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Reconstruction of total and spectral solar irradiance in the satellite era

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Total and spectral solar irradiance are key to understanding the influence of the Sun on changes in the Earth's climate, and also represent a useful index of solar activity from the apparent relationship with solar magnetism. We present a SATIRE-S model reconstruction of total and spectral solar irradiance spanning the period of 1974 to 2013. The model ascribes variation in solar irradiance, on timescales greater than a day, to the occurrence and evolution of magnetic structures on the photosphere. This is an update of preceding efforts with the model based on full disc magnetograms from the KPVT and SoHO/MDI. We extended the model to the present with similar observations from SDO/HMI, and cross calibrated the various magnetogram data sets to yield a single, consistent solar irradiance time series. The decadal trend in the PMOD composite record of total solar irradiance is almost exactly reproduced, giving support to solar surface magnetism as a driver of secular variation in solar irradiance. The reconstruction exhibits excellent agreement with various measurements of spectral solar irradiance ($R^2 \gtrsim 0.9$) but diverge significantly from the observations from SORCE/SIM, adding to existing evidence that SIM measurements might contain unresolved instrumental trends.