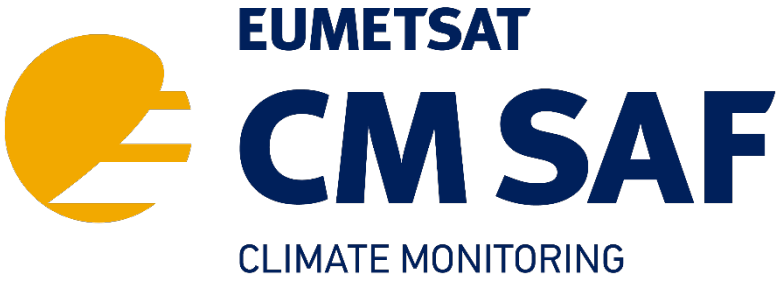
EUMETSAT Satellite Application Facility on Climate Monitoring



Product User Manual

CM SAF Cloud, Albedo, Radiation data record, AVHRR-based, Edition 3 (CLARA-A3)

Surface Radiation

DOI: 10.5676/EUM_SAF_CM/CLARA_AVHRR/V003

	TCDR	ICDR
Surface Incoming Shortwave Radiation	**CM-11202**	**CM-6211**
Surface Downward Longwave Radiation	**CM-11262**	**CM-6261**
Surface Radiation Budget	**CM-11272**	**CM-6271**
Surface Net Shortwave Radiation	**CM-11281**	**CM-6281**
Surface Net Longwave Radiation	**CM-11291**	**CM-6291**

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Applicable documents

Reference	Title	Code
AD 1	CM SAF Product Requirements Document	SAF/CM/DWD/PRD/4.0

Reference Documents

Reference	Title	Code
RD 1	Validation Report CM SAF Cloud, Albedo, Radiation dataset, AVHRR-based, Edition 3 (CLARA-A3) Surface Radiation Products	SAF/CM/DWD/VAL/GAC/RAD/3.1
RD 2	Algorithm Theoretical Basis Document CM SAF Cloud, Albedo, Radiation dataset, AVHRR-based, Edition 3 (CLARA-A3) Surface Radiation Products	SAF/CM/DWD/ATBD/GAC/RAD/3.3

Reference	Title	Code
RD 3	Validation Report CM SAF Cloud, Albedo, Radiation dataset, AVHRR-based, Edition 3 (CLARA-A3) Top-of-Atmosphere Radiation	SAF/CM/RMIB/VAL/GAC/TOA/1.1

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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 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 Service of the United Kingdom (UK MetOffice). 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 sets is pursued. The ultimate aim is to make the resulting data sets suitable for the analysis of climate variability and potentially the detection of climate trends. 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 CM SAF is on ECVs associated with the global energy and water cycle.

Another essential task of CM SAF is to produce data sets that can serve applications related to the new Global Framework of Climate Services initiated by the WMO World Climate Conference-3 in 2009. CM SAF is supporting climate services at national meteorological and hydrological services (NMHSs) with long-term data records but also with data sets 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. CM SAF ECV data sets also serve the improvement of climate models both at global and regional scale.

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 highest standards and guidelines as lined out by GCOS for the satellite data processing,

- Processing of satellite data within a true international collaboration benefiting from developments at international level and pollinating the partnership with own ideas and standards,
- Intensive validation and improvement of the CM SAF climate data records,
- Taking a major role in data set assessments performed by research organisations such as WCRP. This role provides the CM SAF with deep 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.

1 Introduction

This CM SAF Product User Manual provides information on the CM SAF CLARA surface radiation data sets derived from AVHRR observations.

This manual briefly describes the historical development of CM SAF and the AVHRR CLARA surface radiation data sets. A technical description of the data sets 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]. A detailed validation of the AVHRR CLARA-based surface radiation parameters is available in the Validation Report [RD 1].

2 Product definitions

The CM SAF CLARA surface radiation data record based on AVHRR satellite observations provides global coverage. The instantaneous AVHRR observations are used to derive the spatio-temporal averaged data sets. The final products are available as monthly averages on a regular latitude/longitude grid with a spatial resolution of 0.25° × 0.25° degrees. For the surface solar irradiance (SIS: surface incoming solar radiation) also daily averages are available. The temporal coverage of the climate data record ranges from 1 January 1979 to 31 December 2020; these data are temporally extended by the CLARA-A3 Interim Climate Data Record (ICDR).

The products covered by this document are:

- Surface Incoming Shortwave Radiation (SIS)
- Surface Downward Longwave Radiation (SDL)
- Surface Net Shortwave Radiation (SNS)
- Surface Net Longwave Radiation (SNL)
- Surface Radiation Budget (SRB)

Table 2-1 presents a summary of the accuracy of the different products contained in the CM SAF CLARA-A3 surface radiation data set. For more information on the validation strategy and more detailed accuracy information, the reader is referred to the corresponding validation report [RD 2].

All products have been developed and evaluated with respect to requirement goals defined in the PRD [AD 1]. The finally achieved product accuracies are described in the validation report [RD 1]. Of specific interest here are requirements as outlined by the Global Climate Observing System (GCOS) community and issued by the United Nations World Meteorological Organisation (WMO) in December 2011. All products in the GAC surface radiation dataset fulfil GCOS requirements regarding the horizontal resolution (100 km). The GCOS accuracy requirements are fulfilled for the surface radiation products (detailed results to be described further below).

Table 2-1: Summary of the accuracy of the CM SAF CLARA surface radiation data sets based on the mean absolute difference to surface reference measurements.

Data Set	Threshold / Target / Optimal Accuracies in W/m²	Dataset Accuracy in W/m²
SIS	9 / 5 / 3 18 / 15 / 10 (daily averages)	7 17
SDL	8 / 5 / 3	7
SNS	8 / 5 / 3	10
SNL	8 / 5 / 3	7
SRB	8 / 5 / 3	10

2.1 Parameter Retrievals

Here a brief overview of the retrieval methods used to generate the CM SAF CLARA surface radiation data sets is given. More detailed information can be found in the ATBD [RD 2].

Surface incoming shortwave radiation

The retrieval of the surface incoming solar radiation is based on the method presented in Mueller et al., (2009). The vertically integrated water vapour and ozone, and the surface albedo is taken from from the ERA-5 data set (Hersbach *et al.,* 2020). The GADS/OPAC data base (Hess et al., 1998) is used for the aerosol information for the satellite retrieval. For the calculation of daily clear-sky surface irradiance (used to derive daily all-sky surface irradiance from the satellite retrieval) monthly climatological aerosol information of the natural and anthropogenic aerosol loading are used based on Fiedler et al., (2019a, b). The decadal variability of the aerosol loading in the data sets had a small, but degrading, effect on the decadal trend in surface irradiance when compared with surface reference measurements. On the other hand, the use of climatological aerosol information does reduce a potential trend in the resulting CLARA-A3 SIS.

The probabilistic cloud detection provided by the Nowcasting SAF software (PPSv2021) is used to distinguish between cloudy- and clear-sky pixels. A probability threshold of detection of 50 % is used for cloud detection; over bright, snow-covered surfaces, the threshold is set to 90 %.

For clear-sky pixels, no additional satellite information is required to calculate the surface incoming solar radiation using the Mesoscale Atmospheric Global Irradiance Code (MAGIC, http://gnu-magic.sourceforge.net/). For cloudy pixels, look-up tables are used to assign the atmospheric transmissivity to the measured albedo at the top-of-the-atmosphere. The transmissivity can be directly converted to the surface incoming solar radiation. The temporal averaging of the instantaneous retrieval results on the pixel level is conducted following the method of Möser and Raschke (1984), which takes into account the diurnal cycle of the solar radiation and is derived on a global 0.05° grid, closely following the spatial resolution of the satellite data. For the estimation of the daily average in each 0.25° grid box, at least 20 instantaneous observations (on the 0.05° grid) need to be available. Note that during certain periods in the data record, in particular when only a single satellite was available, the daily averages can be derived from only one satellite overpass; under these conditions the diurnal cycle of cloud coverage is not considered.. Monthly averages are only generated when at least 20 valid daily mean values are available.

More details on the retrieval and the specific limitations are given in the ATBD [RD 2]. The overall accuracy of the CM SAF CLARA SIS data set has been estimated to be 7 W/m^2 for the monthly mean data and 17 W/m^2 for the daily averages. Further information on the accuracy of the product is contained in the validation report [RD 1].

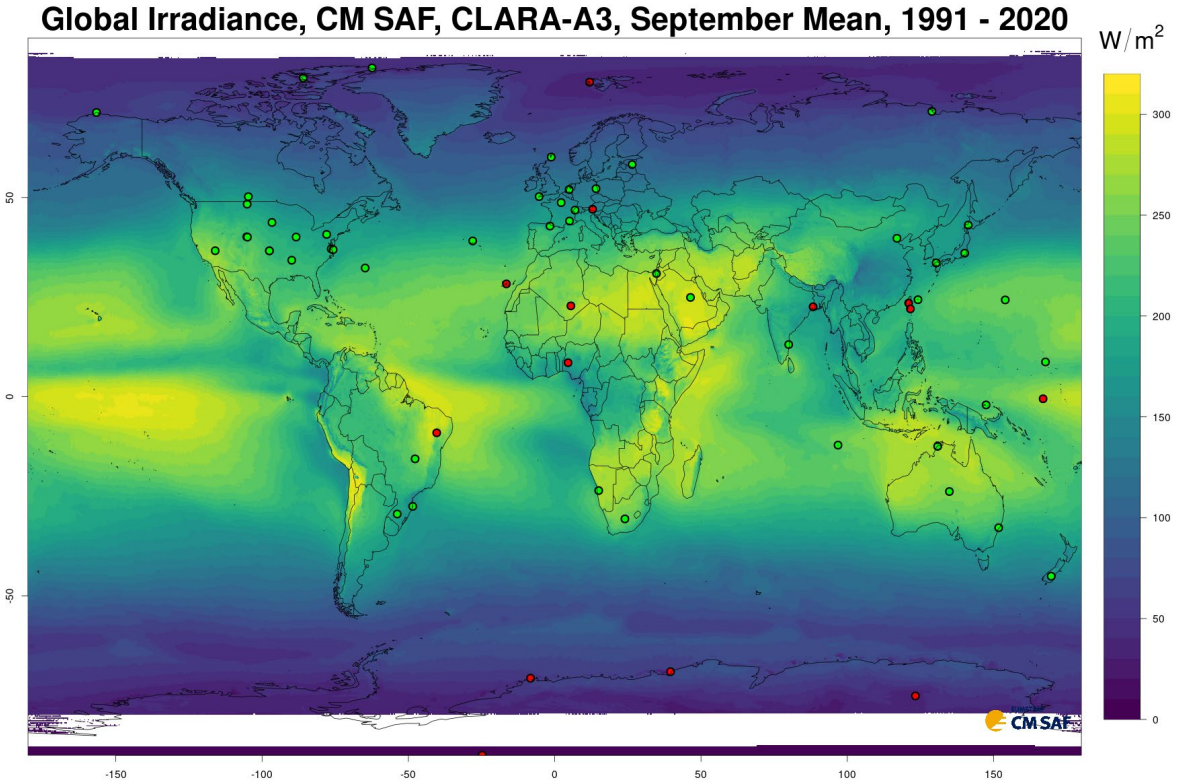

Figure 2-1: Multi-year average of the CM SAF CLARA surface solar irradiance data set for the month of September and validation results obtained by comparison with available BSRN surface measurements. Green dots represent surface stations where the CLARA SIS data set is within the target accuracy, red dots correspond to surface stations, where the CLARA SIS data set does not meet the target accuracy.

Surface downward longwave radiation

The surface downward longwave radiation is derived by correcting the monthly-averaged downward longwave surface radiation from the ERA-5 reanalysis with the CM SAF CLARA CFC data record. A cloud correction factor (CCF) to account for the impact of cloud coverage on the surface downwelling longwave radiation is calculated for each month based on ERA-5 data. The monthly surface downwelling longwave radiation from ERA-5 is corrected depending on the difference between the cloud fraction derived from CLARA-A3 and the ERA-5 cloud fraction.

More details on the algorithm and the specific limitations are given in the ATBD [RD 2]. The overall accuracy of the CM SAF GAC SDL data set has been estimated to be about 7 W/m^2. Further information on the accuracy of the product is contained in the validation report [RD 1].

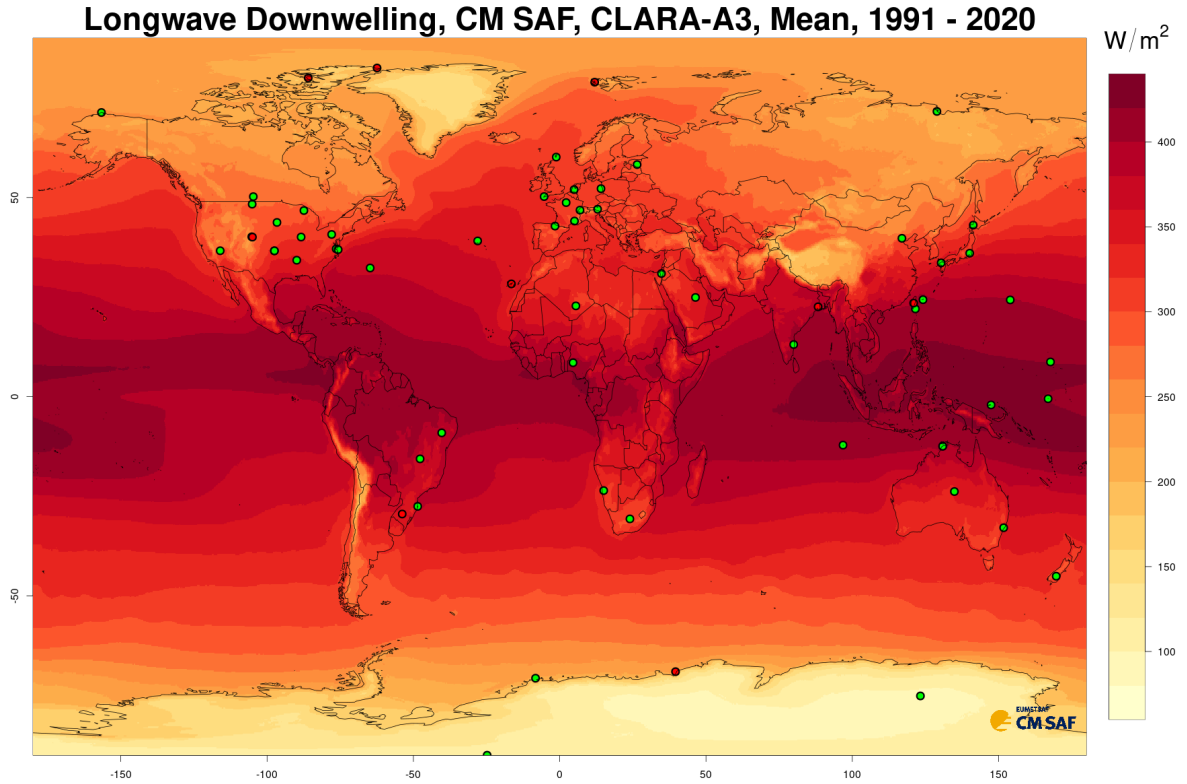

Figure 2-2: Multi-year mean from the CMSAF CLARA SDL data set. Green dots correspond to BSRN surface stations, where the CM SAF CLARA SDL data set fulfils the accuracy requirements.

Figure 2-2 presents an illustrative example of the CM SAF CLARA SDL data record. Shown is the multi-year average of the surface longwave downwelling radiation. The green dots correspond to surface stations where the CM SAF CLARA SDL data set is within the accuracy requirements.

Surface Net Shortwave Radiation

According to their definition, the surface net shortwave radiation (SNS) is derived from the daily surface irradiance (SIS) and the pentad blue-sky surface albedo (SAL) from CLARA-A3:

$$SNS = SIS * (1. - SAL)$$

More details on the algorithm and the specific limitations are given in the ATBD [RD 2]. The overall accuracy of the CM SAF GAC SNS data set has been estimated to be about 10 W/m^2. Further information on the accuracy of the product is contained in the validation report [RD 1].

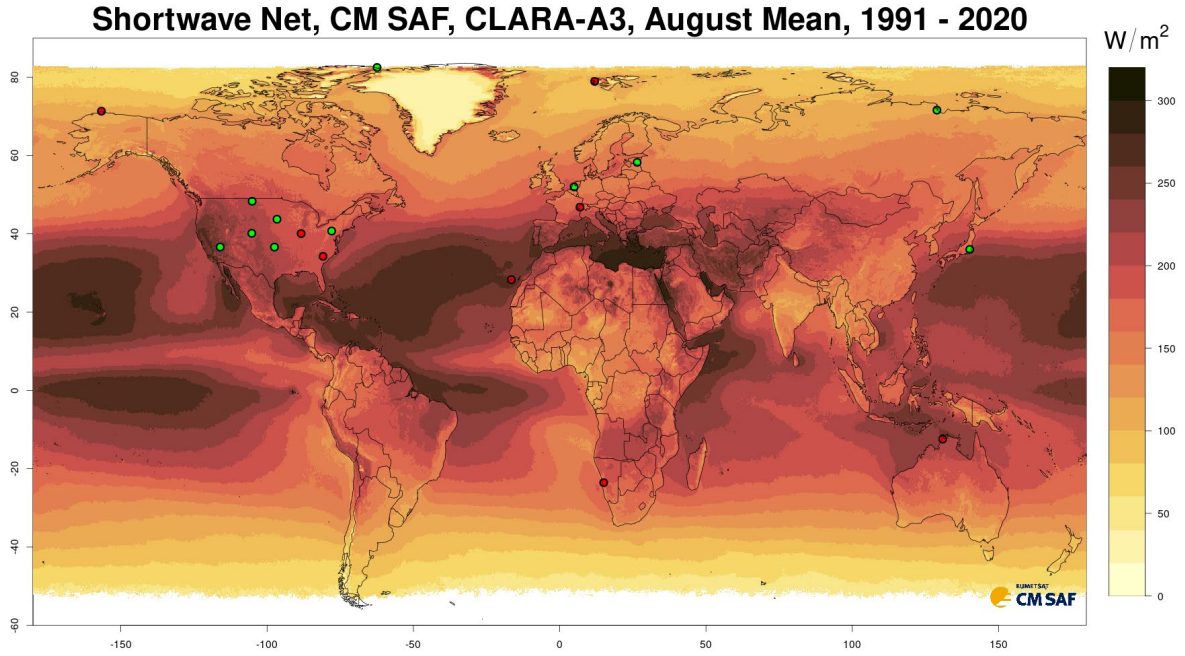

Figure 2-3: Multi-year mean from the CMSAF CLARA SNS data set. Green dots correspond to BSRN surface stations, where the CM SAF CLARA SNS data set fulfils the accuracy requirements.

Figure 2-3 presents an illustrative example of the CM SAF CLARA SNS data record. Shown is the multi-year average of the surface net shortwave radiation for August. The green dots correspond to surface stations where the CM SAF CLARA SNS data set is within the accuracy requirements.

Surface Net Longwave Radiation

The monthly surface net longwave radiation, SNL, is derived as the sum of the monthly surface downwelling longwave (SDL) and surface outgoing longwave (SOL) radiation. The CM SAF CLARA-A3 SDL data are used; the monthly SOL data are derived from the monthly net surface longwave and the surface downwelling longwave radiation provided, both provided as part of ERA-5.

More details on the algorithm and the specific limitations are given in the ATBD [RD 2]. The overall accuracy of the CM SAF GAC SNL data set has been estimated to be about 7 W/m^2. Further information on the accuracy of the product is contained in the validation report [RD 1].

Figure 2-4 presents an illustrative example of the CM SAF CLARA SNS data record. Shown is the multi-year average of the surface net longwave radiation for August. The green dots correspond to surface stations where the CM SAF CLARA SNS data set is within the accuracy requirements.

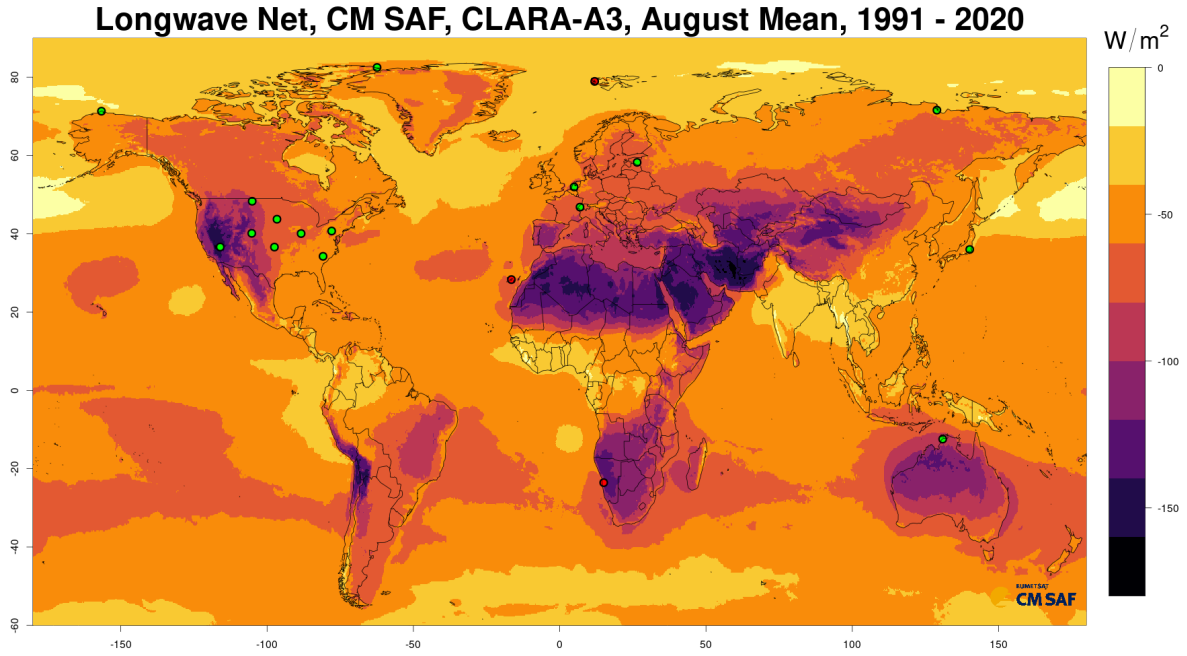

Figure 2-4: Multi-year mean for August from the CMSAF CLARA SNL data set. Green dots correspond to BSRN surface stations, where the CM SAF CLARA SNL data set fulfils the accuracy requirements.

Surface Radiation Budget

The surface radiation budget is defined and calculated as the sum of the surface net shortwave and the surface net longwave fluxes. Slightly more details on the algorithm and the specific limitations are given in the ATBD [RD 2]. The overall accuracy of the CM SAF GAC SRB data set has been estimated to be about 10 W/m^2. Further information on the accuracy of the product is contained in the validation report [RD 1].

Figure 2-5 presents an illustrative example of the CM SAF CLARA SRB data record. Shown is the multi-year average of the surface radiation budget for August. The green dots correspond to surface stations where the CM SAF CLARA SRB data set is within the accuracy requirements.

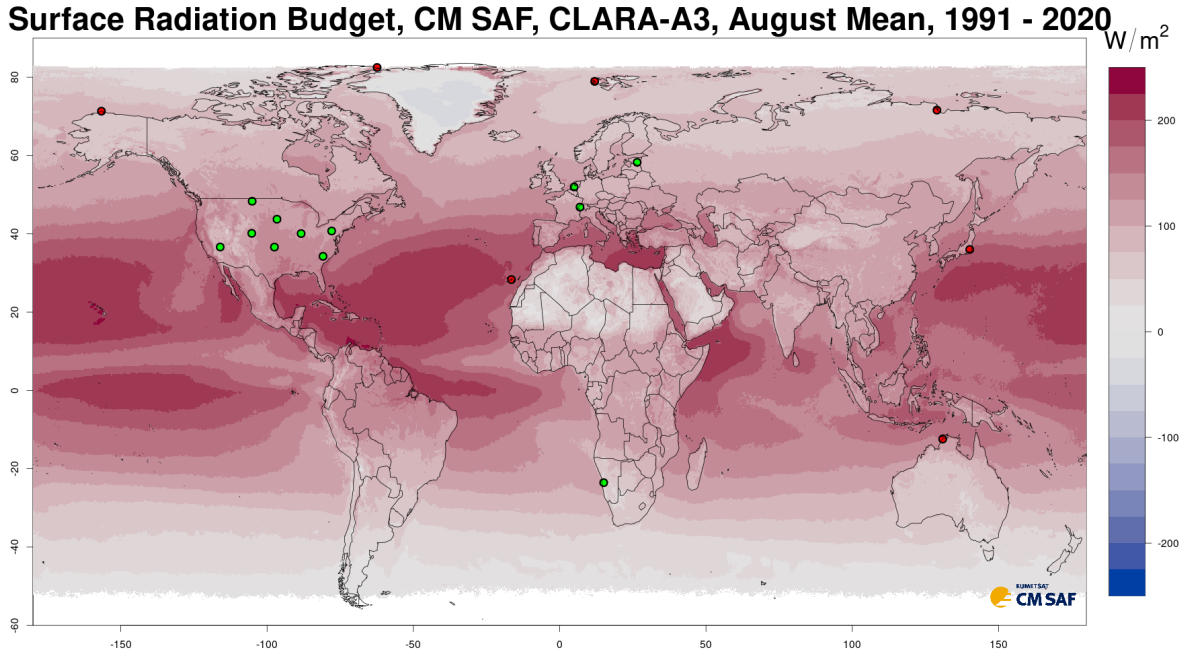

Figure 2-5: Multi-year mean for August from the CMSAF CLARA SRB data set. Green dots correspond to BSRN surface stations, where the CM SAF CLARA SRB data set fulfils the accuracy requirements.

2.2 General limitations and recommendations

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

The sun synchronous orbit of the NOAA satellites does not allow a high temporal coverage in lower latitudes. Hence, especially during times when only few AVHRR satellites were in orbit the calculation of daily averages are based on a single satellite overpass; while the diurnal solar cycle is considered in the calculation of the daily averages, the diurnal cycle of cloud coverage cannot be measured and considered under such circumstances. The accuracy of the data increases with the availability of further satellites in different orbits. This effect should be taken into account when analysing temporal changes and trends, in particular in regions with a strong and systematic diurnal cycle of cloud coverage.

The calibration coefficients for the AVHRR instruments used for the generation of the CLARA-A3 data records have been derived based on data available in 2017; considering that the reliability of the calibration is decreasing with time the stability of the CLARA-A3 data records after 2018 might be degraded, even though no such degradation was detected in the validation.

The estimation of monthly averages requires the availability of 20 valid daily means. This requirement results in an incomplete coverage of some of the monthly-averaged data, which limits the possibility to estimate the global average of surface irradiance. This concerns in particular the solar irradiance (SIS) and depending parameters, i.e, SNS and SRB. The satellite retrieval of SIS is limited to solar zenith angles below 80°, which results in missing daily mean (and subsequently monthly mean) data around polar night. Hence, the spatial

average of the available SIS data does not properly represent the global average due to the unavailability of data around polar night results, which results in an overestimation of the global mean. Special care has to be taken when estimating larger-scale or even global averages from the CLARA-A3 SIS data record due to the presence of systematic missing data. See RD 3 for more details on missing data in the CM SAF CLARA-A3 TRS data record, which apply also to the CLARA-A3 SIS and dependent records. The use of monthly climatological aerosol information prevents the use of the CLARA SIS data record to assess the direct aerosol effect on surface radiation. Temporal changes / trends in the CLARA SIS data are due to changes in cloud coverage and cloud properties and are not directly related to changes in aerosol.

The dependence of the longwave surface radiation data records on the data from the ERA-5 reanalysis limits the applicability of the SDL, SNS, and the SRB data records for the evaluation of model simulations. Also it is noted that the ERA5 reanalysis data cannot be considered temporally homogeneous over the full available time period due to the change of the observing system that is used in the assimilation scheme of the reanalysis. Due to the close tied between CLARA-A3 and ERA5 any inhomogeneity in the ERA5 data record for the surface longwave radiation will transfer to an inhomogeneity of the CLARA-A3 data record of the longwave radiation and the surface radiation budget.

2.3 ICDR

The Interim Climate Data Record (ICDR) temporally extends the climate data record (CDR) after 2020 with a timeliness of about 10 days. The general data processing for the ICDR follows the processing of the CDR, but some changes of the input data are required to fulfil the timeliness requirement.

The calibration of the satellite data used for the ICDR processing will be based on the same calibration coefficients used for the generation of the CDR. Due to increased calibration uncertainty beyond 2020, however, AVHRR data from the Metop-C satellite have not been used in the generation of the CLARA-A3 ICDR data records. This reduced sampling induces some differences between the CDR and the ICDR data records, in particular for the daily surface irradiance in regions with enhanced temporal variability of cloud coverage, e.g., the Western Pacific. The monthly surface radiation data is not impacted by this change in the observing system. New calibration coefficients of the AVHRR instruments are expected to become available in 2023; applying this new calibration to the AVHRR data is expected to allow the inclusion of the AVHRR-instrument on Metop-C in the generation of the CLARA-A3 ICDR. Changes in the accuracy and stability of the ICDR data records are expected and will be documented in the corresponding CM SAF Annual Quality Assessment Report (AQA).

Also, the final data from the ERA-5 reanalysis is not available at such a short timeliness; instead data from the ERA-5 initial release data, i.e., ERA-5T, is used. These data are generated at ECMWF with the same IFS model setup as the final ERA-5 data, but might differ slightly from the final ERA-5 data record due to additional quality checks that are not possible for the initial release data. The following input data (and CLARA parameters) are affected: water vapor (SIS), ozone (SIS), surface albedo (SIS), monthly cloud fraction (SDL, SNL, SRB), monthly surface downwelling longwave radiation (SDL, SNL, SRB), monthly surface net longwave radiation (SNL, SRB).

The used sea ice information, used for the generation of the probabilistic cloud mask and the surface albedo, also had to be adjusted to the timeliness requirements, with some implications on cloud detection, hence, on the derived surface irradiance. Possible differences between the CDR and the ICDR in the surface albedo impact the calculation of the surface net shortwave radiation as well as the surface radiation budget.Beware that possible changes in the ICDR input data streams and a decay with time of calibration coefficient can lead to reduced quality in the CM SAF ICDR products, with partly distinct regional imprints and exceeding the effective ICDR Service Specifications. Please use the data and associated plots with care and check the Service Messages and the Annual Validation Reports (AQARep) of the ICDR (https://www.cmsaf.eu).

3 Outlook

Future tasks will involve the use of non-AVHRR satellite instruments in the CLARA data record, e.g., VIIRS, to extent the available satellite data and to ensure the continuation of the CLARA data record into the future.

The impact of the direct aerosol effect on clear sky surface irradiance and, subsequently, on all-sky irradiance needs to be addressed in future versions of the CLARA data record. However, an assessment of the quality of the aerosol information and their application within the CLARA retrieval scheme requires significant efforts.

4 Data format description

CM SAF's climate monitoring CLARA surface radiation products are provided as NetCDF (Network Common Data Format) files (https://www.unidata.ucar.edu/software/netcdf/). The data files are created following NetCDF Climate and Forecast (CF) Metadata Convention version 1.7 (http://cf-pcmdi.llnl.gov/) and NetCDF Attribute Convention for Dataset Discovery version 1.0.

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

4.1 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. All CM SAF GAC surface radiation products files are built following the same design principles.

Each data file contains the following coordinate variables:

time
: start of averaging/composite time period [days counted from 1970-01-01]

time_bnds
: two-dimensional array defining the averaging/composite time period [days counted from 1970-01-01]

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 variables:

SIS, SDL, SNS, SNL, SRB
: parameter grid box mean value, the name depends on the parameter

VAR_nobs
: total number of observations counted during the average/composite period, VAR corresponds to the variable name

VAR_stdv
: standard variation, VAR corresponds to the variable name

Each file extracted from the CM SAF database has one record of the dimension (time, lat, lon) with the time dimension as the record dimension. This allows it to concatenate the individual records into an aggregated file. Global attributes are summarized in Table 4-1 and possible variable attributes in Table 4-2.

Table 4-1: Global NetCDF attributes.

Name	Description
title	dataset title
Conventions	conventions followed, "CF-1.7" for all files
Metadata_Convention	conventions followed, "Unidata Dataset Discovery v1.0" for all files
institution	institution where the data was produced
creator_url	URL contact information for the creator of the data
creator_email	email contact information for the creator of the data
references	references that describe the data or methods used to produce it
source	original data source
cdm_data_type	data type, “grid” for all files
filename	original filename
time_coverage_start	temporal coverage start of the data [ISO8601 date]
time_coverage_end	temporal coverage end of the data [ISO8601 date]
time_coverage_duration	temporal coverage duration of the data [ISO8601 duration]
geospatial_lat_units	latitude attributes unit
geospatial_lat_resolution	latitude grid resolution
geospatial_lat_min	latitude bounding box minimum
geospatial_lat_max	latitude bounding box maximum
geospatial_lon_units	longitude attributes unit
geospatial_lon_resolution	longitude grid resolution
geospatial_lon_min	longitude bounding box minimum
geospatial_lon_max	longitude bounding box maximum
cmsaf_gac_major_version_number	CM SAF GAC major release version
cmsaf_gac_minor_version_number	CM SAF GAC minor release version
processed_satellite	satellites processed for this mean
processed_orbit_node	satellite orbit nodes processed for this mean "ascending, descending" for all files
cmsaf_parameter_id	CM SAF product identifier
cmsaf_parameter_code	CM SAF product name
intercalibration	intercalibration version applied
date_created	date on which the data was created [ISO8601 date]
history	provides an audit trail for modifications to the original data

Table 4-2: Attributes assigned to variables.

Name	Description
long_name	long descriptive name
standard_name	standard name that references a description of a variable's content in the CF standard name table
units	physical unit [udunits standards]
C_format	format string that should be used for C applications to print values for this variable, applies to the scaled (internal) type and value
FORTRAN_format	format string that should be used for FORTRAN applications to print values for this variable, applies to the scaled (internal) type and value
valid_min	smallest valid value of a variable
valid_max	largest valid value of a variable
scale_factor	The data are to be multiplied by this factor after it is read.
add_offset	This number is to be added to the data after it is read. If scale_factor is present, the data are first scaled before the offset is added.
_FillValue	This number represent missing or undefined data. Missing values are to be filtered before scaling.
missing_data	This number represent missing or undefined data. Missing values are to be filtered before scaling. Contains the same value as the _FillValue-attribute.
cell_methods	method used to derive data that represents cell values following the CF Convention

4.2 ICDR specific adaptions

None.

5 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 how to use it for product search and ordering is given. We refer the user 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 CM SAF and the CM SAF products are available from the CM SAF home page (http://www.cmsaf.eu).

5.1 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 6.1). 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), or 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.

5.2 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).

5.3 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 5.6) 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).

5.4 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.

5.5 User feedback

Users of CM SAF products and services are encouraged to provide feedback on the CM SAF product and services to the CM SAF team. We are 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.

EUMETSAT CM SAF is a 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).

5.6 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).

5.7 User Workshops

CM SAF is organizing on regular basis training workshops in order to facilitate the use of our data. Furthermore, through our regular (approximately every four years) user's workshop we revisit our product baseline. 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.

6 Copyright and Disclaimer

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

6.1 Copyright

All intellectual property rights of the CM SAF products belong to EUMETSAT. The use of these products is granted to every interested user, free of charge. If you wish to use these products in publications, presentations, web pages etc., EUMETSAT's copyright credit must be shown by displaying the words "copyright (year) EUMETSAT" on each of the products used.

6.2 Acknowledgement and Identification

When exploiting EUMETSAT/CM SAF data you are kindly requested to acknowledge this contribution accordingly and make reference to the CM SAF, e.g. by stating "The work performed was done (i.a.) by using data from EUMETSAT's Satellite Application Facility on Climate Monitoring (CM SAF)". It is highly recommended to clearly identify the product version used. An effective way to do this is the citation of CM SAF data records via the digital object identifier (doi). All information can be retrieved through (http://www.cmsaf.eu/DOI).

The DOI for this data set is provided on the title page of this document.

6.3 Re-distribution of CM SAF data

Please do not re-distribute CM SAF data to 3rd parties. The use of the CM SAF products is granted free of charge to every interested user, but we have an essential interest to know how many and what users the CM SAF has. This helps to ensure of the CM SAF operational services as well as its evolution according to user's needs and requirements. Each new user shall register at CM SAF in order to retrieve the data.

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