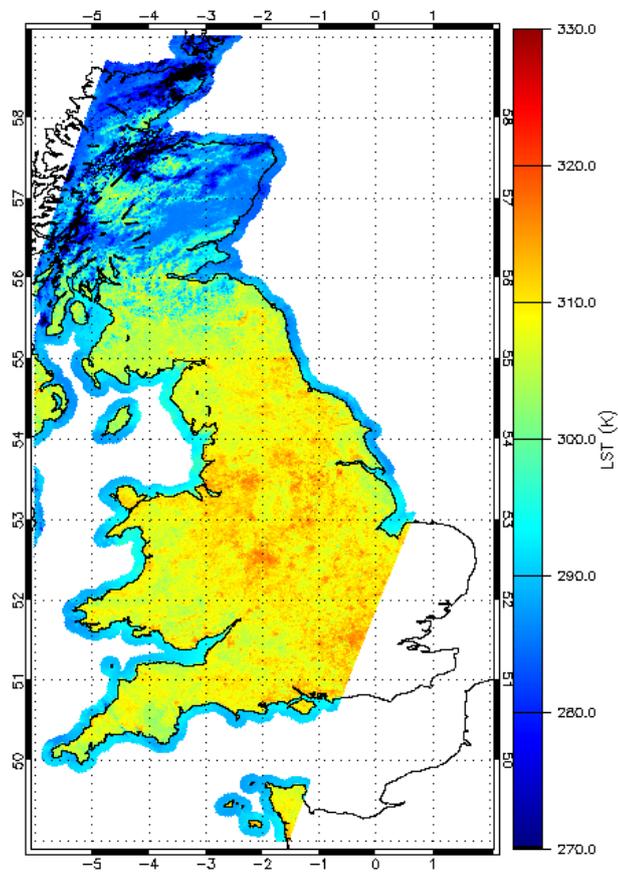


(A)ATSR Land Surface Temperature (LST) Product (UOL_LST_L2) Level 2 User Guide

v 1.0



Version History

Version	Date	Change
0.9	03/12/2013	Initial version for evaluation
1.0	17/12/2013	ESA QC recommendations applied

Table of Contents

1	Introduction	4
2	Product Description.....	4
2.1	Scope.....	4
2.2	Filename Convention	5
2.3	File contents	6
3	Metadata.....	7
3.1	Global attributes	8
3.2	Variable Metadata.....	9
	Recommended Approach.....	10
	References	10
4	Glossary.....	11
5	Appendices	12
5.1	Examples of product datasets.....	12
5.2	Custom land cover classification.....	18
5.3	Example output.....	19

1 Introduction

The purpose of this document is to describe the content and use of the reprocessed Level-2 University of Leicester Land Surface Temperature (LST) product (UOL_LST_L2) for the Along Track Scanning Radiometers (ATSRs). The product provides (A)ATSR-based LST and its associated uncertainty, as well as additional auxiliary information, which was used as part of the retrieval algorithm.

The algorithm applied for computing LST is based on the methodology originally developed by [1] in that it uses a split-window approach with model-derived regression coefficients which implicitly include the effects of emissivity. However, the updated methodology that was used for this reprocessing applies significantly improved auxiliary datasets for land cover, green vegetation fraction, and total column water vapour and as such is able to reduce or eliminate a wide variety of issues that were observed with the original LST product. Further details about the algorithm used for producing this dataset can be found in [2].

The resulting data product has been extensively validated by [3, 4] using the LST validation methodology described in [5].

2 Product Description

The following sections describe the overall scope of the data product, introduce the file naming convention and its elements, and briefly describe the actual file contents.

2.1 Scope

The product primarily provides data on LST and its associated uncertainty. It further provides auxiliary information that has been used for the LST retrieval, such as land cover type, fractional vegetation cover, total column water vapour, normalized difference vegetation index (NDVI), and quality control flags. Within some daily subdirectories there exists an additional folder called “segregated”. Orbits within these folders have been processed to UOL_LST_L2 but have been separated due to the non-nominal nature of the input level-1b data (for more details see the Envisat AATSR Performance Report (IDEAS-VEG-OQC-REP-1143), which is available from the ESA Document Library: <https://earth.esa.int/web/guest/document-library>).

2.2 Filename Convention

The filename of the product follows the generic Envisat filename convention [6], which consists of the following elements:

```
<product_ID> <processing_stage_flag> <originator_ID> <start_day> <"_">  
<start_time> <"_"> <duration> <phase> <cycle> <"_"> <relative_orbit> <"_">  
<absolute_orbit> <"_"> <counter> <". "> <extension>
```

The elements are described based on the following example filename

```
ATS_LST_2PUUOL20060718_102137_000065272049_00308_22907_6417.nc
```

Element	Example	Description
<product_ID>	ATS_LST_2P	10-character string identifying sensor - AT1, AT2, ATS - for ATSR-1, ATSR-2, AATSR respectively, processing level, and type of product
<processing_stage_flag>	U	Identifier for the processing stage (U = 3 rd reprocessing)
<originator_ID>	UOL	Identifier of the production facility (UOL = University of Leicester)
<start_day>	20060718	The start day of the product based on the start time of the first data set record. Given in YYYYMMDD
<start_time>	102137	The start time of the product from the UTC time of the first data set record, given in HHMMSS
<duration>	00006527	Time coverage of the product expressed in seconds
<phase>	2	Mission phase identifier
<cycle>	049	Cycle number within the mission phase
<relative_orbit>	00308	Relative orbit number
<absolute_orbit>	22907	Absolute orbit number
<counter>	6417	Numerical wrap-around counter for quick file identification
<extension>	.nc	File name extension

2.3 File contents

The data is provided in netCDF-4 classic format [7] using the CF-1.4 metadata convention [8]. This netCDF format is a self-describing, portable, scalable, appendable, sharable, archivable, and machine-independent data format. It is supported by all major data analysis and visualisation packages, such as for example IDL, Matlab, R, BEAM, Panoply, etc., and programming interfaces exist for a wide variety of other programming languages.

The data is provided as individual variables in the netCDF file. The existing variables are:

Variable	Description
ref_time	Provides the reference time at start of orbit given in seconds since 1981-01-01 00:00:00 UTC.
Lat	Gives the latitude coordinate of the pixel centre in decimal degrees north.
Lon	Gives the longitude coordinate of the pixel centre in decimal degrees east.
Dtime	Provides the time difference between observation time and the reference time. Units are milliseconds. Thus, ref_time plus dtime gives milliseconds after 1981-01-01 00:00:00 UTC.
Lcc	Provides the land cover classification in 27 classes using a modified Globcover classification scheme specifically developed for the (A)ATSR LST product algorithm. See Table 1 in the Appendix for more information.
Fv	Gives the fractional vegetation cover used for estimating LST. The dataset is derived from the GEOLAND-2 FCOVER dataset, which has been gap-filled using climatology.
Tcwv	Provides the total column water vapour data used for estimating (A)ATSR LST. This data is based on the ECMWF ERA-Interim dataset.
LST	Gives the Land Surface Temperature in K
LST_uncertainty	Provides the uncertainty in LST, given in K. The given uncertainty estimate is a combination of individual uncertainties due to radiometric noise, fractional vegetation cover, atmospheric water vapour, geolocation, the coefficient fitting process, and systematic uncertainty due to the radiative transfer modelling.
NDVI	Provides the Normalized Difference Vegetation Index (NDVI) derived

	<p>from the 0.66μm and 0.87μm (A)ATSR channels. This is only derived for daytime retrievals where the solar zenith angle is less than 85°. Note: NDVI cannot be derived for ATSR-1.</p>
QC	<p>Gives quality control flags for each pixel. The individual flags are:</p> <p>1 = night: where the solar zenith angle is less than 0°</p> <p>2 = land including inland and coastal water: where the land cover classification is between 1 and 27. The coastal water is defined as within 10km of the shoreline.</p> <p>4 = V1 mask identifies cloud: standard ESA cloud mask – this is taken directly from bit 1 of the Level 1b cloud word</p> <p>8 = V2 mask identifies cloud aggregation of individual ESA cloud mask with dynamic thresholds</p> <p>16 = V3 mask identifies cloud Probabilistic approach utilising simulated radiances at ATSR tie points</p> <p>32 = snow Combination of two snow masking approaches [9, 10]. Where a pixel is identified as snow LST is retrieved as per land cover classification no. 27 (Table 1)</p> <p>The cloud masks are described in detail in [11]</p>

All variables except `ref_time` have the dimensions `time × nj × ni`, where `time` is the number of different time slots (for the ATSRs this is always set as 1), `nj` is the number of pixels in the along-track direction and `ni` is the number of pixels in the across-track direction; `ref_time` has the dimension of `time` only.

In addition to the actual data, the product files include both global metadata and metadata for the individual variables, which are both described in detail in the following section.

3 Metadata

The following sections describe the metadata attributes that are provided with each netCDF file, both as global metadata attributes and attributes for individual variables.

3.1 Global attributes

Global metadata describe the whole file with regard to general information about conventions, data producer, contact information etc. Examples for the information provided in each of the used attributes can be found in Section 5.3 in the Appendix.

The following global attributes are provided with each file:

Attribute	Description
Conventions	Refers to the metadata convention used in the file. The Climate and Forecasting (CF) metadata convention is used here and its version is given
title	Title of the data product
summary	Summarizes the primary content of the data product
references	Provides a reference to cite for data users
institution	Gives the name of the entity at which the data product was created
history	Provides information about how the product was created
comment	Provides additional information that does not fit any of the other attributes
license	Provides guidance on the data use policy
date_created	Gives the date on which the product was created. Given as DD-MM-YYYY HH:MM:SS±HHMM, where ±HHMM is the time zone relative to UTC
product_version	Provides the version of the data product
netcdf_version_id	Gives the version of the used netCDF format and its creation date
spatial_resolution	Provides the data products' spatial resolution at nadir
start_time	Provides the start time of the product – this is the start of the orbit. Given as YYYY-MM-DD HH:MM:SSZ. Z is the time zone relative to UTC
time_coverage_start	Provides the start time of the total coverage of the data for the whole Envisat mission. Given as YYYY-MM-DD HH:MM:SSZ. Z is the time zone relative to UTC
stop_time	Provides the end time of the product – this is the end time of the orbit. Given as YYYY-MM-DD HH:MM:SSZ. Z is the time zone relative to UTC
time_coverage_end	Provides the end time of the total coverage of the data for

	the whole Envisat mission. Given as YYYY-MM-DD HH:MM:SSZ. Z is the time zone relative to UTC
northernmost_latitude	Provides the northernmost geographical extent of the data product. Given as decimal degrees, positive numbers are north of the equator
southernmost_latitude	Provides the southernmost geographical extent of the data product. Given as decimal degrees, positive numbers are north of the equator
easternmost_longitude	Provides the easternmost geographical extent of the data product. Given as decimal degrees, positive numbers are east of the Greenwich meridian
westernmost_longitude	Provides the westernmost geographical extent of the data product. Given as decimal degrees, positive numbers are east of the Greenwich meridian
Source	Provides information about the source data on which the product is based on
Platform	Provides the name of the orbiting platform/satellite
Sensor	Provides the name of the used sensor/instrument
acknowledgment	Provides information about the funding agencies
creator_name	Gives the name of the creator of the file
creator_email	Gives the E-mail address of the creator of the file
creator_url	Provides the link to a website related to the product

3.2 Variable Metadata

Each individual variable in the products' netCDF files has its own metadata.

The following attributes are common for most variables (unless not applicable for a particular variable):

Attribute	Description
long_name	A free-text descriptive name for the variable
standard_name	The standard name for the variable as defined by CF conventions
units	Text description of the units the data is stored in.
_FillValue	A value used to indicate array elements which contain invalid or missing data
scale_factor	Used to pack data into a smaller datatype. The original data can be recovered using: $value = (scale_factor * packed_data) + add_offset$
add_offset	

valid_min	The minimum valid value for the variable in its packed form
valid_max	The maximum valid value for the variable in its packed form
coordinates	Describes the coordinate system in which the data is given
source	Published or web-based reference describing the origins of any third-party auxiliary data
comment	Other information about the variable or methods used to generate it

Some variables contain additional metadata attributes that are only relevant for this specific variable:

Attribute	Variable(s)	Description
flag_meanings	lcc, QC	Describes the scientific meaning behind the flags given in the variable
flag_values	lcc	Only used for land cover. They take the values 1s, 2s, 3s 27s. These correspond to the equivalent flag meanings.
flag_masks	QC	Only used for quality control. They take the values 1s, 2s, 4s, 8s, 16s, 32s. These correspond to the equivalent flag meanings.

Recommended Approach

Data in the LST variable has been quality checked with regards to input Level 1b data, with only valid data stored - all invalid data is assigned with the `_FillValue`. In addition, valid LST data is only available where QC bit value of 2 is set (land including inland and coastal water).

With respect to utilisation of LST of best quality then it is recommended to apply the V3 cloud mask (where QC bit value of 16 is set). Furthermore, LST where the corresponding LST_uncertainty is greater than 2.0 K should be treated with more caution.

References

1. Prata, F., *Land Surface Temperature Measurement from Space: AATSR Algorithm Theoretical Basis Document*. 2002.
2. Ghent, D., et al., *Advancing the AATSR land surface temperature retrieval with higher resolution auxiliary datasets: Part A - derivation of coefficients*. In preparation.

(A)ATSR LST L2 Product User Guide

3. Ghent, D., *Land Surface Temperature Validation and Algorithm Verification (Report to European Space Agency)*. 2012(UL-NILU-ESA-LST-VAV).
4. Ghent, D., et al., *Advancing the AATSR land surface temperature retrieval with higher resolution auxiliary datasets: Part B - validation*. In preparation.
5. Schneider, P., et al., *Land Surface Temperature Validation Protocol (Report to European Space Agency)*. 2012(UL-NILU-ESA-LST-LVP).
6. McLeod, I., *Envisat-1 Products Specification Annex A: Product Data Conventions*. PO-RS-MDA-GS-2009, 1997.
7. Rew, R., et al., *The NetCDF Users Guide*. 2011.
8. Eaton, B., et al., *NetCDF Climate and Forecast (CF) Metadata Conventions*. 2011.
9. Eastwood, S. and S. Andersen, *Masking of sea ice for METOP SST retrieval (Danish Meteorological Institute report)*. 2007.
10. Istomina, L.G., et al., *The detection of cloud-free snow-covered areas using AATSR measurements*. Atmospheric Measurement Techniques, 2010. 3(4): p. 1005-1017.
11. Bulgin, C.E., et al., *Cloud Clearing Techniques over Land for Land Surface Temperature Retrieval from the Along Track Scanning Radiometers*. International Journal of Remote Sensing, in review.

4 Glossary

AATSR	Advanced Along Track Scanning Radiometer
ATSR-1	Along Track Scanning Radiometer-1
ATSR-2	Along Track Scanning Radiometer-2
CF	Climate and Forecast metadata convention
LST	Land Surface Temperature
NDVI	Normalized Difference Vegetation Index
netCDF	Network Common Data Form
UTC	Coordinated Universal Time

5 Appendices

5.1 Examples of product datasets

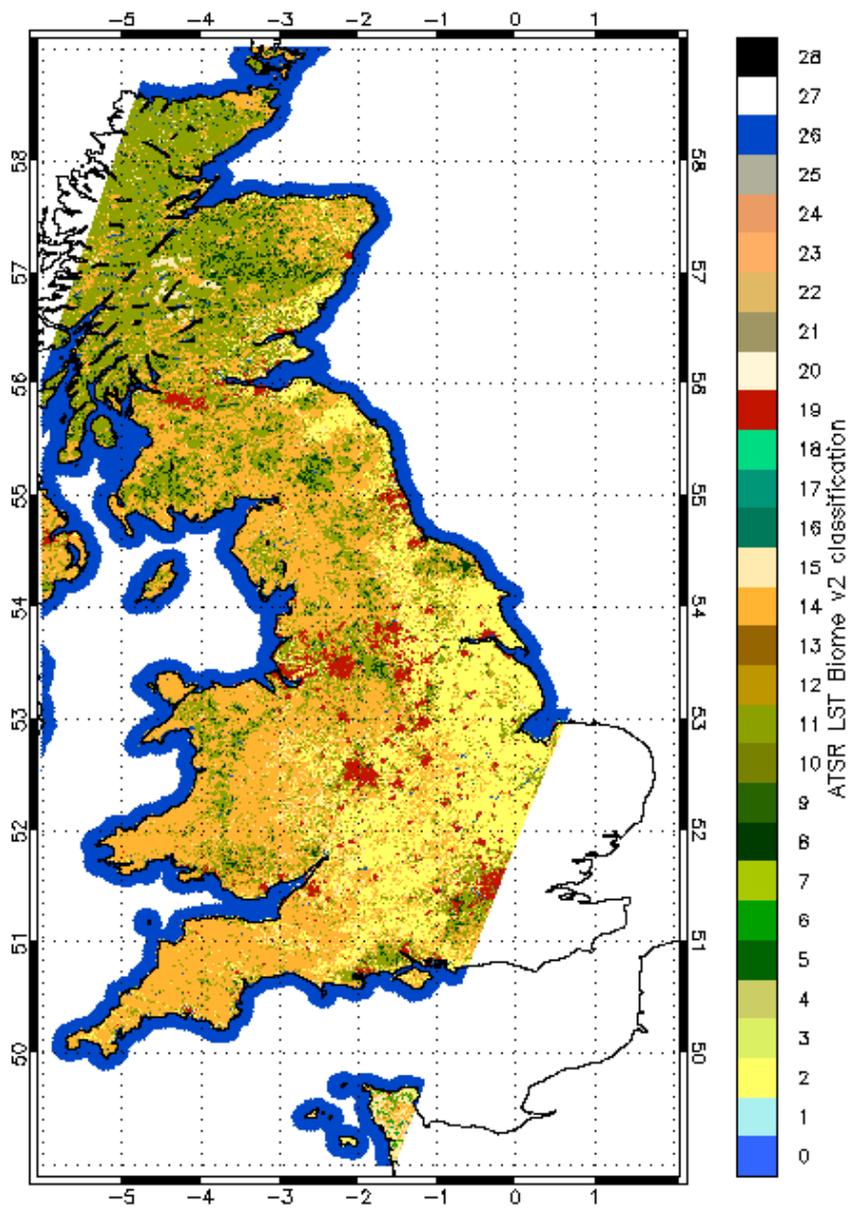


Figure 1: Example for the Globcover-based land cover classification custom-produced for the generation of the (A)ATSR LST product.

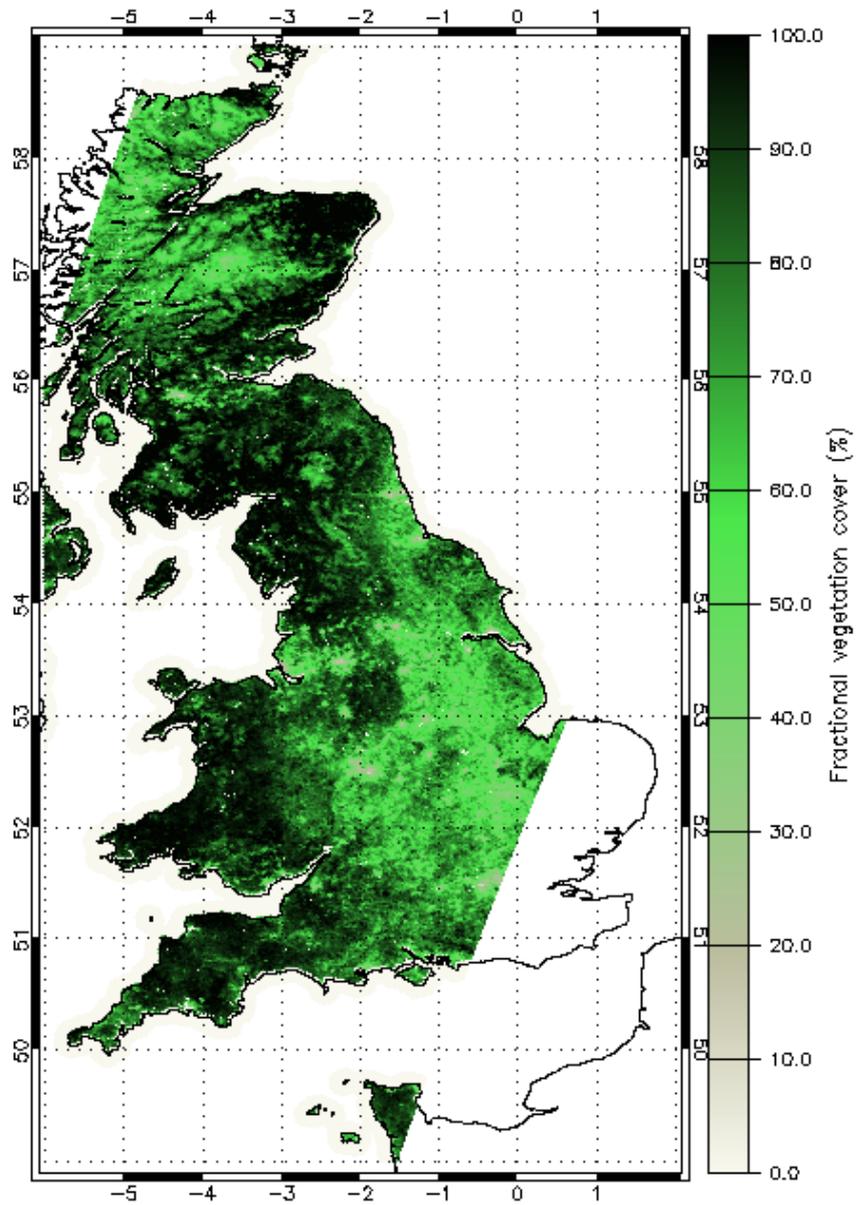


Figure 2: Example for the fractional vegetation cover datasets used for producing the (A)ATSR LST product

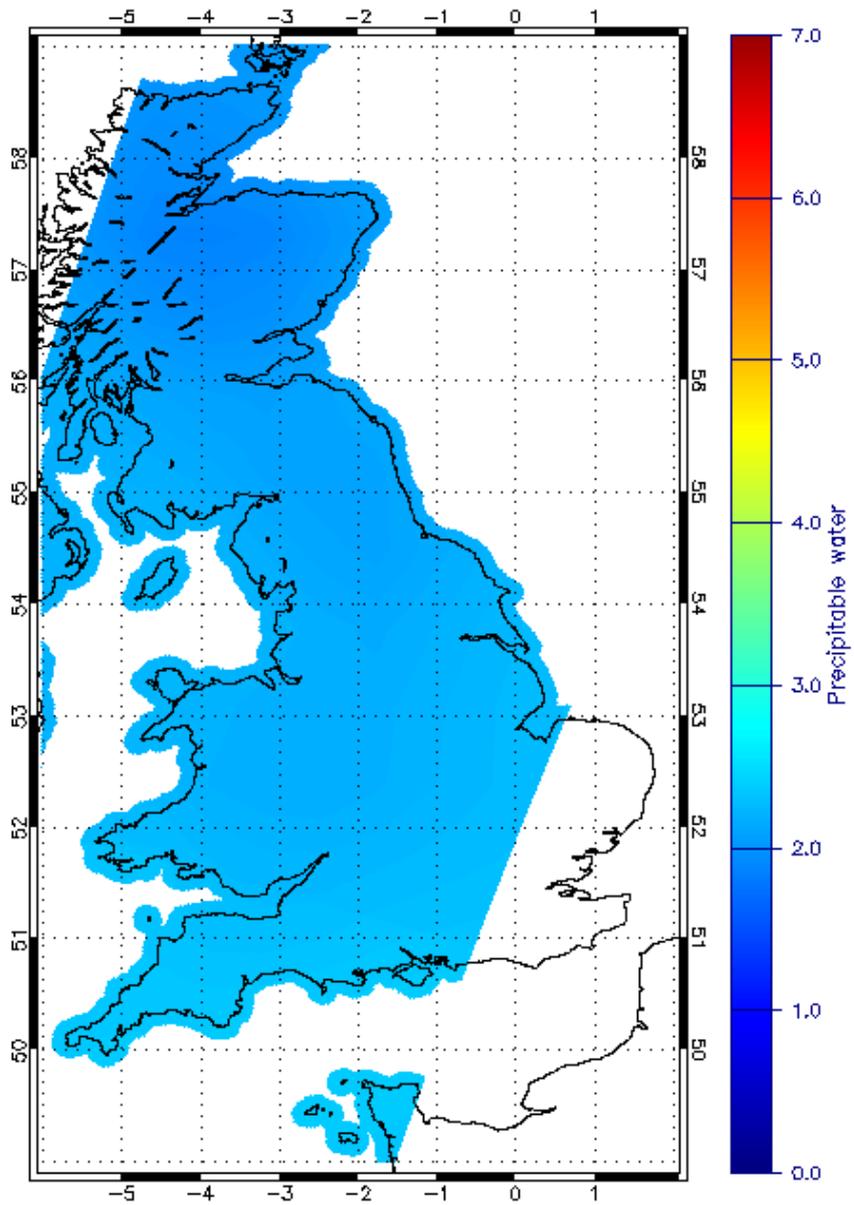


Figure 3: Example for the total column water vapour dataset used for producing the (A)ATSR LST product

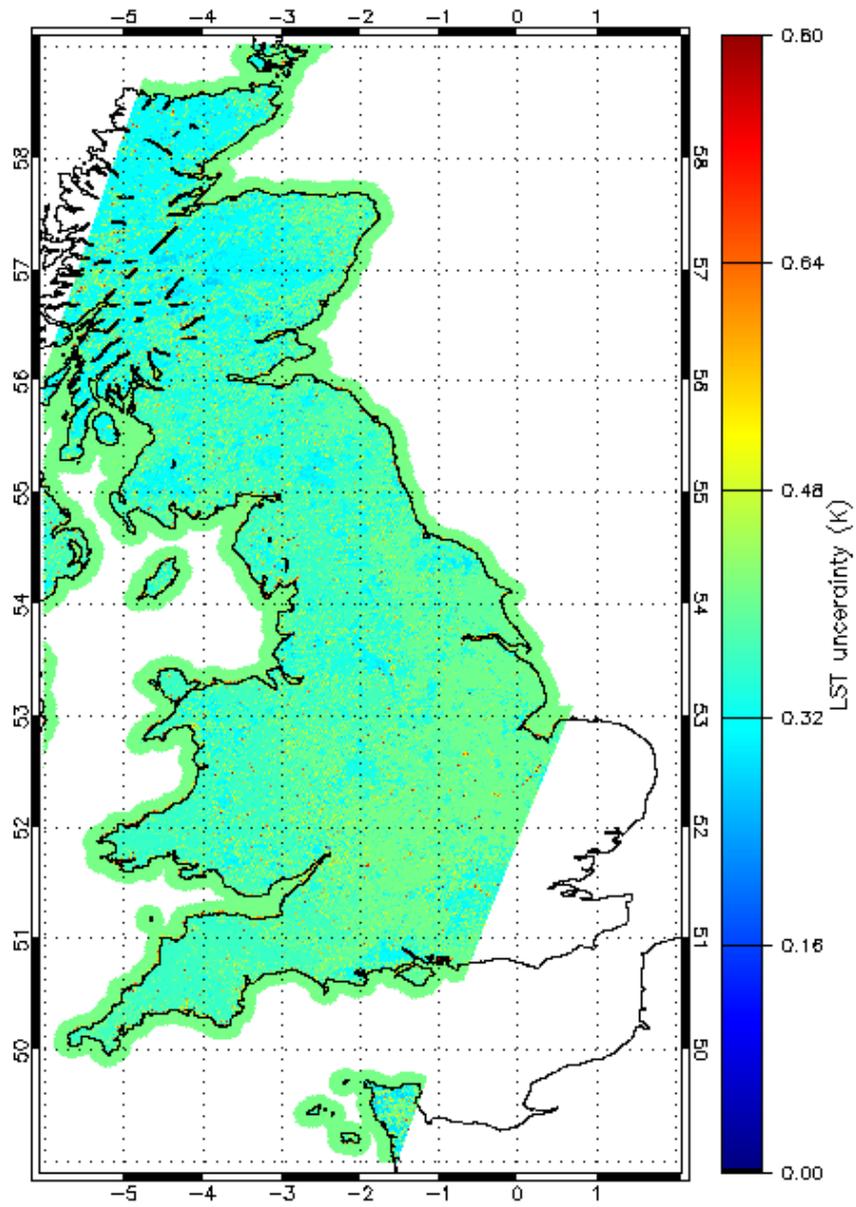


Figure 4: Example for the LST uncertainty derived from (A)ATSR

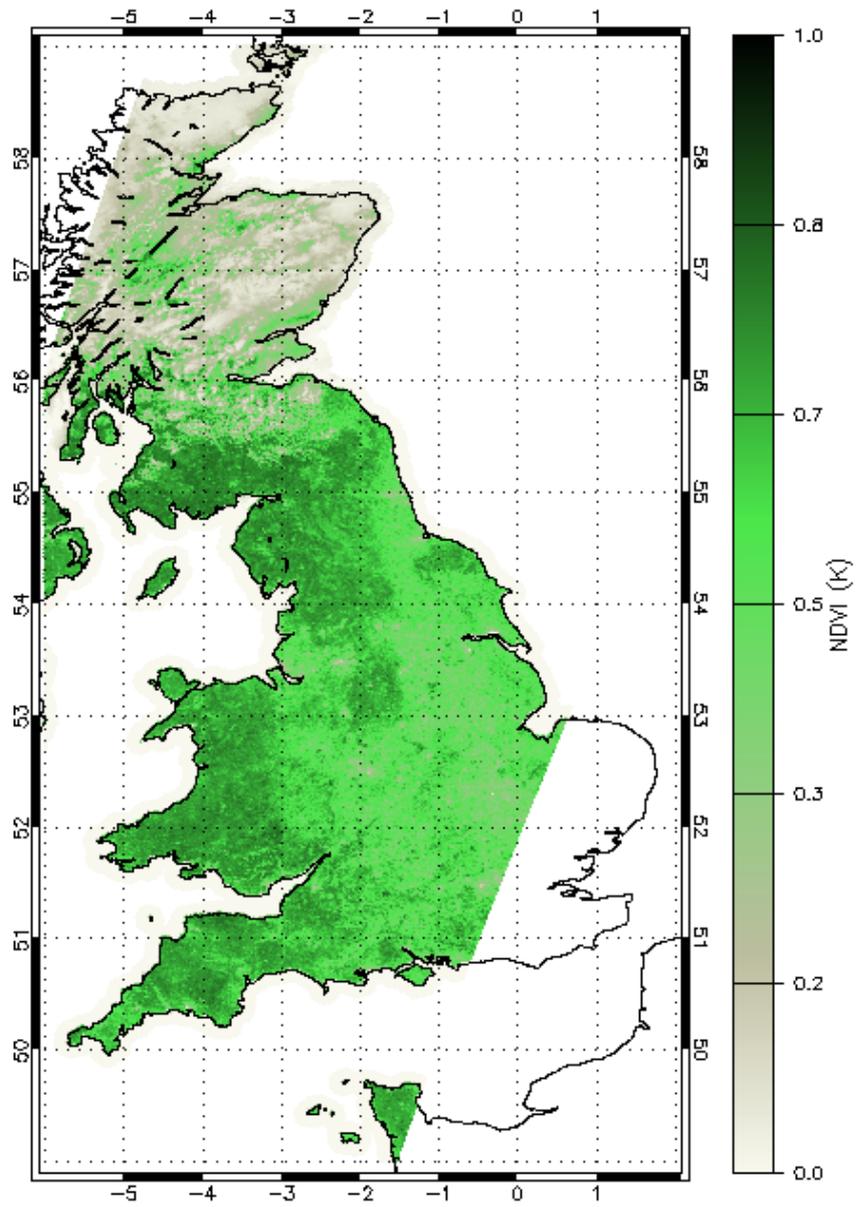


Figure 5: Example for the Normalized Difference Vegetation (NDVI) dataset derived from ATSR-2 or AATSR channels

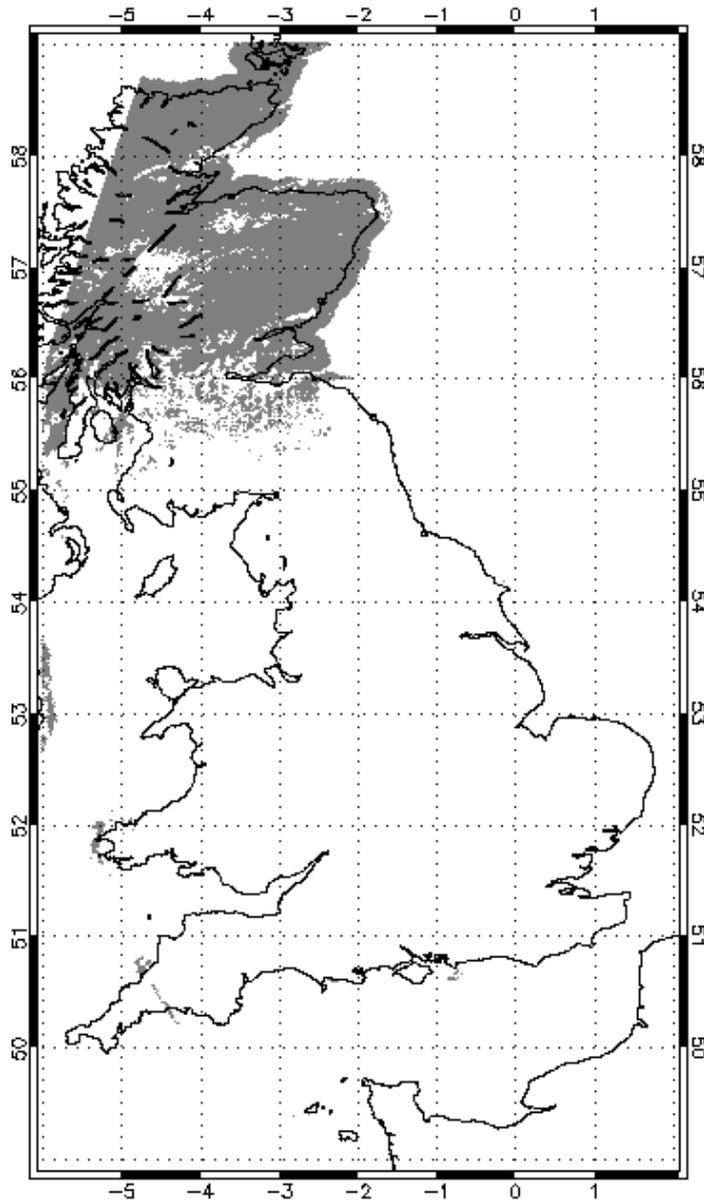


Figure 6: Example for the V3 cloud mask dataset contained within the product

5.2 Custom land cover classification

Table 1- (A)ATSR LST land cover classification version 2 (ALB2) derived from the Globcover classification [2]

No.	Legend	Based on	Fraction of land surface [%]
0	Water bodies of sea (>10km away from coast)	GC210 (GC0)	N/A
1	Post-flooding or irrigated croplands	GC11	0.92
2	Rainfed croplands	GC14	3.68
3	Mosaic Cropland (50-70%) / Vegetation (grassland, shrubland, forest) (20-50%)	GC20	3.03
4	Mosaic Vegetation (grassland, shrubland, forest) (50-70%) / Cropland (20-50%)	GC30	4.01
5	Closed to open (>15%) broadleaved evergreen and/or semi-deciduous forest (>5m)	GC40	4.72
6	Closed (>40%) broadleaved deciduous forest (>5m)	GC50	3.09
7	Open (15-40%) broadleaved deciduous forest (>5m)	GC60	1.16
8	Closed (>40%) needleleaved evergreen forest (>5m)	GC70	1.50
9	Open (15-40%) needleleaved deciduous or evergreen forest (>5m)	GC90	7.38
10	Closed to open (>15%) mixed broadleaved and needleleaved forest (>5m)	GC100	1.47
11	Mosaic Forest/Shrubland (50-70%) / Grassland (20-50%)	GC110	2.98
12	Mosaic Grassland (50-70%) / Forest/Shrubland (20-50%)	GC120	1.86
13	Closed to open (>15%) shrubland (<5m)	GC130	3.90
14	Closed to open (>15%) grassland	GC140	3.98
15	Sparse (>15%) vegetation (woody vegetation, shrubs, grassland)	GC150	9.32
16	Closed (>40%) broadleaved forest regularly flooded - Fresh water	GC160	0.28
17	Closed (>40%) broadleaved semi-deciduous and/or evergreen forest regularly flooded - Saline water	GC170	0.04
18	Closed to open (>15%) vegetation (grassland, shrubland, woody vegetation) on regularly flooded or waterlogged soil - Fresh, brackish or saline water	GC180	0.55
19	Artificial surfaces and associated areas (urban areas >50%)	GC190	0.15
20	Bare areas of soil types not contained in biomes 21 - 25	GC200 and other USDA soil types	2.35
21	Bare areas of soil type "Entisols - Orthents"	GC200 / USDA-99	3.10
22	Bare areas of soil type "Shifting sand"	GC200 / USDA-1	1.38
23	Bare areas of soil type "Aridisols - Calcids"	GC200 / USDA-55	1.22
24	Bare areas of soil type "Aridisols - Cambids"	GC200 / USDA-56	0.52
25	Bare areas of soil type "Gelisols - Orthels"	GC200 / USDA-7	0.49
26	Water bodies (inland lakes, rivers, sea: max 10km away from coast)	GC210	6.05

(A)ATSR LST L2 Product User Guide

27	Permanent snow and ice	GC220 and ATSR land sea mask <60°S	30.81
28	No data (burnt areas, clouds, etc)	GC230	0.03

5.3 Example output

```
netcdf ATS_LST_2PUUOL20060718_102137_000065272049_00308_22907_6417 {
dimensions:
    time = 1 ;
    nj = 43520 ;
    ni = 512 ;
variables:
    int64 ref_time(time) ;
        ref_time:long_name = "reference_time" ;
        ref_time:standard_name = "time" ;
        ref_time:units = "seconds" ;
        ref_time:comment = "reference time in seconds at start of orbit since
1981-01-01 00:00:00" ;
    float lat(time, nj, ni) ;
        lat:long_name = "centre latitude" ;
        lat:standard_name = "latitude" ;
        lat:units = "degrees_north" ;
        lat:_FillValue = -32768.f ;
        lat:valid_min = -90.f ;
        lat:valid_max = 90.f ;
        lat:coordinates = "lon lat" ;
        lat:comment = "latitude coordinate of pixel centre" ;
    float lon(time, nj, ni) ;
        lon:long_name = "centre longitude" ;
        lon:standard_name = "longitude" ;
        lon:units = "degrees_east" ;
        lon:_FillValue = -32768.f ;
        lon:valid_min = -180.f ;
        lon:valid_max = 180.f ;
        lon:coordinates = "lon lat" ;
        lon:comment = "longitude coordinate of pixel centre" ;
    int dtype(time, nj, ni) ;
        dtype:long_name = "time difference from reference time" ;
        dtype:standard_name = "time" ;
        dtype:units = "milliseconds" ;
        dtype:_FillValue = -32768 ;
        dtype:valid_min = 0 ;
        dtype:valid_max = 6527850 ;
        dtype:coordinates = "lon lat" ;
```

(A)ATSR LST L2 Product User Guide

```
        dtype:comment = "reference time plus dtype gives milliseconds after
00:00:00 UTC January 1, 1981" ;
    short lcc(time, nj, ni) ;
        lcc:long_name = "land cover classification" ;
        lcc:units = "1" ;
        lcc:_FillValue = -32768s ;
        lcc:valid_min = 1s ;
        lcc:valid_max = 27s ;
        lcc:coordinates = "lon lat" ;
        lcc:comment = "land cover classification modified from the original
Globcover classification for use with the Advanced Along Track Scanning Radiometer
land surface temperature product" ;
        lcc:source = "Globcover: http://due.esrin.esa.int/globcover/" ;
        lcc:flag_meanings = "Post-flooding_or_irrigated_croplands,
Rainfed_croplands, Mosaic_Cropland/_Vegetation, Mosaic_Vegetation/_Cropland,
Closed_to_open_broadleaved_evergreen_and/or_semi-deciduous_forest,
Closed_broadleaved_deciduous_forest, Open_broadleaved_deciduous_forest,
Closed_needleleaved_evergreen_forest,
Open_needleleaved_deciduous_or_evergreen_forest,
Closed_to_open_mixed_broadleaved_and_needleleaved_forest,
Mosaic_Forest/Shrubland/_Grassland, Mosaic_Grassland/_Forest/Shrubland,
Closed_to_open_shrubland, Closed_to_open_grassland, Sparse_vegetation,
Closed_broadleaved_forest_regularly_flooded_-Fresh, Closed_broadleaved_semi-
deciduous_and/or_evergreen_forest_regularly_flooded_-Saline,
Closed_to_open_vegetation_on_regularly_flooded_or_waterlogged_soil,
Artificial_surfaces_and_associated_areas, Bare_soil_General,
Bare_soil_Entisols_\u2013_Orthents, Bare_soil_Shifting_sand, Bare_soil_Aridisols_-
_Calcids, Bare_soil_Aridisols_-Cambids, Bare_soil_Gelisols_-Orthels,
Water_bodies, Permanent_snow_and_ice" ;
        lcc:flag_values = 1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 11s, 12s,
13s, 14s, 15s, 16s, 17s, 18s, 19s, 20s, 21s, 22s, 23s, 24s, 25s, 26s, 27s ;
    short fv(time, nj, ni) ;
        fv:long_name = "fractional vegetation cover" ;
        fv:standard_name = "vegetation_area_fraction" ;
        fv:units = "1" ;
        fv:_FillValue = -32768s ;
        fv:add_offset = 0.f ;
        fv:scale_factor = 0.004f ;
        fv:valid_min = 0s ;
        fv:valid_max = 250s ;
        fv:coordinates = "lon lat" ;
        fv:comment = "fractional vegetation cover from the GEOLAND-2 FCOVER
dataset for use with the Advanced Along Track Scanning Radiometer land surface
temperature product. The original 10-day datafiles are gap-filled from climatology"
;
        fv:source = "GEOLAND-2 FCOVER dataset: http://www.geoland2.eu/" ;
    short tcwv(time, nj, ni) ;
```

(A)ATSR LST L2 Product User Guide

```
tcwv:long_name = "total column water vapour" ;
tcwv:standard_name = "atmosphere_mass_content_of_water_vapor" ;
tcwv:units = "kg m-2" ;
tcwv:_FillValue = -32768s ;
tcwv:add_offset = 0.f ;
tcwv:scale_factor = 0.004f ;
tcwv:valid_min = 0s ;
tcwv:valid_max = 2000s ;
tcwv:coordinates = "lon lat" ;
tcwv:comment = "total column water vapour from the European Centre for
Medium Weather Forecasting ERA-Interim dataset for use with the Advanced Along
Track Scanning Radiometer land surface temperature product" ;
tcwv:source = "ECMWF ERA-Interim dataset: http://www.ecmwf.int/" ;
short LST(time, nj, ni) ;
LST:long_name = "land surface temperature" ;
LST:standard_name = "surface_temperature" ;
LST:units = "K" ;
LST:_FillValue = -32768s ;
LST:add_offset = 273.15f ;
LST:scale_factor = 0.01f ;
LST:valid_min = -7315s ;
LST:valid_max = 6685s ;
LST:coordinates = "lon lat" ;
LST:comment = "Advanced Along Track Scanning Radiometer pixel land
surface temperature product" ;
short LST_uncertainty(time, nj, ni) ;
LST_uncertainty:long_name = "land surface temperature uncertainty" ;
LST_uncertainty:units = "K" ;
LST_uncertainty:_FillValue = -32768s ;
LST_uncertainty:add_offset = 0.f ;
LST_uncertainty:scale_factor = 0.001f ;
LST_uncertainty:valid_min = 0s ;
LST_uncertainty:valid_max = 10000s ;
LST_uncertainty:coordinates = "lon lat" ;
LST_uncertainty:comment = "Advanced Along Track Scanning Radiometer
land surface temperature pixel uncertainty" ;
short NDVI(time, nj, ni) ;
NDVI:long_name = "normalised difference vegetation index" ;
NDVI:standard_name = "normalized_difference_vegetation_index" ;
NDVI:units = "1" ;
NDVI:_FillValue = -32768s ;
NDVI:add_offset = 0.f ;
NDVI:scale_factor = 0.004f ;
NDVI:valid_min = 0s ;
NDVI:valid_max = 250s ;
NDVI:coordinates = "lon lat" ;
```

(A)ATSR LST L2 Product User Guide

```
        NDVI:comment = "normalised difference vegetation index derived from
the Advanced Along Track Scanning Radiometer" ;
    short QC(time, nj, ni) ;
        QC:long_name = "quality control flags" ;
        QC:units = "1" ;
        QC:_FillValue = -32768s ;
        QC:valid_min = 0 ;
        QC:valid_max = 63 ;
        QC:coordinates = "lon lat" ;
        QC:comment = "quality control flags corresponding to the Advanced
Along Track Scanning Radiometer land surface temperature product" ;
        QC:flag_meanings = "night land_including_inland_coastal_water
cloudy_V1_mask cloudy_V2_mask cloudy_V3_mask snow" ;
        QC:flag_masks = 1s, 2s, 4s, 8s, 16s, 32s ;

// global attributes:
    :Conventions = "CF-1.4" ;
    :title = "Land Surface Temperature from Advanced Along Track Scanning
Radiometer" ;
    :summary = "This file contains land surface temperature (LST) data
estimated from Advanced Along Track Scanning Radiometer (AATSR) observations. By
using these data, you agree to cite the papers given in the references metadata
field in any publications derived from them" ;
    :references = "Ghent D., Land Surface Temperature Validation and
Algorithm Verification (Report to European Space Agency). 2012(UL-NILU-ESA-LST-
VAV)" ;
    :institution = "University of Leicester" ;
    :history = "Created using software developed at University of
Leicester" ;
    :comment = "These data were produced at the UK CEMS facility using
software developed at The University of Leicester" ;
    :license = "Data use is free and open" ;
    :date_created = "30-10-2013 16:08:25+0000" ;
    :product_version = "1.0" ;
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    :time_coverage_end = "2012-04-08 10:58:27Z" ;
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    :easternmost_longitude = 180.f ;
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    :source = "ATS_TOA_1P" ;
    :platform = "Envisat" ;
    :sensor = "AATSR" ;
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(A)ATSR LST L2 Product User Guide

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        :acknowledgment = "Development of the data was funded by ESA and NCEO"  
;  
        :creator_name = "Darren Ghent" ;  
        :creator_email = "djg20@le.ac.uk" ;  
        :creator_url = "http://lst.nilu.no/" ;  
}
```