EUMETSAT CM SAF CLIMATE MONITORING

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Satellite-based climate data records of surface solar radiation

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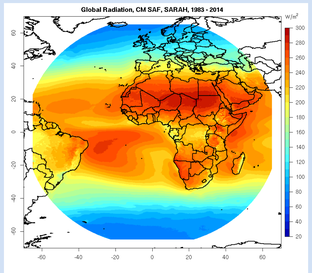
Knowledge of the spatial and temporal distribution of the surface solar incoming radiation is of high relevance for our understanding of the climate system and for the planning of solar power facilities. The EUMETSAT Satellite Application Facility on Climate Monitoring (CM SAF) provides high-quality surface radiation data records from 1982 to today based on geostationary and polar-orbiting satellites.

SARAH-2.1



Variables
Global Radiation (Irradiance), Direct (Normal) Radiation, Sunshine Duration, Effective Cloud Albedo

Resolution
Spatial: **0.05° x 0.05°**
Temporal: **30-min, daily, monthly** means

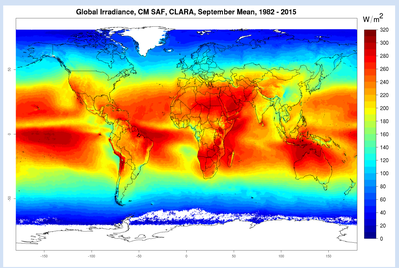
Coverage
Meteosat full disk, 1983 - 2017

Accuracy
Irradiance: **~5 W/m²** for monthly means, ~12 W/m² for daily means
Direct Radiation: **~8 W/m²** for monthly means, ~18 W/m² for daily means
Sunshine Duration: **~19 h** for monthly sums, ~80 min for daily sums

Availability
www.cmsaf.eu; **CF-netcdf**-format, freely available without restrictions

Digital Object Identifier (doi)
10.5676/EUM_SAF_CM/SARAH/V002_01

CLARA-A2.1



Variables
Global Radiation (Irradiance)

Resolution
Spatial: **0.25° x 0.25°**
Temporal: **daily, monthly** means

Coverage
Global, 1982- 2019

Accuracy
~9 W/m² for monthly means, ~19 W/m² for daily means

Availability
www.cmsaf.eu; **CF-netcdf**-format, freely available without restrictions

Digital Object Identifier (doi)
10.5676/EUM_SAF_CM/CLARA/V002_01

SARAH – ICDR

Interim Climate Data Record — Consistent extension of SARAH

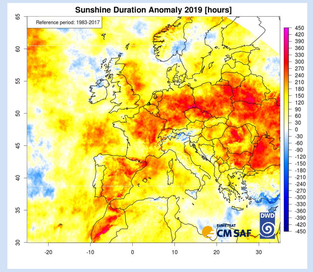
Variables
Global Radiation (Irradiance), Direct (Normal) Radiation, Sunshine Duration

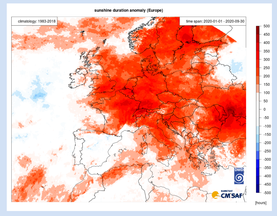
Resolution
Spatial: **0.05° x 0.05°**
Temporal: **30-min, daily, monthly**

Coverage
Meteosat full disk, 2018 onwards

Timeliness
max. 5 days

Sunshine duration anomaly, 2019





Sunshine duration anomaly: 1 Jan to 30 Sep 2020

Good to know

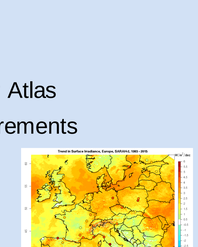
- ✓ All data are freely available at www.cmsaf.eu
- ✓ Make sure to minimize the size of your order / download, e.g., by specifying a certain region
- ✓ Start with monthly averages for an overview
- ✓ Use the CM SAF R-Toolbox, in particular in case you are not familiar with netcdf-files (www.cmsaf.eu/R-Toolbox)
- ✓ When analyzing diurnal cycles, take the scanning time into account and properly calculate the hourly sums

Known limitations

- ✓ SARAH-2 underestimates surface radiation over snow-covered surfaces
- ✓ Trends in surface irradiance due to aerosol changes are not fully described in SARAH; trends seen in SARAH are dominated by changes in cloudiness
- ✓ SARAH data tends to overestimate surface irradiance / sunshine duration in West Africa
- ✓ CLARA misses many daily data prior to 1994 due to few satellites

Applications

- Climate analysis, Trend Analysis
- Solar energy assessment / Solar Atlas
- Quality control of surface measurements
- Climate Monitoring
- Evaluation of (climate) model
- Agrometeorology
- ……

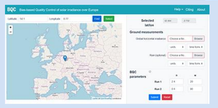


Urraca et al. 2018

Pfeifroth et al. 2018

- ✓ Almost 200 scientific publications use the CM SAF surface radiation data records
- ✓ For web-based applications see: www.cmsaf.eu → Outreach → Applications

ec.europa.eu/jrc/en/pvgis



www.bqcmethod.com

A little bit of history (SARAH)

SARAH-3 2021
- ✓ Improved performance over snow
- ✓ Spectral data sets
- ➢ 1983 – 2020
- ➢ CAL, SIS, SDI (SID + DNI), SDU, PAR, DAL
- ➢ 30-min, daily, monthly
- ➢ 0.05 deg

SARAH-2.1 2017, 2019
- ➢ 1983 – 2017
- ➢ CAL, SIS, SID, DNI, SRI, SDU
- ➢ 30-min, daily, monthly
- ➢ 0.05 deg
- ➢ MAD: 5.1 W/m2
- ➢ Pfeifroth et al., 2018

SARAH 2015
- ➢ 1983 – 2013
- ➢ CAL, SIS, DNI
- ➢ Hourly, daily, monthly
- ➢ 0.05 deg
- ➢ MAD: 5.5 W/m2
- ➢ Müller et al., 2015

MVIRI 2011
- ➢ 1983 – 2005
- ➢ CAL, SIS, SID
- ➢ Hourly, daily, monthly
- ➢ 0.03 deg
- ➢ MAD: 7.8 W/m2
- ➢ Posselt el al., 2012

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