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Solar radiation in Southern Africa: assessing the quality of the HelioClim-1 database

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The solar radiation reaching the ground level on horizontal surfaces is of interest to many domains: agriculture, climate, energy, human health, meteorology... MINES ParisTech has constructed the HelioClim-1 database to supply researchers and other users with estimates of the daily irradiation received at surface. Images of the Meteosat series of satellites for 21 years: 1985-2005 were processed by the means of the Heliosat-2 method converting grey values into surface irradiation. The database covers Europe, Africa and Atlantic Ocean. To perform a comparison, measurements made daily in the meteorological networks in Southeast Africa: Mozambique, Zambia, Zimbabwe, were collected from the World Radiation Data Center. Data from the BSRN (baseline radiation network) station in De Aar (South Africa) was also added, thus totaling 22 stations. The quality of these measurements was questioned prior to the comparison, and several stations were removed from the list. The differences in type of observation between pyranometers: pinpoint, time-integrated measurements, and satellite sensors: instantaneous, space-integrated measurements, are discussed as well as their influence on the assessment of the quality of HelioClim-1. It is also found that changes in ground elevation within a cell may play a significant role. Overall, the quality of HelioClim-1 is good: the root mean square difference is approximately 350 J/cm^2, (approx 17% of the mean observed value) and the correlation coefficient is most often greater than 0.85. These results are similar to those obtained by previous studies for Europe. HelioClim-1 is freely available through the SoDa Service (http://www.soda-is.com) and offers a reliable and accurate knowledge of the solar radiation and its daily, seasonal and annual variations over recent years.