EUMETSAT Satellite Application Facility on Climate Monitoring

Upper Tropospheric Humidity (UTH)

Edition 1.0

Product User Manual

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AD 1	CM SAF Product Requirements Document	SAF/CM/DWD/PRD/2.10

Reference Documents

Reference	Title	Code
RD 1	CM SAF Upper Tropospheric Humidity (UTH) Edition 1.0 Validation Report	SAF/CM/UKMO/VAL/UTH/1.2
RD 2	Algorithm Theoretical Basis Document CM SAF Upper Tropospheric Humidity TCDR Edition 1.0	SAF/CM/UKMO/ATBD/UTH/1.1

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RD 3	ERACLIM2-D3.11 - Microwave Humidity Sounder Radiance Data Record, v1B Draft, 10 August 2017 (available from www.era-clim2.eu/products under D3.11)	EUM/OPS/TEM/17/926984

Table of Contents

List of Tables

List of Figures

1 The EUMETSAT SAF on Climate Monitoring (CM SAF)

The importance of climate monitoring with satellites was recognized in 2000 by EUMETSAT Member States when they amended the EUMETSAT Convention to affirm that the EUMETSAT mandate is also to “contribute to the operational monitoring of the climate and the detection of global climatic changes". Following this, EUMETSAT established within its Satellite Application Facility (SAF) network a dedicated centre, the SAF on Climate Monitoring (CM SAF, http://www.cmsaf.eu).

The consortium of the CM SAF currently comprises the Deutscher Wetterdienst (DWD) as host institute, and the partners from the Royal Meteorological Institute of Belgium (RMIB), the Finnish Meteorological Institute (FMI), the Royal Meteorological Institute of the Netherlands (KNMI), the Swedish Meteorological and Hydrological Institute (SMHI), the Meteorological Service of Switzerland (MeteoSwiss), and the Meteorological Office of the United Kingdom (UK Met Office). Since the beginning in 1999, the EUMETSAT Satellite Application Facility on Climate Monitoring (CM SAF) has developed and will continue to develop capabilities for a sustained generation and provision of Climate Data Records (CDR’s) derived from operational meteorological satellites.

In particular, the generation of long-term data records is pursued. The ultimate aim is to make the resulting data records suitable for the analysis of climate variability and potentially the detection of climate trends. The CM SAF works in close collaboration with the EUMETSAT Central Facility and liaises with other satellite operators to advance the availability, quality and usability of Fundamental Climate Data Records (FCDRs) as defined by the Global Climate Observing System (GCOS). As a major task, the CM-SAF utilizes FCDRs to produce records of Essential Climate Variables (ECVs) as defined by GCOS. Thematically, the focus of the CM SAF is on ECVs associated with the global energy and water cycle.

Another essential task of the CM SAF is to produce data records that can serve applications related to the new Global Framework of Climate Services initiated by the World Meteorological Organisation (WMO) World Climate Conference-3 in 2009. The CM SAF is supporting climate services at national meteorological and hydrological services (NMHSs) with long-term data records, but also with data records produced close to real time that can be used to prepare monthly/annual updates of the state of the climate. Both types of products together allow for a consistent description of mean values, anomalies, variability and potential trends for the chosen ECVs. The CM SAF ECV data records also serve the improvement of climate models both at global and regional scales.

As an essential partner in the related international frameworks, in particular WMO SCOPE-CM (Sustained COordinated Processing of Environmental satellite data for Climate Monitoring), the CM SAF - together with the EUMETSAT Central Facility, assumes the role as main implementer of EUMETSAT’s commitments in support to global climate monitoring. This is achieved through:

- Application of the highest standards and guidelines as outlined by GCOS for satellite data processing,

- Processing of satellite data within a true international collaboration benefiting from developments at international level and pollinating the partnership with its own ideas and standards,

- Intensive validation and improvement of the CM SAF climate data records,

- Taking a major role in data record assessments performed by research organisations such as the World Climate Research Programme (WCRP). This role provides the CM SAF with strong contacts to research organizations that form a substantial user group for the CM SAF CDRs,

- Maintaining and providing an operational and sustained infrastructure that can serve the community within the transition of mature CDR products from the research community into operational environments.

A catalogue of all available CM SAF products is accessible via the CM SAF webpage, www.cmsaf.eu/. Here, detailed information about product ordering, add-on tools, sample programs and documentation is provided

2 Introduction

This CM SAF Product User Manual (PUM) provides information on the CM SAF Upper Tropospheric Humidity (UTH) Thematic CDR (TCDR) derived from microwave humidity sounder observations. A technical description of the data record including information on the file format as well as on the data access is provided. Further details on the implementation of the retrieval processing chain, and individual algorithm descriptions are available in the Algorithm Theoretical Basis Document [RD 2]. Basic accuracy requirements are defined in the Product Requirements Document [AD 1] where it defined as 5/10/15% as Optimal/Target/Threshold values. A detailed validation of the daily UTH product is available in the Validation Report [RD 1]. The accuracy of the UTH data record is better than 5% and thus meets optimal requirement.

3 Product Description

The CM SAF UTH CDR derived from satellite microwave humidity sounder observations provides near-global coverage. The instantaneous satellite observations are used to derive a spatio-temporal averaged data record. The data are available as twice daily (one for the ascending and the other for the descending passes) averages on a regular latitude/longitude grid with a spatial resolution of 1° × 1° degrees. Additionally, the daily mean UTH is provided, which is a weighted average of ascending and descending orbits for all the grid points with valid ascending and descending observations, through the equation:

Equation 3-1

$$UTH_{daily} = \frac{N_{asc} * UTH_{asc} + N_{desc} * UTH_{desc}}{N_{asc} + N_{desc}}$$

where N stands for the number of UTH retrievals either ascending (asc) or descending (desc). The temporal coverage of the data record ranges from January 1999 to December 2015.

The accuracy of the daily UTH CDR was determined by validating the global product against the equivalent UTH derived from the ERA-Interim reanalysis. It should be noted that ERA-Interim does not constitute an absolute reference for UTH as it is subject to its own uncertainties. However, given the significant quality issues for the majority of radiosondes regarding the observation of UTH, ERA-Interim is considered the best validation dataset that is currently available. Also, ERA-Interim assimilates observations from AMSU-B and MHS among other humidity observations (including radiosondes), which means that it is not totally independent from the CM SAF UTH TCDR. For more information on the validation strategy and more detailed accuracy information, the reader is referred to the corresponding validation report [RD 1]. The product has been developed and evaluated with respect to requirement goals defined in the Product Requirements Document (PRD) [AD 1]. Table 3-1 presents a summary of the accuracy of the UTH data record following the three levels of PRD [AD 1]: threshold (less than 15%), target (less than 10%) and optimal (less than 5%). Threshold accuracy is anticipated to be useful for operational monitoring and infrastructure planning, target accuracy for global and regional climate modeling, while optimal accuracy for global and regional climate studies [AD 1]. The achieved product accuracy is described in the validation report [RD 1]

Table 3-1: Summary of the accuracy of the CM SAF UTH data record. The data record accuracy has been assessed by comparing the CM-SAF UTH global, 1x1 degree, daily mean fields with the equivalent UTH derived from ERA-Interim.

Data record	Threshold/Target/Optimal Accuracies (%)	Data record Accuracy (%)
UTH	15/10/5	<5

Table 3-2: Summary of the data used: instrument, satellite platform, the temporal coverage, and the local equator crossing time (LECT) of the ascending node at the time of launch.

Instrument	Satellite	Period	LECT ascending
AMSU-B	NOAA-15	01/1999-12/2002	7:30 pm
AMSU-B	NOAA-16	01/2001-12/2006	2:00 pm
AMSU-B	NOAA-17	01/2003-12/2008	10:00 pm
MHS	NOAA-18	01/2006-12/2015	2:00 pm
MHS	MetOp-A	01/2007-12/2015	9:30 pm
MHS	MetOp-B	01/2013-12/2015	9:30 pm

3.1 UTH Retrievals

Here a brief overview of the retrieval method used to generate the CM SAF UTH product is given. More detailed information can be found in the ATBD [RD 2]. Inter-satellite calibration of the instruments provided in

Table 3-2 was done using the observation minus background (O-B) statistics from the ERA-Interim and taking NOAA-18 MHS as the reference due to the longest data availability. The approach is described in the ERA-Clim2 D3.11 documentation [RD 3].

The retrieval of the UTH is based on the method presented in Buehler and John (2005). The method assumes that there is a simple linear relationship between radiances emanating from water vapour emissions in the upper troposphere (expressed as brightness temperature, T_B) and the natural logarithm of UTH, which is the Jacobian-weighted relative humidity in th upper troposphere:

Equation 3-2

$$ln(UTH) = a + b * T_B$$

where a and b are constants with values 23.467520 and -0.099240916 K^{-1} respectively, and T_B is the brightness temperature measured from the channel 183.31±1 GHz close to nadir. The coefficients *a* and *b* are determined by linear regression, using a training data record of atmospheric temperature and humidity profiles. To get valid coefficients, the data record should capture the global atmospheric variability as best as possible. The diverse atmospheric profile dataset developed by Chevallier et al. (2006) is used to derive the coefficients. The line-by-line radiative transfer model ARTS (Buehler et al., 2005) was used to simulate radiances and Jacobians.

The influence of clouds on the propagation of electromagnetic waves is generally insignificant in the microwave spectrum, implying that radiance measurements of the 183-GHz water vapour absorption band are less prone to clear-sky sampling bias (e.g. John et al., 2011). However, scattering by large hydro-meteors in deep convective clouds or precipitating clouds can scatter the radiation reaching the satellite sensors. Buehler et al. (2007) suggested an efficient method to detect cloud-contaminated 183.31±1 GHz channel measurements and this is used to remove cloud contaminated measurements before producing the CM SAF UTH data record. The vertical distribution of weighting functions indicates that the 183.31±1 GHz channel is sensitive to higher levels in the troposphere than the 183.31±7 GHz (190.31 GHz for MHS) channel (e.g. Buehler and John, 2005). Because the atmospheric temperature generally decreases with height in the free troposphere, this means that brightness temperatures of the 183.31±1 GHz channel should be colder than those of the 183.31±7 GHz (190.31 GHz for MHS) channel under clear-sky conditions. However, such a relationship could be reversed in the presence of convective or precipitating clouds because of the scattering effects of ice particles or rain drops (Buehler et al., 2007; John et al., 2011). Therefore, the negative brightness temperature difference [i.e., 183.31±7 GHz − 183.31±1 GHz < 0] can be indicative of contamination by large ice particles or rain drops.

In addition to the cloud filtering procedure described above, the limb darkening effect needs to be corrected in order to make a temporally and spatially averaged data record from measurements with different satellite viewing angles. A method suggested by Chung et al. (2013) is used here to limb-correct the 183.31±1 GHz channel measurements prior to the retrieval of UTH. An analytical relation can be employed to convert off-nadir brightness temperature ($\mathrm{T_B}(\theta)$) into the nadir equivalent as follows (Chung et al., 2013):

Equation 3-3

$$T_B^{Nadir} = T_B(\theta) + \frac{log(cos\,\theta)}{c}$$

To determine c for the limb correction, brightness temperatures are simulated for a multitude of viewing angles (and thus satellite zenith angles) as well as the nadir case with atmospheric profiles of the 60-level sampled European Centre for Medium-Range Weather Forecasts (ECMWF) dataset (Chevallier, 2001) as input to a radiative transfer model (Buehler et al., 2005).

More details on the retrieval and the specific limitations are given in the ATBD [RD 2]. The overall accuracy of the UTH data record has been estimated to be better than 5 % for the

daily averages. Further information on the accuracy of the product can be found in the validation report [RD 1].

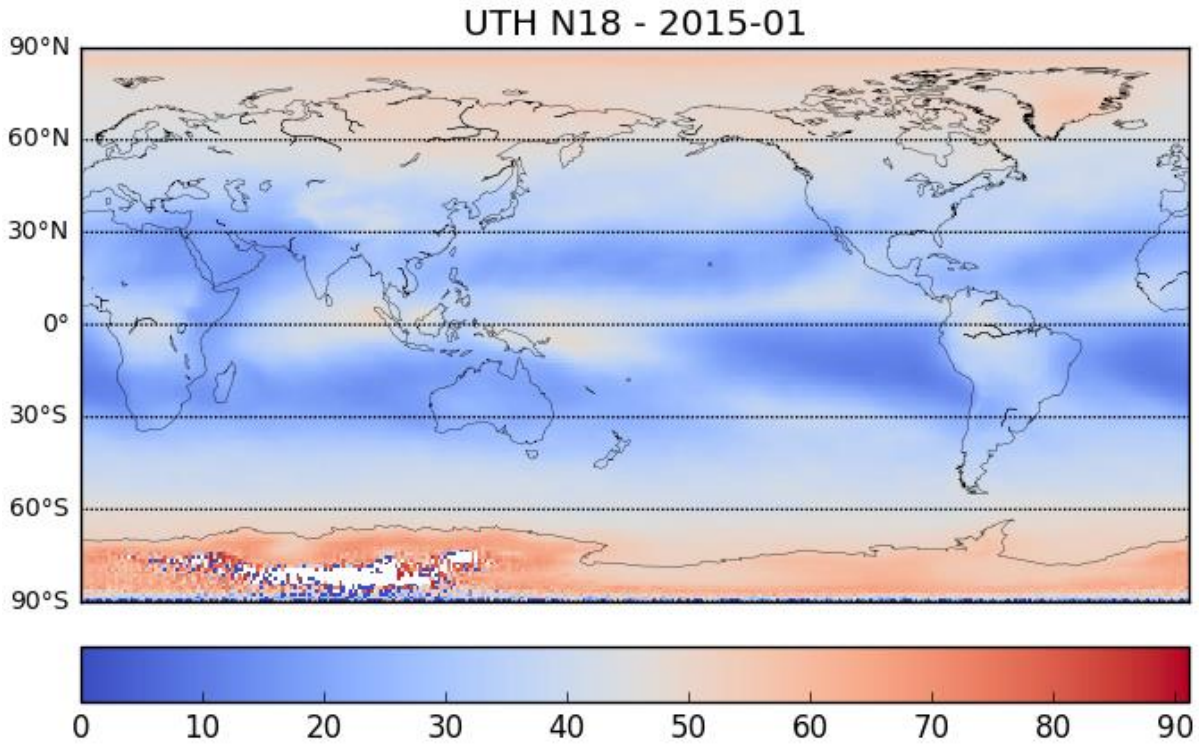

Figure 3-1: Yearly average UTH computed using NOAA-18 measurements in 2015. Data towards the Poles (outside the region 60°S-60°N) should be treated with caution as the channel 183.31±1 GHz is sensitive to the lower parts of the atmosphere (i.e. it does not sense the upper atmosphere anymore). The white area over Antarctic indicates the absence of valid retrievals year round due to surface contamination. The noisy pixels around it reflect also the very limited number of retrievals for the whole year and as such they are not representative of the annual mean

Figure 3-1 presents an illustrative example of the CM SAF UTH data record, showing an annual average map of the UTH (in %) using measurements of NOAA-18 in 2015. The distributions obtained for UTH are determined by the general circulation. The regions of subsidence are marked by low UTH, because sinking air warms adiabatically, and relative humidity decreases accordingly. In contrast to this subsidence drying, regions of ascent are marked by high UTH. The high UTH values in the polar regions are misleading, and do not truly represent a very humid upper troposphere, as the satellite-observed signal is dominated by the lower troposphere.

3.2 General limitations and recommendations

Here, general limitations of the application of the CM SAF UTH data record are presented. More specific limitations and shortcomings for each data record can be found in the ATBD [RD 2].

The UTH retrieval method described here is a mere transformation of radiance, expressed in brightness temperature, measured by the 183.31±1.00 GHz channel to a more intuitive humidity unit. The relative humidity Jacobian, which is used to define the UTH, moves vertically depending on the water vapour load in the atmosphere. It is generally assumed that the Jacobian covers a broad atmospheric layer between 500 and 200 hPa. However, in a drier atmosphere the Jacobian will have significant contributions from altitudes below the 500 hPa level and in a wetter atmosphere there can be contributions from altitudes above the 200 hPa level. In other words, UTH is not an averaged relative humidity in a fixed vertical layer of the troposphere. Therefore, it is not easy to compare this data record with other products, particularly water vapour profiles from radiosondes or model outputs. In order to obtain a like-to-like comparison, potential users need to conduct radiative transfer simulations (for example, using RTTOV (Radiative Transfer for TOVS; Saunders et al., 1999) or other radiative transfer models) using temperature and water vapour profiles from other sources to obtain corresponding brightness temperatures, before transforming to UTH retrieval using Equation 3-2.

The linear relationship between the natural logarithm of UTH and the 183.31±1.00 GHz measurements is derived based on the assumption that the lapse rate and RH are uniform in the upper troposphere. Of course, the RH in real profiles is far from uniform with height and this is reflected in the scatter between UTH and brightness temperature. However, there is no physical basis for RH to become more non-uniform in a warming climate. One potential issue is a changing lapse rate due to amplification of the surface temperature trend in the tropical upper troposphere. On a multi-decadal time-scale this could be misinterpreted as systematic humidity changes in the upper troposphere.

The UTH retrieval is generally not valid outside ±60° latitudes because of the very low water vapour loading here in the upper troposphere. However, there will be some valid UTH retrievals outside of these regions. A global data record is provided with the appropriate masking to enable maximum exploitation of the data. Users can make informed decisions on the representativeness of the grid-point averages using the number of used and discarded measurements which are also provided in the data record.

Depending on the application, users may wish to consider rejecting the first nine months of the CM SAF UTH product for NOAA-15 AMSU-B (January to September 1999) as these data are affected by radiofrequency interference. These data exhibit higher variance and a step change in zonal mean UTH of ~2.5 % with respect to the reference ERA-Interim UTH (RD 1).

4 Outlook

Future tasks will involve potential improvement of the retrieval algorithm, for example, when an updated atmospheric profile dataset is available, further evaluation of the data record, and improved aggregation of the data.

Further evaluations of the data record will include the comparison of the data record with other available gridded datasets (e.g., HIRS), but also from reanalysis projects (e.g., ERA-5, MERRA, JRA). These evaluations will also be extended to provide information on the long-term stability of the data record.

The data record can be used for answering scientific questions such as how long it takes to detect a significant change in specific humidity (based upon the difference between UTH and the theoretical UTH for fixed specific humidity and changing temperature) for an assumed temperature trend. Boers and Meijgaard (2009) analyzed this using climate model simulations. One has to rely on model simulations here due to non-availability of sufficient quality/stable observations. Even with “perfect” specific humidity measurements it needs 30 years of continuous data for detecting trends in upper tropospheric specific humidity. If stable temperature measurements are available, for example, from MSU/AMSU-A it will be possible to detect specific humidity trends using our data when 30 or more years of data are available. The dataset could be used also for process studies or determination of feedbacks.

5 Data format description

The CM SAF's climate monitoring UTH products are provided as NetCDF (Network Common Data Format) files (http://www.unidata.ucar.edu/software/netcdf/). The data files are created following NetCDF Climate and Forecast (CF) Metadata Convention version 1.6 (http://cfconventions.org/cf-conventions/v1.6.0/cf-conventions.html) and NetCDF Attribute Convention for Dataset Discovery version 1.3

(http://wiki.esipfed.org/index.php/Attribute_Convention_for_Data_Discovery_1-3).

For data processing and conversion to various graphical packages input format, the CM SAF recommends the usage of the climate data operators (CDO), available under GNU Public License (GPL) from MPI-M (http://www.mpimet.mpg.de/~cdo).

5.1 Data file contents

A common NetCDF file consists of dimensions, variables, and attributes. These components can be used together to capture the meaning of data and relations among data. CM SAF UTH product files are built following the same design principles.

Each data file contains the following coordinate variables:

time

days since 1970-01-01 00:00:00

latitude

geographical latitude of grid-box centre [degree_north]

longitude

geographical longitude of grid-box centre [degree_east]

Each data file contains a subset of the following 3-dimensional (time-lat-lon) variables:

Variable	Description	Unit
uth_mean_ascend	Mean of all UTH retrievals in a grid box for ascending passes	%
uth_std_ascend	Standard deviation of all UTH retrievals in a grid box for ascending passes	%
uth_median_ascend	Median of all UTH retrievals in a grid box for	%

	ascending passes	
n_obs_valid_uth_ascend	Number of valid UTH observations in a grid box for ascending passes	1
uth_mean_descend	Mean of all UTH retrievals in a grid box for descending passes	%
uth_std_descend	Standard deviation of all UTH retrievals in a grid box for descending passes	%
uth_median_descend	Median of all UTH retrievals in a grid box for descending passes	%
n_obs_valid_uth_descend	Number of valid UTH observations in a grid box for descending passes	1
uth_mean_ascend_descend	Mean of all UTH retrievals in a grid box for ascending and descending passes	%
uth_std_ascend_descend	Standard deviation of all UTH retrievals in a grid box for ascending and descending passes	%
uth_median_ascend_descend	Median of all UTH retrievals in a grid box for ascending and descending passes	%
n_obs_valid_ascend_descend	Number of valid UTH observations in a grid box for ascending and descending passes	1
tb18_mean_ascend	Mean of all brightness temperatures which were used to retrieve UTH in a grid box for ascending passes	K
tb18_std_ascend	Standard deviation of all brightness temperatures which were used to retrieve UTH in a grid box for ascending passes	K
tb18_mean_descend	Mean of all brightness temperatures which were used to retrieve UTH in a grid box for descending passes	K
tb18_std_descend	Standard deviation of all brightness temperatures which were used to retrieve UTH in a grid box for descending passes	K
n_obs_all_ascend	Number of all observations in a grid box for ascending passes – without filtering for clouds or	1

	surface contamination	
n_obs_all_descend	Number of all observations in a grid box for descending passes – without filtering for clouds or surface contamination	1
n_obs_all_ascend_descend	Number all observations in a grid box for ascending and descending passes – without filtering for clouds or surface contamination	1

Global attributes are summarized in Table 5-1 and existing variable attributes in Table 5-2.

Table 5-1: Global NetCDF attributes.

Name	Description
title	A short phrase describing the dataset i.e. “Upper Tropospheric Humidity (UTH) based on microwave sounders observations developed by Met Office Hadley Centre, UK on behalf of EUMETSAT Climate Monitoring Satellite Applications Facility (CM SAF).”.
summary	A paragraph describing the dataset i.e. “The upper tropospheric humidity (UTH) channel is the one located at 183.31+/-1.00 GHz of AMSU-B and MHS instruments. The current data record extends from 1999 to 2015 and it is available to the community for climate studies. The main advantage of microwave based UTH in comparison to retrievals from infrared instruments is that the impact of clouds is significantly lower, which is turn offers better coverage of the Earth.”.
id	An identifier for the data set, provided by and unique within its naming authority (e.g. DOI) i.e. “DOI:10.5676/EUM_SAF_CM/UTH/V001”.
product_version	Version identifier of the product as assigned by the data creator i.e. “1.0”.
creator_name	The name of the organisation principally responsible for creating this data i.e. “UK/MOD/MET/HADLEY”.

creator_email	The email address of the organisation principally responsible for creating this data i.e. contact.cmsaf@dwd.de.
creator_url	The URL of the organisation principally responsible for creating this data i.e. www.cmsaf.eu.
institution	The name of the institution principally responsible for originating this data i.e. “EUMETSAT/CMSAF”.
project	The name of the project principally responsible for originating this data i.e. “Satellite Application Facility on Climate Monitoring (CM SAF)”.
references	Published or web-based references that describe the data or methods used to produce it, i.e. http://dx.doi.org/10.5676/EUM_SAF_CM/UTH/V001.
Conventions	A comma-separated list of the conventions that are followed by the dataset i.e. “CF-1.6, ACDD-1.3”.
keywords_vocabulary	A controlled vocabulary for the words/phrases in the "keywords" attribute, this is the unique name or identifier of the vocabulary from which keywords are taken i.e. "GCMD Science Keywords, Version 8.1".
keywords	A list of key words i.e. " EARTH SCIENCE > ATMOSPHERE > ATMOSPHERIC WATER VAPOR".
standard_name_vocabulary	The name and version of the controlled vocabulary from which variable standard names are taken i.e. "Standard Name Table (v28, 07 January 2015)".
geospatial_lat_units	Units for the latitude axis described in "geospatial_lat_min" and "geospatial_lat_max" attributes i.e. "degree_north".
geospatial_lat_min	Describes a simple lower latitude limit. Geospatial_lat_min specifies the southernmost latitude covered by the dataset i.e. “-89.5f”.
geospatial_lat_max	Describes a simple upper latitude limit. Geospatial_lat_max specifies the northernmost latitude covered by the dataset i.e. “89.5f”.
geospatial_lon_units	Units for the longitude axis described in "geospatial_lon_min" and "geospatial_lon_max" attributes i.e. "degree_east".

geospatial_lon_min	Describes a simple longitude limit. Geospatial_lon_min specifies the westernmost longitude covered by the dataset i.e. “0.5f”.
geospatial_lon_max	Describes a simple longitude limit. geospatial_lon_max specifies the easternmost longitude covered by the dataset i.e. “359.5f”.
geospatial_lat_resolution	Information about the targeted spacing of points in latitude i.e. "1.0 degree".
geospatial_lon_resolution	Information about the targeted spacing of points in longitude i.e. “1.0 degree”.
time_coverage_resolution	Describes the targeted time period between each value in the data set using the ISO 8601:2004 duration format i.e. "P1D".
platform	Name of the platform that supported the sensor data used to create this data set i.e. "NOAA-16 > National Oceanic & Atmospheric Administration-16".
platform_vocabulary	Controlled vocabulary for the names used in the "platform" attribute i.e. "GCMD Platforms, Version 8.5”.
instrument	Name of the contributing sensor used to create this data set i.e. "AMSU-B > Advanced Microwave Sounding Unit-B".
instrument_vocabulary	Controlled vocabulary for the names used in the "instrument" attribute i.e. "GCMD Instruments, Version 8.5".
history	Provides an audit trail for modifications to the original data.
date_created	The date on which this version of the data was created.

Table 5-2: Attributes assigned to variables. It is useful to note that only the coordinate variables have the attribute standard_name.

Name	Description
long_name	A descriptive name that indicates a variable’s content. This name is not standardized.
standard_name	A standard name that references a description of a variable’s content in the standard name table.

units	Units of a variable's content.
valid_range	Smallest and largest valid values of a variable.
_FillValue	A value used to represent missing or undefined data. Not allowed for coordinate data except in the case of auxiliary coordinate variables in discrete sampling geometries.

6 Data ordering via the Web User Interface (WUI)

The internet address http://wui.cmsaf.eu allows direct access to the CM SAF data ordering interface. On this webpage a detailed description of how to use it for product search and ordering is given. The user is referred to this description since it is the central and most up to date documentation. However, some of the key features and services are briefly described in the following sections.

Further user service including information and documentation about the CM SAF and the CM SAF products are available from the CM SAF home page (http://www.cmsaf.eu).

6.1 Product ordering process

You need to be registered and logged in to order products. A login is provided upon registration; all products are delivered free of charge (Please not the copyright disclaimer given in section 8.1). After the selection of the product, the desired way of data transfer can be chosen. This is either via a temporary ftp account (the default setting), by CD/DVD, or email. Each order will be confirmed via email, and the user will get another email once the data have been prepared. If the ftp data transfer was selected, this second email will provide the information on how to access the ftp server.

6.2 Contact User Help Desk staff

In case of questions the contact information of the User Help Desk (e-mail address contact.cmsaf@dwd.de) are available via the CM SAF home webpage (www.cmsaf.eu) or the home page of the Web User Interface (http://wui.cmsaf.eu).

6.3 User Problem Report

Users of CM SAF products and services are encouraged to provide feedback on the CM SAF product and services to the CM SAF team. Users can either contact the User Help Desk (see section 6.2) or use the “User Problem Report” page. A link to the “User Problem Report” is available either from the CM SAF home page (www.cmsaf.eu) or the Web User Interface home page (http://wui.cmsaf.eu).

6.4 Service Messages / log of changes

Service messages and a log of changes are also accessible from the CM SAF home webpage (http://www.cmsaf.eu) and provide useful information on product status, versioning and known deficiencies.

7 Feedback

7.1 User feedback

Users of the CM SAF products and services are encouraged to provide feedback on the CM SAF product and services to the CM SAF team. CM SAF is keen to learn of what use the CM SAF data are. So please feedback your experiences as well as your application area of the CM SAF data.

The EUMETSAT CM SAF is an user-driven service and is committed to consider the needs and requirements of its users in the planning for product improvements and additions. Please provide your feedback e.g. to our User Help Desk (e-mail address contact.cmsaf@dwd.de).

7.2 Specific requirements for future products

Beside your general feedback you are cordially invited to provide your specific requirements on future products for your applications. Please provide your requirements e.g. to our staff or via our User Help Desk (e-mail address contact.cmsaf@dwd.de).

7.3 User Workshops

The CM SAF organises training workshops on regular basis in order to facilitate the use of our data. Furthermore, through our regular (approximately every four years) user's workshop our product baseline is revisited. Your participation in any of these workshops is highly appreciated. Please have a look at on the CM SAF home web page (www.cmsaf.eu) to get the latest news on upcoming events.

8 Copyright and Disclaimer

The user of CM SAF data agrees to respect the following regulations:

8.1 Copyright

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8.2 Acknowledgement and Identification

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