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Evaluating the spatial and temporal variations of the performance of CAMS Radiation Service and HelioClim-3 databases of surface irradiation in Germany

Mathilde Marchand (1), Yves-Marie Saint-Drenan (2), Laurent Saboret (1), Claire Thomas (1), and Lucien Wald (2)

(1) Transvalor Innovation, Mougins, France (mathilde.marchand@transvalor.com), (2) MINES ParisTech, PSL Research University, OIE – Center Observation, Impacts, Energy, Sophia Antipolis, 06904, France

Satellite-derived databases of the surface solar irradiance (SSI) have become an essential source of information for various applications in solar energy. Assessing the accuracy of these data by comparison with reference in-situ measurements is therefore ever gaining in importance. Several authors have reported that performances of a given database differ from one site to another depending on the geographical region, topography, orography, climate, viewing angle from the satellite... A good understanding of the spatial and temporal variation of the SSI estimation error is key to allow end-user to have an appropriate level of expectation on the accuracy of this data. This knowledge can also be very important for the further developments of the algorithms.
The present work contributes to this objective by extending the validation works carried out in the last years for numerous regions (Europe, Brazil, Egypt, Arabic Peninsula, Morocco and The Netherlands) to Germany. We consider two databases: the CAMS Radiation Service version 3 (abbreviated as CAMS-Rad) and the HelioClim-3 version 5 (abbreviated as HC3v5) that are widely used by academics and practitioners.
The present communication focuses on several stations located in Germany operated by the Deutscher Wetterdienst (DWD). They are spread over the country, thus allowing the study of the spatial consistency of the performance of each database. Measurements of 10 min means of global irradiance made by pyranometers (CM11 and CM21) and SCAPP set publicly available by the DWD for the period 2010-2018 (9 years) have been used for the validation. Measurements were quality-checked using the method described by Roesch et al. (2011).
Satellite-derived SSI estimates were collected from the SoDa web site (www.soda-pro.com) for the same locations and same instants of measurements for both databases. CAMS-Rad uses the Heliosat-4 method with different inputs: the clear-sky radiation is evaluated using Copernicus Atmosphere Monitoring Service (CAMS) information on the aerosol, ozone and water vapour contained in the atmosphere, the cloud attenuation is considered using cloud optical properties retrieved every 15 min from Meteosat imagery using APPOLO. The second database is the HelioClim-3v5 that is derived from Meteosat images using the Heliosat-2 method, McClear and CAMS products.
For each database, standard error metrics are computed at each station. A particular attention is paid in the presentation of the validation results to evaluate the effects of different parameters such as e.g. the solar elevation and the clearness index on the error. A focus of this work is laid on the consistency of the errors with space and time.