ECMWF COPERNICUS | REPORT

Copernicus
Europe's eyes on Earth

Copernicus Atmosphere Monitoring Service

The Copernicus Atmosphere Monitoring Service (CAMS) Radiation Service in a nutshell

Version 21

Issued by: M. Schroedter-Homscheidt, DLR

Date: 20/12/2024

REF.: Service Contract No 2021/CAMS2_73/SC2

European Commission

Copernicus
Europe's eyes on Earth

IMPLEMENTED BY
ECMWF

This document has been produced in the context of the Copernicus Atmosphere Monitoring Service (CAMS).
The activities leading to these results have been contracted by the European Centre for Medium-Range Weather Forecasts, operator of CAMS on behalf of the European Union (Contribution Agreement signed on 22/07/2021). All information in this document is provided "as is" and no guarantee or warranty is given that the information is fit for any particular purpose.
The users thereof use the information at its sole risk and liability. For the avoidance of all doubts, the European Commission and the European Centre for Medium-Range Weather Forecasts has no liability in respect of this document, which is merely representing the authors view.

The Copernicus Atmosphere Monitoring Service (CAMS)

All-Sky Radiation Service in a nutshell

The atmosphere service of Copernicus combines state-of-the-art atmospheric modelling on aerosols with Earth observation data to provide information services covering European air quality, global atmospheric composition, climate, and UV and solar energy. The CAMS Radiation Service provides a fast parameterisation of the radiative transfer in the atmosphere (Fig. 1) and couples cloud-free sky parameters as aerosols, water vapour, and ozone with satellite-based cloud information (Fig. 2).

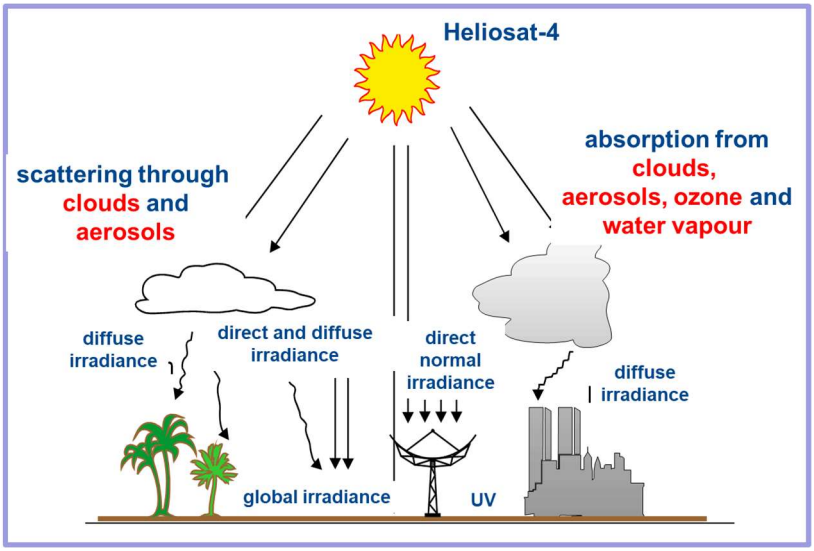

Figure 1: Principle of radiative transfer which is the basis of the CAMS Radiation Service

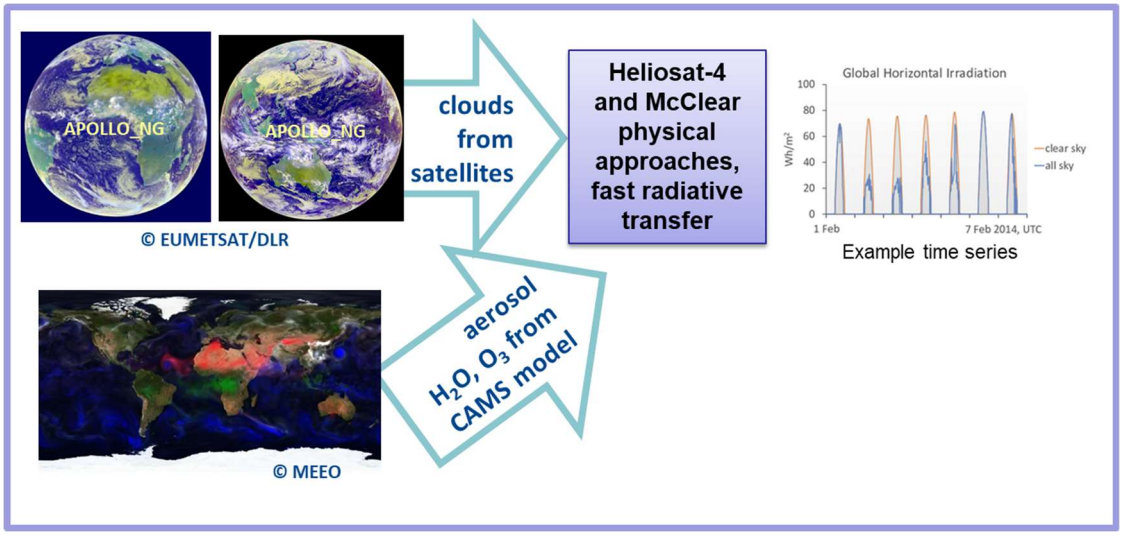

Figure 2: Combination of satellite-based cloud information with model based aerosol, water vapour and ozone information to derive time series of solar radiation at the surface in cloudy and cloud-free conditions

The CAMS Radiation Service is jointly provided by DLR, Armines, and Vaisala France. The Monitoring Atmospheric Composition and Climate (MACC) project series prepared for the service provision, which is now operational as part of the Copernicus programme.

- Period of record: Feb 2004–present for Meteosat and Jan 2016 for Himawari satellite field of view, data is provided with up to 2 days delay
- Temporal resolution: 1 min, 15 min, 1 h, day, month
- Spatial coverage: Europe/Africa/Middle East/Eastern part of South America/Atlantic Ocean in the Meteosat field of view; part of Asia and Australia in the Himawari field of view
- Spatial resolution: Interpolated to the point of interest
- Data elements and sources: Global, direct, diffuse, and direct at normal incidence irradiation; global, direct, diffuse and direct normal irradiation in cloud free conditions; verbose mode with all atmospheric input parameters used for clouds, aerosols, ozone, water vapour, and the surface reflective properties.
  For cloudy atmospheres, the direct components (also known as beam components) include both non-scattered and scattered radiation within the field-of-view of a pyrheliometer.
- Data quality control and assessment: Input quality control, regular quarterly benchmarking against ground stations, regular monitoring the consistency and detecting possible trends.
- Availability:
  https://ads.atmosphere.copernicus.eu/datasets/cams-solar-radiation-timeseries for time series at user-defined locations of interest and including the expert mode with detailed access to inputs used
  https://ads.atmosphere.copernicus.eu/datasets/cams-gridded-solar-radiation for a pre-calculated gridded dataset in 15 min and 0.1° latitude/longitude grid
- Updates: Continuous.
- Data policy: Following the Copernicus data policy – free for any use.
- Documentation:
  Dataset information at https://ads.atmosphere.copernicus.eu/datasets/cams-solar-radiation-timeseries?tab=overview

  User Guide at https://ads.atmosphere.copernicus.eu/datasets/cams-solar-radiation-timeseries?tab=documentation
  Quarterly validation reports at https://atmosphere.copernicus.eu/supplementary-services
- Scientific references:
  APOLLO_NG/Heliosat-4: Schroedter-Homscheidt et al., Surface solar irradiation retrieval from MSG/SEVIRI based on APOLLO Next Generation and HELIOSAT-4 methods, Meteorol. Z./Contrib. Atm. Sci., DOI10.1127/metz/2022/1131

  Heliosat-4 method: Qu, Z., Oumbe, A., Blanc, P., Espinar, B., Gesell, G., Gschwind, B., Klüser, L., Lefèvre, M., Saboret, L., Schroedter-Homscheidt, M., and Wald L.: Fast radiative transfer parameterisation for assessing the surface solar irradiance: The Heliosat-4 method, *Meteorol. Z.*, 26, 33-57, doi: 10.1127/metz/2016/0781, 2017

The Copernicus Atmosphere Monitoring Service (CAMS) Clear Sky Radiation Service in a nutshell

The fast clear-sky model called Copernicus McClear implements a fully physical modelling replacing empirical relations or simpler models used before. It exploits the recent results on aerosol properties and total column content in water vapour and ozone produced by the Copernicus service. It provides irradiances that would be observed in cloud-free conditions.

- Period of record: 2004–present, data is provided with up to 2 days delay
- Temporal resolution: 1 min, 15 min, 1 h, day, month
- Spatial coverage: Global
- Spatial resolution: Interpolated to the point of interest
- Data elements and sources: clear sky (i.e. cloud free) global, direct, diffuse and direct at normal incidence irradiances; verbose mode with all atmospheric input parameters used for clouds, aerosols, ozone, water vapour and the surface reflective properties.
- Data quality control and assessment: Input quality control, regular benchmarking against ground stations, regular monitoring of consistency and detecting possible trends
- Availability:
  https://ads.atmosphere.copernicus.eu/datasets/cams-solar-radiation-timeseries for time series at user-defined locations of interest and including the expert mode with detailed access to inputs used
  https://ads.atmosphere.copernicus.eu/datasets/cams-gridded-solar-radiation for a pre-calculated gridded dataset in 15 min and 0.1° latitude/longitude grid
- Updates: Continuous.
- Data policy: Following the Copernicus data policy – free for any use.
- Documentation:
  Dataset information at https://ads.atmosphere.copernicus.eu/datasets/cams-solar-radiation-timeseries?tab=overview
  User's Guide at https://ads.atmosphere.copernicus.eu/datasets/cams-solar-radiation-timeseries?tab=documentation
  Quarterly validation reports at https://atmosphere.copernicus.eu/supplementary-services
- Scientific references:
  McClear V2: Lefèvre, M., Oumbe, A., Blanc, P., Espinar, B., Gschwind, B., Qu, Z., Wald, L., Schroedter-Homscheidt, M., Hoyer-Klick, C., Arola, A., Benedetti, A., Kaiser, J., W., and Morcrette, J.-J.: McClear: a new model estimating downwelling solar radiation at ground level in clear-sky conditions, *Atmos. Meas. Tech.*, 6, 2403–2418, doi: 10.5194/amt-6-2403-2013, 2013.
  McClear V3: Gschwind, B., Wald L., Blanc, P., Lefèvre, M., Schroedter-Homscheidt, M., Arola, A., 2019. Improving the McClear model estimating the downwelling solar radiation at ground level in cloud free conditions – McClear-V3., Meteorol. Z./Contrib. Atm. Sci., 28, 2, 147-163, doi:10.1127/metz/2019/0946.

ECMWF Shinfield Park Reading RG2 9AX UK

Contact: info@copernicus-atmosphere.eu