



Long-term variations of total, UV-A, and erythemal irradiance at Thessaloniki, Greece

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The time series of the Total (TSI), UV-A, and erythemal solar irradiance for a period of 19 years (1993-2011) over Thessaloniki, Greece, are analyzed to derive information on their long-term changes. All these radiation quantities are regularly monitored with one minute time resolution. The long-term changes are estimated for the entire datasets, for subsets under cloud-free conditions, and for different solar zenith angles (SZA), separately for each season. The calculated linear trends depend on the spectral band and SZA, and each band is influenced differently by atmospheric constituents such as clouds, ozone and aerosols. Since Thessaloniki constitutes a characteristic urban-industrial complex, the long-term change in AOD for the same period is also investigated. The AOD is derived spectrally from direct solar irradiance sun measurements by a co-located spectroradiometer. The effect of the variations in the AOD on the long-term changes in solar irradiance is investigated for the dataset recorded under clear skies. The observed differences in the seasonal trends of solar irradiance at the three spectral bands are discussed with respect to the seasonal characteristics of the aerosol optical properties. Finally the statistical method of the cumulative sums is employed on the data to investigate the temporal changes in the trends during the period and to detect any changes in the sign of the trends.