



## **Exploring the use of variogram in the validation of the CAMS Radiation Service**

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Several data sets of the downwelling solar radiation received at surface exist that are derived from satellite images. They are the subject of validation activities. A protocol for validation has been proposed several years ago by the Task SHC 36 of the International Energy Agency. It compares coincident time series of satellite-derived estimates and measurements of irradiance performed at terrestrial stations. As such, it estimates the ability of a data set to reproduce exactly the series of measurements at a given time scale. If the protocol is used at several nearby stations, then some conclusion may be drawn on the ability of the data set to reproduce the spatial variability of the field of irradiance.

The present communication deals with the variogram that is another tool that may contribute to such an assessment on spatial variability. Depending on the case and assumptions made, it does not require the data to be coincident in time nor in space. The variogram and co-variogram are presented.

Hourly means of irradiance measured by pyranometers at 31 stations located in The Netherlands operated by the met-office KNMI have been collected from the KNMI website. Measurements were quality-checked using recognized procedures. In this preliminary study, only measurements performed at 12:00 UT have been retained for the sake of the simplicity. The 31 stations are close to each other and the orographic effects on the solar irradiance are limited in the Netherlands. It is a favorable area for this study, especially at exploring the benefit that the variogram may bring to validation.

Estimates were collected from the Copernicus Atmosphere Monitoring Service (CAMS) Radiation Service version 3 (abbreviated as CRS) for the entire area and same hours. Clearness indices were computed from measurements and estimates. In addition, estimates of the irradiance that should be received if the sky were cloud-free were collected from the CAMS McClear service. Variograms were computed with measurements on the one hand and CRS and McClear on the other hand, and then compared. Co-variograms were also computed that describe the co-variability of the measurements and CRS estimates. Since the field has two dimensions: latitude and longitude, tests were made by computing variograms along each dimension and by integrating over the space. Eventually, variograms were computed taking into account all terrestrial pixels of the CRS data set in The Netherlands. The results and conclusions on the use of variogram will be presented.