EMS Annual Meeting Abstracts
Vol. 14, EMS2017-518, 2017

Spatial prediction of sunshine duration climatology over Germany merging satellite and in situ data

Jakub P. Walawender, Jörg Trentmann, Steffen Kothe, Uwe Pfeifroth, and Roswitha Cremer
Deutscher Wetterdienst, Climate and Environment, Offenbach, Germany (uwe.pfeifroth@dwd.de)

The purpose of this study is to create a 1 km2 gridded daily sunshine duration data record for Germany covering the period from 1983 to 2015 based on satellite estimates of direct normalised surface solar radiation and in-situ sunshine duration observations using a geostatistical approach.

The CM SAF SARAH direct normalized irradiance (DNI) satellite climate data record and in situ observations of sunshine duration from weather stations operated by DWD are used as input datasets. The selected period of 33 years is associated with the availability of satellite data. In order to achieve long-term constistency of the final sunhine duration dataset, 121 station have been used that have at least 90% data availability.
In the first step, DNI data record is used to derive sunshine hours by applying the WMO threshold of 120 W/m2 (SDU = DNI > 120 W/m2) and weighting of sunny slots to correct the sunshine length between two instantaneous satellite images due to cloud movements. In the second step, linear regression between SDU and in situ sunshine duration is calculated to adjust the satellite product to the ground observations and the output regression coefficients are applied to create a regression grid.
In the last step regression residuals are interpolated using ordinary kriging and added to the regression grid. An accuracy assessment of the final gridded sunshine duration data record is performed by calculating prediction errors (cross-validation routine). “R” is used for data processing. A short analysis of the spatial distribution and temporal variability of sunshine duration over Germany based on the created dataset will be presented.
The gridded sunshine duration data record can be used for various applications in climate-related studies, as well as in agriculture and solar energy potential calculations.