



Homogenization and trend analysis of the 1958-2016 in-situ surface solar radiation records in China

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This job presents a method to homogenize China's surface solar radiation (SSR) data and uses the resulting homogenized SSR data to assess the SSR trend over the period 1958-2016. Neighboring surface sunshine duration (SSD) data are used as reference data to assess the SSR data homogeneity. A Principle Components Analysis is applied to build a reference series, which is proven to be less sensitive to occasional data issues than using the arithmetic mean of data from adjacent stations. A relative or absolute test is applied to detect change points, depending on whether or not a suitable reference series is available. A Quantile-Matching method is used to adjust the data to diminish the inhomogeneities.

As a result, 60 out of the 119 SSR stations were found to have inhomogeneity issues. These were mainly caused by changes in instrument and observation schedule. The non-climatic changes exaggerated the SSR change rates in 1991-1993 and resulted in a sudden rise in the national average SSR series, causing an unrealistically drastic trend reversal in the 1990s. This was diminished by the data homogenization.

The homogenized data show that the national average SSR has been declining significantly over the period 1958-1990; this dimming trend mostly diminished over the period 1991-2005 and was replaced by a brightening trend in the recent decade. From the homogenized SSR data, the 1958-1990 and 1958-2005 dimming rate is estimated to be -6.13 ± 0.47 and -5.08 ± 0.27 Wm⁻² decade⁻¹, respectively, and the 2005-2016 brightening rate 6.13 ± 1.77 Wm⁻² decade⁻¹.