



Comparison of several databases of downward solar daily irradiation data at ocean surface with PIRATA measurements

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The solar radiation impinging at sea surface is an essential variable in climate system. There are several means to assess the daily irradiation at surface, such as pyranometers aboard ship or on buoys, meteorological re-analyses and satellite-derived databases. Among the latter, assessments made from the series of geostationary Meteosat satellites offer synoptic views of the tropical and equatorial Atlantic Ocean every 15 min with a spatial resolution of approximately 5 km. Such Meteosat-derived databases are fairly recent and the quality of the estimates of the daily irradiation must be established. Efforts have been made for the land masses and must be repeated for the Atlantic Ocean. The Prediction and Research Moored Array in the Tropical Atlantic (PIRATA) network of moorings in the Tropical Atlantic Ocean is considered as a reference for oceanographic data. It consists in 17 long-term Autonomous Temperature Line Acquisition System (ATLAS) buoys equipped with sensors to measure near-surface meteorological and subsurface oceanic parameters, including downward solar irradiation. Corrected downward solar daily irradiation from PIRATA were downloaded from the NOAA web site and were compared to several databases: CAMS RAD, HelioClim-1, HelioClim-3 v4 and HelioClim-3 v5. CAMS-RAD, the CAMS radiation service, combines products of the Copernicus Atmosphere Monitoring Service (CAMS) on gaseous content and aerosols in the atmosphere together with cloud optical properties deduced every 15 min from Meteosat imagery to supply estimates of the solar irradiation. Part of this service is the McClear clear sky model that provides estimates of the solar irradiation that should be observed in cloud-free conditions. The second and third databases are HelioClim-1 and HelioClim-3 v4 that are derived from Meteosat images using the Heliosat-2 method and the ESRA clear sky model, based on the Linke turbidity factor. HelioClim-3 v5 is the fourth database and differs from v4 by the partial use of McClear and CAMS products. HelioClim-1 covers the period 1985-2005, while the others start in 2004 and are updated daily. Deviations between PIRATA measurements and estimates were computed and summarized by usual statistics. Biases and root mean square errors differ from one database to the other. As a whole, the correlation coefficients are large, meaning that each database reproduces the day-to-day changes in irradiation well. These good results will support the development of a satellite-derived database of daily irradiation created by MINES ParisTech within the HelioClim project. The size of the cells will be 0.25° . HelioClim-1 and HelioClim-3v5 will be combined yielding a period coverage of 32 years, from 1985 to 2016, thus allowing analyses of long term variability of downward shortwave solar radiation over the Atlantic Ocean.