Evaluation of solar indices used in semi-empirical proxy models of solar irradiance

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The most important environmental problems facing humanity today is to understand and predict global change (both natural and man-induced) as well as the rapid changes in our space environment. The critical issue is to understand the relative impacts of natural and anthropogenic influences on changes in the Earth's atmosphere. However, the time period of interest far exceeds the lifespan of any single experiment. Accordingly, composite irradiance time series must be compiled from data of several irradiance experiments. Further, on time scales longer than the three-decade long irradiance measurements or in the absence of direct space irradiance observations, surrogates for irradiance have to be used to mimic/model the irradiance changes. The question is however how well these indices used for irradiance modeling are reliable for predicting irradiance changes on various time scales. In this paper we compare total solar and UV/EUV irradiances with various solar indices, such as the Ca K index, He line equivalent width at 1083 nm, full disk magnetic flux, facular and sunspot areas, the GOES X-ray data, 10.7 cm radio flux and the international sunspot number. Our goal is to establish to what degree these indices can represent solar irradiance variability over the entire solar spectrum and at various wavelengths.