EUMETSAT CM SAF CLIMATE MONITORING

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MeteoSwiss

Product User Manual

MeteoSwiss Radiation Data v.4.2.0

ALB	Surface Albedo
SIS	Surface Incoming Solar Radiation
SISCF	Clear Sky Surface Incoming Solar Radiation
SISDIF	Diffuse Surface Incoming Solar Radiation
SISDIR	Direct Surface Incoming Solar Radiation
SISDIRCF	Clear Sky Direct Surface Incoming Solar Radiation
SISDNI	Direct Normal Surface Incoming Solar Radiation
SOL	Surface Outgoing Longwave Radiation
SDL	Surface Downward Longwave Radiation
NSR	Net Shortwave Radiation
NLR	Net Longwave Radiation
BB-EM	Broad-band emissivity
SRB	Surface Radiation Budget

Document Change Record

Issue/ Revision	Date	DCN No.	Changed Pages/Paragraphs
4.2	10/10/2025	MeteoSwiss/PUM/MET/SwissRAD/4.2	First version

Reference Documents

Reference	Title	Code
RD 1	Validation Report Meteosat Surface Radiative Budget Edition 1 (0.05° grid)	SAF/CM/MeteoSwiss/VAL/MET/SRB/1.0
RD 2	Validation Report Meteosat Swiss Radiation Edition 1 (0.02° grid)	Sharma, V. (2025), Validation Report Meteosat Swiss Radiation Edition 1, *Technical Report MeteoSwiss*, No. 289.
RD 3	Algorithm Theoretical Basis Document Meteosat Surface Radiative Budget Edition 1	SAF/CM/MeteoSwiss/ATBD/MET/SRB/1
RD 4	The HelioMont Surface Solar Radiation Processing	Stöckli, R. (2017), The HelioMont Surface Solar Radiation Processing, *Scientific Report MeteoSwiss*, No. 93.

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1 Product Description

The MeteoSwiss Radiation data include four individual radiation components from the Surface Radiation Budget (SRB): Surface Albedo (SAL), Surface Incoming Solar radiation (SIS), Surface Downwelling Longwave radiation (SDL), and Surface Outgoing Longwave radiation (SOL):

SIS - Surface Incoming Solar Downward radiation at the surface, representing the primary solar energy input to the Earth's surface system.

SAL - Ratio between the Surface Incoming Solar Downward Radiation and the Surface Outgoing Upward Solar Radiation. It represents the fraction of shortwave radiation reflected by the earth surface.

SDL - Surface Downward Longwave Downward radiation at the surface, primarily from atmospheric emission.

SOL - Surface Outgoing Longwave Upward radiation from the surface, representing thermal emission from the ground.

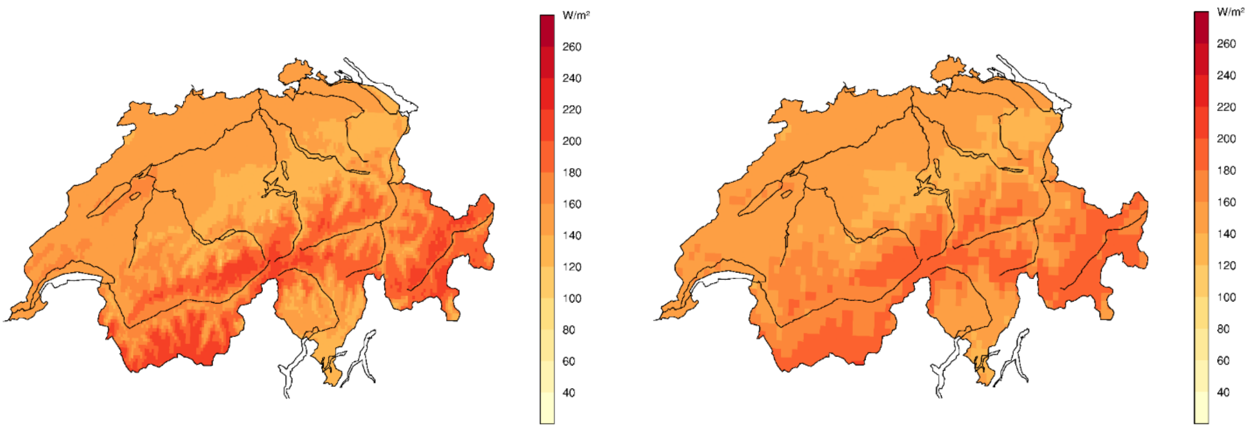

Figure 1: Product example Meteosat Surface Incoming Solar Radiation (SIS). Left: ch02 (0.02° lat/lon) grid. Right: ch05h (0.05° lat/lon) grid.

The Swiss Meteosat Radiation products are generated in near-real-time and as long-term climate data record for the period 1991-now (ch05h, 0.05° latitude and longitude grid) and the period 2004-now (ch02, 0.02° latitude and longitude grid) for entire Switzerland.

The following parameters are available:

Parameter	Name	Description	Period and Grid	Temporal
ALB	Albedo	Surface Blue Sky Albedo	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420
SIS	Surface incoming solar radiation	Solar Incoming Surface Radiation with terrain (shadow) correction	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420
SIS-No-Horizon	Surface incoming solar radiation	Solar Incoming Surface Radiation without terrain (shadow) correction	2004-now (0.02°)	H,D,M,Y Norm0420
SISCF	Clear sky surface incoming solar radiation	Clear sky surface incoming solar radiation with terrain (shadow) correction	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420
SISCF-No-Horizon	Clear sky surface	Clear sky surface incoming solar	2004-now (0.02°)	H Norm0420

	incoming solar radiation	radiation without terrain (shadow) correction		
SISDIF	Diffuse surface incoming solar radiation	Diffuse surface incoming solar radiation with terrain (shadow) correction	1991-now (0.05°) 2004-now (0.02°)	H Norm9120 Norm0420
SISDIF-No-Horizon	Diffuse surface incoming solar radiation	Diffuse surface incoming solar radiation without terrain (shadow) correction	2004-now (0.02°)	H Norm0420
SISDIR	Direct surface incoming solar radiation	Direct surface incoming solar radiation with terrain (shadow) correction	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y (ch02) H,D,M,Y (ch05h2) Norm9120 Norm0420
SISDIR-No-Horizon	Direct surface incoming solar radiation	Direct surface incoming solar radiation without terrain (shadow) correction	2004-now (0.02°)	H,D,M,Y Norm0420
SISDIRCF	Clear-sky direct surface incoming	Clear-sky direct surface incoming solar radiation with terrain (shadow) correction	2004-now (0.02°)	H,D,M,Y Norm0420

	solar radiation			
SISDIRCF-No-horizon	Clear-sky direct surface incoming solar radiation	Clear-sky direct surface incoming solar radiation without terrain (shadow) correction	2004-now (0.02°)	H Norm0420
SISDNI	Direct normal surface incoming solar radiation	Direct Normal Radiation (DNR) is the amount of solar radiation received by a surface that is positioned perpendicular to the sun's rays.	2004-now (0.02°)	H Norm0420
SISDNI-No-Horizon	Direct normal surface incoming solar radiation	Direct Normal Radiation (DNR) is the amount of solar radiation received by a surface that is positioned perpendicular to the sun's rays. Without terrain (shadow) correction.	2004-now (0.02°)	H Norm0420
KI	Cloud Index	Heliomont Cloud index which exploits	2004-now (0.02°)	H Norm0420

		the radiative properties of clouds in the visible and infrared solar spectrum. The cloud index is a surrogate for the radiative cloud forcing in the shortwave solar spectrum. It empirically accounts for the absorption, reflection and scattering of solar radiation in clouds.		
SDL	Surface downward longwave radiation	The surface downward thermal radiation on the Earth surface emitted by the clouds and the atmosphere.	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420
SOL	Surface outgoing longwave radiation	The infrared thermal radiation emitted by the Earth's surface.	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420

NSR	Net Shortwave Radiation	Net shortwave radiation is the difference between the incoming solar (shortwave, SIS) radiation and the outgoing reflected (shortwave, ALB) radiation at a surface.	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420
NLR	Net Longwave Radiation	Net shortwave radiation is the difference between the incoming thermal (longwave, SDL) radiation and the outgoing thermal (longwave, SOL) radiation at a surface.	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420
SRB	Surface Radiation Budget	The surface radiation budget is the balance between the incoming and outgoing radiation at the Earth's surface.	1991-now (0.05°) 2004-now (0.02°)	H,D,M,Y Norm9120 Norm0420

		It includes the absorption of solar (shortwave, NSR) radiation and the emission of thermal (longwave, NLR) radiation. SRB is the difference between all downward and upward radiation fluxes.		
BB_EM	Broad-band emissivity	The effective emissivity of the Earth surface for the entire thermal infrared spectrum.	1991-now (0.05°)	D Norm9120

Table 1: Parameters of the MeteoSwiss radiation products. The parameters are available for Switzerland at a 0.05° (ch05h) and/or 0.02° (ch02) latitude and longitude grid for different time resolutions: H=hourly, D=daily, M=monthly, Y=yearly. For each parameter a norm value is available for 1991-2020 and/or 2004-2020 is indicated in the table.

In addition, the following auxiliary data are available:

Ancillary Parameter	Name	Description	Period and Grid	Temporal
IR	Infrared Temperature	Top-of-atmosphere Meteosat Infrared	1991-now	Instantaneous: 15 min for MSG

		Brighntness Temperature measured at 10.8 micrometer wavelength	native satellite resolution	and 30 min for MFG
VIS	Meteosat visible radiance	Top of Atmosphere visible Meteosat radiance	1991-now Native satellite resolution	Instantaneous: 15 min for MSG and 30 min for MFG
SAA	Solar azimuth angle	Pixel-wise solar azimuth angle	1991-now Native satellite resolution	Instantaneous: 15 min for MSG and 30 min for MFG
SZA	Solar zenith angle	Pixel-wise solar zenith angle	1991-now Native satellite resolution	Instantaneous: 15 min for MSG and 30 min for MFG
SCAN_TIME	Meteosat scan time	Precise scan time per satellite pixel	1991-now Native satellite resolution	Instantaneous: 15 min for MSG and 30 min for MFG

Table 2: Auxiliary data available for the MeteoSwiss radiation products.

1.1 Short Algorithm Description

GeoSatClim represents a comprehensive satellite-based processing system for deriving all Surface Radiative Budget (SRB) components from Meteosat observations. The software was developed at MeteoSwiss as part of its engagement within the CM

SAF consortium [RD3, RD4] with funding from EUMETSAT's SAF framework for 20 years+.

The system utilizes Meteosat Visible Infra-Red Imager (MVIRI) and Spinning Enhanced Visible and Infrared Imager (SEVIRI) data from Meteosat First and Second Generation (MFG and MSG) satellites, respectively. Calibration factors published by EUMETSAT are employed for MVIRI and SEVIRI, though infrared coefficient factors for MVIRI utilize those from John et al. (2019). These coefficient factors enable conversion of Meteosat digital number counts to Top Of Atmosphere (TOA) radiances, which are subsequently converted to reflectance for visible channels and brightness temperature for infrared channels.

The clear-sky solar radiation calculations employ LibRadTran (library for Radiative Transfer) as the primary radiative transfer model. LibRadTran is executed offline for a comprehensive range of atmospheric and surface states, including aerosol and cloud optical parameters, atmospheric gas concentrations, and solar and viewing zenith and azimuth angles for different Spectral Response Functions (SRF) of Meteosat sensors. The system utilizes the SBDART absorption parameterization with 4 radiation streams and the DISORT radiative transfer equation solver, yielding extensive look-up tables (LUT) that enable GeoSatClim to achieve computational efficiency during operational processing.

Cloud-snow discrimination represents a critical algorithmic component, particularly relevant for Alpine regions where snow and cloud surfaces exhibit similar optical properties in visible wavelengths. The algorithm employs sophisticated multi-spectral techniques leveraging differential absorption characteristics. The distinction between water and ice clouds utilizes a simple formula where the fraction of water clouds depends on brightness temperature, with values constrained between minimum and maximum thresholds of 245K and 265K respectively. LUT values for ice and water clouds are subsequently combined linearly using the fraction of water clouds.

The topographic treatment incorporates comprehensive corrections for complex terrain effects. Orthorectification addresses the slant viewing geometry of non-nadir Meteosat pixels, which generates artificial geometric shifts in mountainous terrain. This correction utilizes surface elevation datasets projected onto orthorectified Meteosat grids to generate appropriate pixel relocations. Cloud parallax correction accounts for geometric shifts caused by elevated cloud positions, which can amount to up to 10 km displacement for 10 km high clouds at 45° longitude or latitude.

Surface albedo retrieval employs the MODIS Algorithm Theoretical Basis Document approach, adapted for Meteosat geostationary observations. The algorithm calculates blue sky albedo from Black Sky Albedo (BSA) and White Sky Albedo (WSA) using a Bidirectional Reflectance Distribution Function (BRDF) model. This kernel-based BRDF model combines isotropic scattering, radiative transfer-type volumetric scattering (RossThick kernel), and geometric-optical surface scattering (LiSparse kernel) components. Surface reflectance calculations utilize LibRadTran RTM with comprehensive LUTs incorporating TOA reflectance, satellite and solar directional parameters.

ERA5 total column water vapor and ozone concentrations, and CAMS Aerosol Optical Depth.

Longwave radiation algorithms address the significant challenges posed by atmospheric absorption and emission effects. Surface Downwelling Longwave radiation utilizes the LSA SAF methodology, combining satellite-derived cloud cover information with numerical weather prediction model data for atmospheric water vapor content and near-surface temperature. The algorithm employs bulk atmospheric emissivity calculations as functions of total column water vapor, while effective air temperatures depend on screen level temperature and observed dew point depression. GeoSatClim cloud fractional cover determines cloudy and clear sky fractions contributing to the SDL signal through weighted combinations. The technical implementation combines Fortran 90 and C programming languages with parallelization through the Message Passing Interface (MPI) for distributed processing across satellite scenes. The system maintains pure CPU operation with NETCDF library as the only external dependency. Processing systems deliver near-real-time products within operational timeframes while maintaining consistency across the multi-decadal Meteosat observation period through careful inter-sensor calibration and homogenization procedures.

Please note that for the 0.05° grid (ch05h) we strictly run the CM SAF algorithms described in [RD3]. For the 0.02° grid (ch02) we run the Heliomont algorithm [RD4] for SIS and the CM SAF algorithms [RD3] for Albedo, SOL and SDL.

1.2 Highlights

- Fully seamless climate data record and near-real time data (GeoSatClim 4.2.0) back to 1991
- Real-time climate data issued with 1 day latency
- High spatial resolution as observed by the Meteosat high resolution scans for Europe (0.02° latitude and longitude grid).
- Truly physical radiative transfer-based retrieval scheme to ensure the best possible quality.
- Cloud-snow discrimination as a critical algorithmic component.
- Climate quality over the period 1991-now by using recalibrated MVIRI and SEVIRI Meteosat radiances (0.05° latitude and longitude grid)
- Joint retrieval of all radiation components of the Surface Radiation Budget with similar boundary conditions.
- Near-real-time production with a daily latency.

1.3 Validation

This section is a summary of the validation reports. There is one separate, reviewed validation report for the 0.05° and the 0.02° latitude and longitude grids: ch05h [RD1] and ch02 [RD2]. For details, please refer to those reports.

A representative station: Payerne

The Payerne station (PAY) serves as an exemplary case study for detailed validation analysis. PAY station demonstrates exceptional agreement with GeoSatClim satellite retrievals across all measured radiation variables. Table 3 summarizes the monthly-scale validation performance for the radiation components.

Variable	R^2	Precision (bias corrected RMSE)	Accuracy (mean bias)
SIS (ch02)	0.998	4.52 W/m²	-0.40 W/m²
SIS (ch05h)	0.997	5.62 W/m²	1.31 W/m²
SDL (ch02)	0.975	5.09 W/m²	+4.86 W/m²
SDL (ch05h)	0.975	7.03 W/m²	+3.77 W/m²
SOL (ch02)	0.980	6.98 W/m²	-3.27 W/m²
SOL (ch05h)	0.997	4.50 W/m²	-4.19 W/m²
Albedo (ch05h)	0.706	0.03 %	0.007 %

Table 3: PAY station validation performance summary (monthly averages, 2010-2024). RMSE=Root Mean Square Error. R=correlation coefficient.

For hourly and daily measurements, the precision (bias corrected root mean square error, RMSE) is 42.94 W/m² and 13.75 W/m² for SIS, 20.67 W/m² and 13.52 W/m² for SDL and 23.02 W/m² and 15 W.23 W/m² for SOL at the station Payerne for the 0.02 latitude and longitude grid. The bias is more or less consistent across all temporal scales and indicates a small underestimation for SOL (order -3 W/m², a systematic overestimation for SDL (order 5 W/m²) and neglectable bias for SIS.

The seasonal variation of the GeoSatClim retrievals is very similar to the ground measurements in Payerne (figure 2, 0.02 latitude and longitude grid). For winter month, a larger spread is observed for the different components likely due to undetected fog (SIS) and very cold ground (SOL) and atmospheres (SDL).

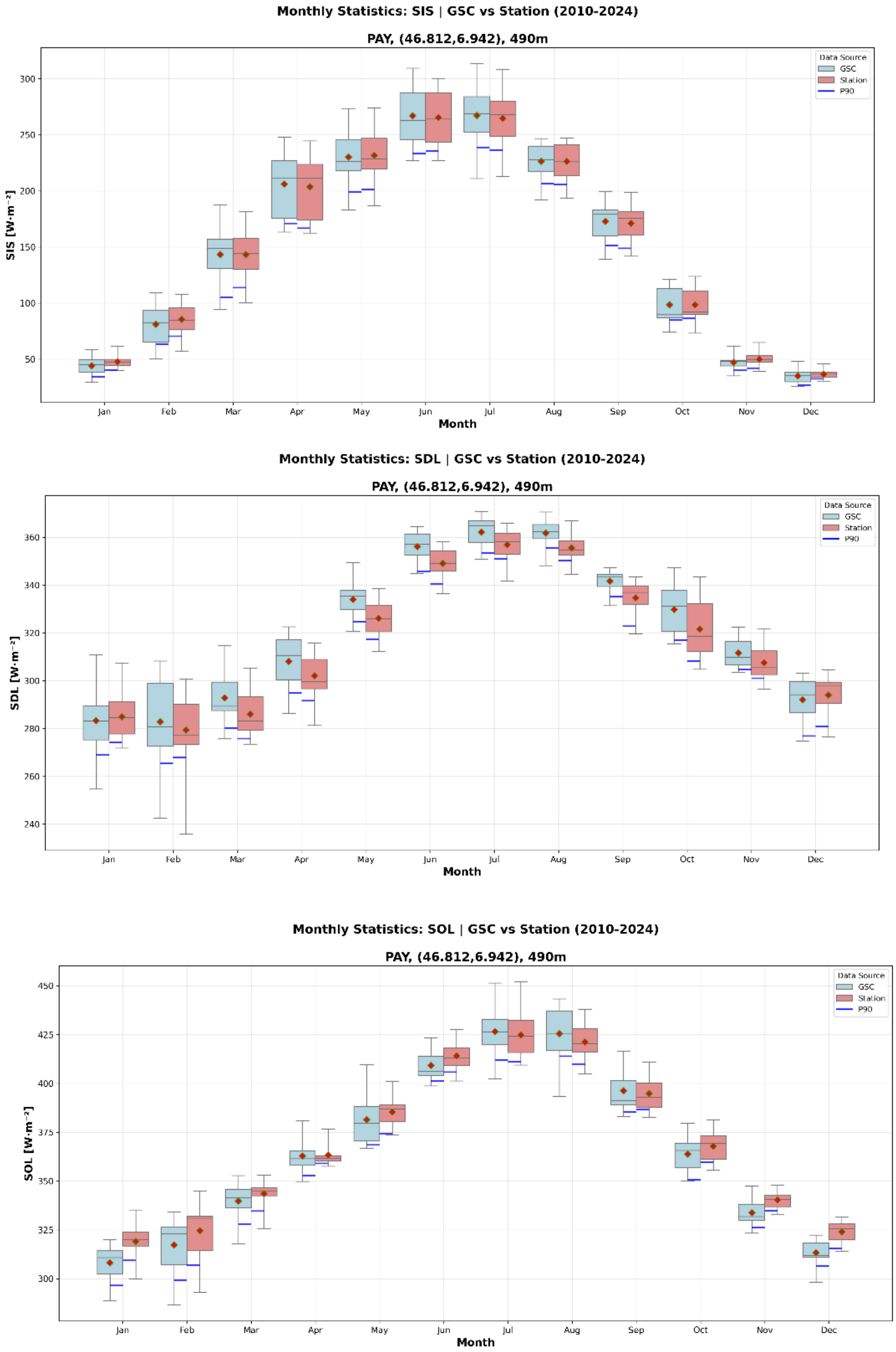

Figure 2: Summary of validation statistics at the Swiss station Payerne (blue: Meteosat radiation, red: ground station) for SIS (upper), SOL (mid) and SDL (below) for the 0.02° latitude and longitude grid.

Validation across the MeteoSwiss network

The validation across the Swiss territory for the 0.02° latitude and longitude grid data demonstrates consistently strong performance of the GeoSatClim satellite retrievals, with performance varying by radiation variable and measurement complexity (table 4, table 5):

Variable	Stations	Mean R² (±std)	Mean bias corrected RMSE W/m² (±std)	Mean MB W/m² (±std)
SIS	73	0.988 ± 0.011	8.54 ± 3.64	-0.29 ± 5.41
SDL	35	0.960 ± 0.030	7.30 ± 2.55	-3.24 ± 9.78
SOL	4	0.964 ± 0.015	8.77 ± 2.38	-3.97 ± 2.91

Table 4: Network-wide validation statistic summery. RMSE=Root Mean Square Error. R=correlation coefficient.

Variable	Elevation Band	Station Count	Mean W/m²	Mean Bias W/m²	Bias corrected RMSE W/m²
SIS	0-500 m 500-1500 m >1500 m	27 27 19	147.3 146.9 161.2	-0.13 -0.99 +0.49	5.76 8.59 12.44
SDL	0-500 m 500-1500 m >1500 m	14 11 10	321.1 308.2 271.0	+0.08 -5.89 -4.99	5.73 6.97 9.86

Table 5: Performance by elevation bands. RMSE=Root Mean Square Error, R=correlation coefficient.

1.4 Recommended Application

The surface radiation budget, with its single radiation components, is the key driver of all land surface processes including the surface layer atmospheric states. Apart from precipitation, the surface radiation is the single most important ECV influencing the anthroposphere through many socio-economic sensitive terrestrial ecosystem processes. It is primordial for plant net primary production and can be used as a surrogate for the state of soil moisture. Surface radiation is a main input variable for hydrological and agricultural applications. Climate Services benefit from the surface radiation for applications like drought stress analysis, monitoring of surface states and solar potential estimates. Moreover, the hourly resolved solar radiation data are valuable training data for solar radiation and power production forecasting. MeteoSwiss has therefore developed climate services for the renewable energy sector (sonnendach.ch) and droughts (drougth.admin.ch) based on the Meteosat climate data.

The 0.05 latitude and longitude data (ch05h) are retrieved from recalibrated Meteosat radiances and have climate quality. Those data can be used to analyse the climate signal (see e.g., Schilliger et al. 2024).

The 0.02° latitude and longitude data (ch02) are calculated using the high resolution Meteosat scans. Those data are not recalibrated and are available only for short periods. Hence, we cannot assure full climate quality for ch02. With the highest possible resolution Meteosat can observe, the 0.02° latitude and longitude fields should be used for all applications where spatial resolution matters.

Schilliger,L.,Tetzlaff,A.,Bourgeois,Q.,Correa,L.F.,&Wild,M.(2024).An investigation on causes of the detected surface solar radiation brightening in Europe using satellite data. Journal of Geophysical Research: Atmospheres, 129, e2024JD041101. https://doi.org/10.1029/2024JD041101

2 Data format description

The MeteoSwiss's climate monitoring radiation 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 1.8 (https://cfconventions.org/Data/cf-conventions/cf-conventions-1.8/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, MeteoSwiss recommends the usage of the climate data operators (CDO), available under GNU Public License (GPL) from MPI-M (http://www.mpimet.mpg.de/~cdo).

2.1 Spatial gridding

The presented MeteoSwiss Radiation Data are provided on a regular latitude and longitude grid. The geographic reprojection from the native Meteosat grid onto the latitude longitude grid is carried out using a spatial nearest neighbour search. Please note that with the selected grid we more or less represent the native grid resolution which is about 0.01° for the Meteosat rapid HRV scans, about 0.03° for the SEVIRI sensor and about 0.05° for the MVIRI sensor over Switzerland.

Lon min	Lon max	Lat min	Lat max	Spacing (lon, lat)	Projection	Datum
5.750	10.750	45.750	47.875	0.02°	latitude - longitude	WGS 84
5.025	10.975	45.025	48.975	0.05°	latitude - longitude	WGS 84

Table 6: Characteristics of the MeteoSwiss Radiation Data geographical coverage.

For the high-resolution data processing (ch02) we merge 0.03° SEVIRI (thermal) and 0.01° HRV scans (optical) for the cloud retrieval and therefore decided for an intermediate 0.02° latitude and longitude grid.

With the ch05h time series back to 1991 we provide a true climate time series over the 0.05° MVIRI and 0.03° SEVIRI period which is not altered by downscaling artifacts. We have therefore decided for the 0.05° MVIRI grid resolution.

Hence, we provide the highest possible spatial resolution as observed by the satellite sensor for each time series. Table 6 gives information on the geographical coverage. The 0.05° data are slightly larger than Switzerland and also cover those regions outside Switzerland which are relevant for the Swiss hydrological catchment.

2.2 Temporal gridding

The MeteoSwiss Radiation Data are Level-3 presented as hourly, daily, monthly and yearly means. Re-projected, instantaneous fields are aggregated into hourly, daily and monthly means. The spatial and temporal aggregation is conducted using the GeoSatClim re-projection and aggregation tools. Hourly means are derived as an arithmetic mean from two slots for MVIRI and four slots for SEVIRI:

- MVIRI: the 0-hour mean is composed of 2 full disc scans starting at 0 and 30 minutes after 00:00 UTC

- SEVIRI: the 0-hour mean is composed of 4 full disc scans starting at 0, 15, 30 and 45 minutes after 00:00 UTC

The hourly averaging is performed if at least one measurement is within the hourly interval. The daily mean is the mean of all hourly means if at least four valid hourly means are present. The monthly mean is the mean of all daily means if at least 20 valid daily means are present. The monthly mean diurnal cycle is a vector of 24 values containing the mean hourly values for the respective month for hours with at least 20 valid hourly means.

The SIS daily compositing, and only the SIS daily compositing, is more than a simple mean. Here, daily mean values are derived from instantaneous values as:

$$SIS^{d} = SIS_{cf}^{d} \frac{\sum_{i=1}^{n} SIS^{i}}{\sum_{i=1}^{n} SIS_{cf}^{i}}$$

Where SIS^{d}_{cf} is the daily mean of the clear sky radiation, SIS^{i} and SIS^{i}_{cf} are the slot-wise all sky and clear sky radiation for n valid time slots per day. This calculation reconstructs the daily mean radiation even when missing data is present (such as during night or during satellite maintenance and maneuvers), by weighting the remaining data with the diurnal cycle of clear sky solar radiation and cloudiness. SIS^{d} is calculated when the clear sky radiation of the available time slots covers at least 75% of the total diurnal clear sky radiation.

2.3 File naming and packing

Hourly, daily and monthly data are packed into monthly files to simply the data transfer, which follows the naming convention:

[satellite].[variable].[t]_[region].lonlat_[yyyy][mm]01000000.nc

Where satellite is the satellite identifier (msg, mfg), variable is the radiation component (SIS, SOL, SDL, ALB), t is time interval (m=monthly, d=daily, h=hourly), region (ch02, ch05h), yyyy=year, mm=month.

Example Surface Outgoing Longwave Radiation (SOL) data for September 2025 for the ch05h grid:

msg.SOL.H_ch05h.lonlat_20250901000000.nc (720 hourly mean steps in one file) msg.SOL.D_ch05h.lonlat_20250901000000.nc (30 daily mean steps in one file)

msg.SOL.M_ch05h.lonlat_20250901000000.nc (1 monthly mean step in one file)

2.4 General Variables

Name	Description
lon	*geographical longitude of grid-box centre [degree_east]*
lat	*geographical latitude of grid-box centre [degree_north]*
time	*time of averaging/composite time period; in case of diurnal cycles, this vector has 24 elements [days counted from 1970- 01-01]*
lon_bnds	*geographical longitude of grid-box edges [degree_east]*
lat_bnds	*geographical latitude of grid-box edges [degree_north]*
time_bnds	*time edges*
record_status	*overall status of each record (timestamp) in this file. If a record is flagged as not ok, it is recommended not to use it.*
grid_mapping	*projection parameters*
SATID	*spacecraft ID (unique number defined by MSGGS or GSDS or NORAD or COSPAR): 19 = MFG 4, 20 = MFG 5, 21 = MFG 6, 22 = MFG 7, 321 = MSG 1, 322 = MSG 2, 323 = MSG 3, 324 = MSG 4*

Table 7: General Variables.

2.5 Global Attributes

Name	Description
institution	Data produced at Federal Office of Meteorology and Climatology MeteoSwiss

title	Satellite-based Climate Data Record of MeteoSwiss
summary	This file contains Climate Data using the software GeoSatClim from the Satellite Application Facility on Climate Monitoring (CM SAF)
id	not assigned
variable_id	NA
product_version	*4.2.0*
creator_name	not assigned
creator_email	not assigned
creator_url	www.meteoswiss.admin.ch
institution	*Federal Office of Meteorology and Climatology MeteoSwiss*
project	*Satellite Application Facility on Climate Monitoring (CM SAF)*
references	Information on the data is available at https://www.meteoswiss.admin.ch/climate/the-climate-of-switzerland/spatial-climate-analyses.html
Conventions	CF-1.8, ACDD-1.3
standard_name_vocabulary	*Standard Name Table (v28, 07 January 2015)*
date_created	*creation date*
time_coverage_start	*starting date*
time_coverage_end	*ending date*
time_coverage_duration	*time duration*
time_coverage_resolution	*time resolution*
geospatial_lon_units	*degrees_east*
geospatial_lon_min	*Minimum longitude*
geospatial_lon_max	*Maximum longitude*
geospatial_lon_resolution	*Grid spacing in °*
geospatial_lat_units	*degrees_north*
geospatial_lat_min	*Minimum longitude*
geospatial_lat_max	*Maximum longitude*
geospatial_lat_resolution	*Grid spacing in °*

licence	*The GeoSatClim product ("Climate Product") is subject to the Federal Office of Meteorology and Climatology MeteoSwiss Data Policy. By accessing or using the Climate Product, users agree to comply with the terms outlined in Policy, including the following attribution: "Source MeteoSwiss". The Climate Product was generated using the EUMETSAT software GeoSatClim provided through the Climate Monitoring Satellite Application Facility (CM SAF). The Climate Product contains modified EUMETSAT Meteosat data since 1991, as well as additional data and products obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF), NASA's Combined ASTER and MODIS Emissivity over Land (CAMEL) emissivity data, and CMIP6 aerosol data and elevation data from the SwissTopo DHM25 as ancillary fields.*
platform	*MFG or MSG*
platform_vocabulary	*GCMD Platforms, Version 8.6*
instrument	*MVIRI or SEVIRI*
instrument_vocabulary	*GCMD Instruments, Version 8.6*

Table 8: Global attributes.

2.6 Variables

[Parameter] (time, lat, lon)

field containing the mean parameter values. For a detailed description see table 1.

Parameter	Unit	Valid range	Type	Scale	Offset	Fill Value
ALB	1	[0,1]	float	1.0	0.0	9.96921e+36
SIS	W/m²	[0,1400]	float	1.0	0.0	9.96921e+36
SIS-No-Horizon	W/m²	[0,1400]	float	1.0	0.0	9.96921e+36
SISCF	W/m²	[0,1400]	float	1.0	0.0	9.96921e+

						36
SISCF-No-Horizon	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
SISDIF	W/m²	[0,800]	float	1.0	0.0	9.969 21e+ 36
SISDIF-No-Horizon	W/m²	[0,800]	float	1.0	0.0	9.969 21e+ 36
SISDIR	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
SISDIR-No-Horizon	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
SISDIRCF	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
SISDIRCF-No-horizon	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
SISDNI	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
SISDNI-No-Horizon	W/m²	[0,1400]	float	1.0	0.0	9.969 21e+ 36
KI	-	[0,1.2]	float	1.0	0.0	9.969 21e+ 36
SDL	W/m²	[0,800]	float	1.0	0.0	9.969 21e+ 36
SOL	W/m²	[0,600]	float	1.0	0.0	9.969 21e+ 36
NSR	W/m²	[-100,1000]	float	1.0	0.0	9.969 21e+ 36
NLR	W/m²	[-200,200]	float	1.0	0.0	9.969 21e+ 36
SRB	W/m²	[-200,500]	float	1.0	0.0	9.969 21e+ 36
BB_EM	-	0.95 to 1	float	1.0	0.0	9.969 21e+ 36
VIS	mW·m-	[0,2]	float	1.0	0.0	9.969

	2·sr-1·(cm-1)-1					21e+36
IR	K	[220,350]	float	1.0	0.0	9.96921e+36
SAA	degree	[0,360]	float	1.0	0.0	9.96921e+36
SZA	degree	[0,180]	float	1.0	0.0	9.96921e+36

Table 9: Parameters with specifications of the MeteoSwiss Radiation Data. For a detailed description please refer to table 1.

3 Feedback

3.1 User feedback

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

Please provide your feedback to our customer service (e-mail kundendienst@meteoswiss.ch).

3.2 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 to our staff or via our customer service (e-mail address kundendienst@meteoswiss.ch).

4 Copyright and Disclaimer

The user of the MeteoSwiss Radiation Data agrees to respect the following regulations:

4.1 Copyright

This GeoSatClim products ("MeteoSwiss Radiation Data") are subject to the Federal Office of Meteorology and Climatology MeteoSwiss Data Policy. By accessing or using this Climate Product, users agree to comply with the terms outlined in Policy, including the following attribution: “Source MeteoSwiss”. The Climate Products were generated using the EUMETSAT software GeoSatClim provided through the Climate Monitoring Satellite Application Facility (CM SAF). The Climate Products contain modified EUMETSAT Meteosat data since 1991, and are also based on additional data and products obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF), NASA's Combined ASTER and MODIS Emissivity over Land (CAMEL) emissivity data, and CMIP6 aerosol data and elevation data from the SwissTopo DHM25 as ancillary fields.”

4.2 Acknowledgement and Identification

When exploiting the MeteoSwiss Radiation Data you are kindly requested to acknowledge this contribution accordingly and make reference to MeteoSwiss and the CM SAF, e.g., by stating “The work performed was done by using data from MeteoSwiss generated with the software GeoSatClim from EUMETSAT’s Satellite Application Facility on Climate Monitoring (CM SAF)”. It is highly recommended to identify the product version used clearly.

4.3 Re-distribution of CM SAF data

Please do not re-distribute the MeteoSwiss Radiation Data to third parties. The use of the MeteoSwiss products is granted free of charge to every interested user, but an essential interest exists to know how many and what users MeteoSwiss has. This helps to ensure of the MeteoSwiss operational services as well as its evolution according to user needs and requirements.