

## Increasing the accuracy of HelioClim-1 using HelioClim-3

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The HelioClim project of MINES ParisTech aims at producing fields of surface solar downward irradiation (SSI). To that purpose, images of the first generation of the Meteosat series were processed with the Heliosat-2 method to create and update the HelioClim-1 database containing daily SSI for the period 1985-2005. The HelioClim-1 database (HC1v4) has been validated against measurements performed by pyranometers at ground stations and has been promoted to Data Collection of Open Resources for Everyone (Data-CORE) by the GEOSS (Global Earth Observation System of Systems). The GEOSS Data-CORE is a distributed pool of documented data sets with full, open and unrestricted access. Heliosat-2 was further adapted to processing of images from the second generation of the Meteosat satellites. Since 2004, Meteosat images are acquired at MINES ParisTech every 15 min and routinely processed to update the HelioClim-3 database containing 15 min SSI. Access to the HelioClim databases is given by the SoDa Service ([www.soda-pro.com](http://www.soda-pro.com)).

It was found that HelioClim-3, and especially its version 5 HC3v5, is more accurate than HelioClim-1 when compared to ground measurements. Because HelioClim-1 is widely used, it is tempting to try to improve its accuracy by using HelioClim-3. This communication presents the methods that have been studied and the benefits of the adjusted HelioClim-1 when compared to ground measurements.

The methodology is to adjust HC1v4 daily irradiation onto HC3v5 daily irradiation for the common period Feb 2004-2005 (23 months), then apply the adjustment onto the entire HC1v4 from 1985 to Jan 2004, and then concatenate bias-adjusted HC1 and HC3v5 to yield the time series from 1985 to 2005. The possible improvement in bias and other statistical indicators brought by each method was assessed by comparing the original HC1 and the bias-adjusted HC1 with measurements from ground stations. Six approaches have been investigated: addition of difference in means or modes, ratio of means or modes, affine transform and quantile mapping. Each approach may apply to the clearness indices KT as well, i.e. the HC1 KT is adjusted and then the adjusted irradiation HC1 is computed by multiplying KT by the daily irradiation at the top of atmosphere. This makes a total of 12 methods that have been tested.

Seventeen stations having archives of measurements of daily SSI were used for validation.

It was found that no method clearly surpasses the others. However, it was observed that the method 'quantile mapping' applied to KT (QM KT) exhibits much better results than the others for all indicators: standard deviation, root mean square error, correlation coefficient and median, except the bias. QM KT improves the bias in 12 stations over 17 (13 for clearness index) and exhibit a slight degradation of the bias in the remaining cases.

The fusion of HC1 and HC3v5 is feasible in an easy way that can be turned into operation. In most cases, the adjusted HC1 performs better than HC1 when compared to qualified daily irradiation measured in meteorological networks.