



**Copernicus Atmosphere Monitoring Service**



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

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

The atmosphere service of Copernicus combines state-of-the-art atmospheric modeling on aerosols with Earth observation data to provide information services covering European air quality, global atmospheric composition, climate, and UV and solar energy. Within the radiation service, existing historical and daily updated databases HelioClim-3 and SOLEMI for monitoring incoming surface solar irradiance are further developed. The new service is jointly provided by DLR, Armines, and Transvalor. The Monitoring Atmospheric Composition and Climate (MACC) project series have been prepared for the service provision, which is now operational as part of the Copernicus programme. Data are made available both via the Copernicus portal and the SODA portal.

- Period of record: Feb 2004–present, data is provided with up to 2 days delay
- Temporal resolution: 1-minute, 15-minute, hour, day, month
- Spatial coverage: Europe/Africa/Middle East/Eastern part of South America/Atlantic Ocean.
- Spatial resolution: Spatial resolution is the original pixel of the Meteosat Second Generation image (approx. 3 km at satellite nadir and 5 km at mid-latitude).
- Data elements and sources: Global, direct, diffuse, and direct at normal incidence irradiances; global, direct, diffuse and direct normal irradiances in cloud free conditions; verbose mode with all atmospheric input parameters used for clouds, aerosols, ozone, water vapor and the surface reflective properties.
- Data quality control and assessment: Input quality control, regular quarterly benchmarking against ground stations, regular monitoring the consistency and detecting possible trends.
- Estimated uncertainties: The 15 min means of irradiance estimated by Heliosat-4 were compared to corresponding measurements made at 13 stations within the Baseline Surface Radiation Network and being located in the field of view of MSG and in various climates. The bias for global irradiance was comprised between 2 and 32  $W m^{-2}$ . The root mean square error (RMSE) ranged between 74 and 94  $W m^{-2}$ . Relative RMSE values ranged between 15% and 20% of the mean observed irradiance for stations in desert and Mediterranean climates, and between 26% and 43% for rainy climates with mild winters. Correlation coefficients between 0.91 and 0.97 were found. The bias for the direct irradiance at normal incidence was comprised between -163 and +50  $W m^{-2}$ . The RMSE ranged from 160  $W m^{-2}$  (29% of the mean observed irradiance) to 288  $W m^{-2}$  (63%). The correlation coefficient ranged between 0.67 and 0.87.



- Documentation: User's Guide at the Copernicus portal [https://atmosphere.copernicus.eu/sites/default/files/repository/MACCIII\\_RAD\\_DEL\\_D57.5\\_final\\_0.pdf](https://atmosphere.copernicus.eu/sites/default/files/repository/MACCIII_RAD_DEL_D57.5_final_0.pdf)
- Availability: Copernicus portal <http://atmosphere.copernicus.eu/> and the SODA portal <http://www.soda-pro.com/web-services/radiation/cams-radiation-service>.
- Updates: Continuous.
- Data policy: Following the Copernicus data policy – free for any use, also commercial use, not allowed to sell directly without modification.

## 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 modeling replacing empirical relations or simpler models used before. It exploits the recent results on aerosol properties and total column content in water vapor and ozone produced by the Copernicus service. Data are made available both via the Copernicus and the SODA service.

- Period of record: 2004–present
- Temporal resolution: 1-minute, 15-minute, hour, 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 vapor 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
- Estimated uncertainties: McClear irradiances were compared to 1 min measurements made in clear-sky conditions at several stations within the Baseline Surface Radiation Network in various climates. The bias for global irradiance comprised between  $-6$  and  $25 \text{ Wm}^{-2}$ . The RMSE ranged from  $20 \text{ Wm}^{-2}$  (3% of the mean observed irradiance) to  $36 \text{ Wm}^{-2}$  (5 %) and the correlation coefficient ranged between 0.95 and 0.99. The bias for the direct irradiance comprised between  $-48$  and  $+33 \text{ Wm}^{-2}$ . The root mean square error (RMSE) ranged from  $33 \text{ Wm}^{-2}$  (5 %) to  $64 \text{ Wm}^{-2}$  (10 %). The correlation coefficient ranged between 0.84 and 0.98.



- Documentation: User's Guide at the Copernicus portal [https://atmosphere.copernicus.eu/sites/default/files/repository/MACCIII\\_RAD\\_DELD57.5\\_final\\_0.pdf](https://atmosphere.copernicus.eu/sites/default/files/repository/MACCIII_RAD_DELD57.5_final_0.pdf)
- Availability: Copernicus portal <http://atmosphere.copernicus.eu/> and the SODA portal <http://www.soda-pro.com/web-services/radiation/cams-mcclear>
- Updates: Continuous.
- Data policy: Following the Copernicus data policy – free for any use, also commercial use, not allowed to sell directly without modification

## References

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User's Guide at

[https://atmosphere.copernicus.eu/sites/default/files/repository/MACCIII\\_RAD\\_DELD57.5\\_final\\_0.pdf](https://atmosphere.copernicus.eu/sites/default/files/repository/MACCIII_RAD_DELD57.5_final_0.pdf)

