



Feasibility of sunshine duration records to detect changes in atmospheric aerosols: review and new evidences

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The suitability of traditional sunshine duration recorders, e.g. the Campbell-Stokes recorder invented in 1879, to detect changes in the atmospheric turbidity has been previously reported, especially due to changes in atmospheric aerosol concentrations. It is widely recognized that aerosols play a complex role in the Earth's radiation budget enhancing the absorption and scattering of incoming solar radiation, and therefore weakening the direct solar radiation needed to activate the sunshine recorder, mainly during the sunrise and sunset. In this study we present a review of the results published up to the present about the feasibility of sunshine recorders to detect changes in the atmospheric turbidity. In addition, we present the results of an experimental measurement campaign that was carried out in Valencia (eastern Spain) during the summer of 2011. The results confirm the suitability of the Campbell-Stokes observations to identify changes in atmospheric aerosol concentrations. The historical long-term sunshine duration series is used to reconstruct surface solar radiation under clear-sky (overcast) conditions in Valencia, with the aim of studying the possible direct (indirect) effects of the aerosols during the 1938-2010 period. These analyses can be extended to other geographical areas with available long-term series of sunshine duration in order to estimate changes in atmospheric turbidity since late 19th century.