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Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DATASET DESCRIPTION

Gridded (1 km) hourly near-realtime data of surface irradiance and sunshine duration based on surface measurements and satellite observations - DUETT Project

Version: v8d

Publication date: 2025

Cite data set as:	Gridded (1 km) hourly near-realtime data of surface irradiance and sunshine duration based on surface measurements and satellite observations - DUETT Project, Version v8d
Dataset-ID:	urn:wmo:md:de-dwd-cdc:5ffce5ae-3b32-4e43-9457-374c1bce6204
Dataset-URL:	https://opendata.dwd.de/climate_environment/CDC/grids_germany/hourly/duett/radiation_global/recent
Dataset-URL:	https://opendata.dwd.de/climate_environment/CDC/grids_germany/hourly/duett/sunshine_duration/recent
Dataset-URL:	https://opendata.dwd.de/climate_environment/CDC/grids_germany/hourly/duett/DUETT_ListOfStations.csv

ABSTRACT

These data are generated by combining satellite-based and surface-measured data of the surface irradiance (global radiation) and the sunshine duration. The associated algorithms have been developed within the DUETT-project and are continuously adjusted and improved. Gridded data (EPSG-3035 projection, Germany) of the surface irradiance and the sunshine duration are generated with a spatial resolution of 1 km and a temporal resolution of 1 hour (average / sum for synoptic hours, ending at minute 50). The data set is separated into two parts: the directory ./{parameter}/recent/ contains the latest data; in the directory ./{parameter}/historical/ older data are archived.

POINT OF CONTACT

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DATASET DESCRIPTION

Parameter	global radiation, sunshine duration
Temporal coverage	2024-01-01 -- ...
Temporal resolution	
Spatial coverage	stations in Germany
Projection	ETRS89 / LAEA Europe (EPSG:3035)
Format description	recent hourly mean surface downwelling shortwave radiation (SIS) : The folder .radiation_global/recent/ contains recent hourly gridded data files in netcdf-format. The naming of the files follows: {parameter}_duett_1km_DE_60min_{YYYYmmddHHMM}_{version}.nc
Format description	recent hourly sunshine duration (SDU) : The folder .sunshine_duration/recent/ contains hourly gridded data of the current year in netcdf format. The namng convention of the netcdf-files is: {parameter}_duett_1km_DE_60min_{YYYYmmddHHMM}_{version}.nc
Format description	List of stations : Liste der Stationen mit Insitu-Messungen, welche zur Erzeugung des Rasterproduktes verwendet werden.

DATA ORIGIN

The gridded data are based on satellite observations and surface measurements. The used satellite data are generated by DWD in near-realtime every 10-min as instantaneous data of the suface radiation in 1.5 km resolution based on data from the geostationary Meteosat satellite. The surface measurements (aggregated over 10 min) are collected at 42 locations from the DWD network (mainly pyranometer instruments). Both data sets are aggregated to synoptic hourly data. A geostatistical algorithm is used to generate the gridded data of surface irradiance and sunshine duration from those two data sources.

RESOURCE MAINTENANCE

In the directory ./recent/ the data files are updated hourly.

In the directories ./{parameter}/historical/ the data files are updated annually.
The hourly data files are merged into monthly files.

VALIDATION AND UNCERTAINTY ESTIMATE

The gridded data are regularly compared with direct measurements of sunshine duration and global radiation at independent stations. There are only minor systematic differences (approx. 1 min for the sunshine duration, approx. 10 W/m2 for the global radiation, each approx. 5%); the mean absolute deviations are in the range of approx. 6 min and 30 W/m2, respectively. For specific situations, the deviations can be significantly lower or higher than the average. The data contain also information on the uncertainty of the surface irradiance and the sunshine duration. These are estimated on the basis of the statistics of the differences between the satellite and the surface measurement data, the surrounding data variability and the geometric uncertainty of the cloud observation.

UNCERTAINTIES

The main focus of these products is on the provision of near real-time observations. The software for generating the gridded data is constantly being improved and updated, which can lead to discontinuities when analysing long time series. In the case of heterogeneous cloud conditions, especially in mountainous regions, the gridded data may differ, sometimes significantly, from the measurements of nearby stations. This is due to the different spatial representativeness of the two measurement methods. Small-scale features such as cumulus clouds or fog patches may not be represented in the gridded data. Further sources of error are geometric errors, which are caused by different positions of the satellite and the sun relative to the observation point. When the sky is clear and there is snow cover, the grid data may potentially underestimate solar radiation and sunshine duration, as it is difficult for satellites to distinguish between snow-covered ground and cloud cover.

CONSIDERATIONS FOR APPLICATIONS

The data represent the spatially averaged value for the specified grid area.

ADDITIONAL INFORMATION

The gridded data are obtained from ground measurements and satellite data using a geo-statistical method. This method is subject to continuous further development; a temporal homogeneity of the data cannot be guaranteed. Changes in the method used are indicated in the file name. A complete check of the data does not take place; we are grateful for information on problematic data points in the raster data (see Contact).

LITERATURE

Brinckmann et al., EMS 2022: Combination of satellite and ground measurements of hourly surface solar radiation data in Germany

Klameth et al., 2022:Towards the combination of in-situ and satellite-based solar radiation data in near-realtime – the project DUETT at DWD

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REVISION HISTORY

This document is maintained by Deutscher Wetterdienst, CMSAF - Satelliten-gestütztes Klimamonitoring, last edited at 2025-11-28.