



From Dimming to Brightening: Uncertainty of Measurements

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Intensity and distribution of solar radiation determine the earth's weather and climate. Because of its importance, G has been observed with a pyranometer globally since late 1950's. Such observations suggest a widespread decrease between the 1950s and 1980s ('global dimming'), with a partial recovery more recently at many locations ('brightening'). In particular, G is reported to have decreased at a rate of -3.5 W m^{-2} per decade (or -2% per decade) averaged from 400 stations over land from 1960 to 1990. From 1986 to 2000, G increased at a rate of 2.2 W m^{-2} per decade (or 1.2% per decade) averaged from 352 stations over land. However, an essential question has not been answered: how the measurement uncertainty impacts the reported long-term trends of G? Under ideal conditions, G collected by an unshaded pyranometer has an uncertainty of 5%. However, if the uncertainty is time independent, the trends may be still reliable and it is desirable to examine the uncertainties further. The Uncertainty of G measurements at different time scales has been examined in this study.