

Reconstruction and Analysis of the 1964–2013 Erythemal UV Radiation Time Series from Hradec Králové, Czech Republic

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The changes in ozone have a significant impact on the levels of ultraviolet radiation (UV) which then may affect ecosystems and human health. Since most of the UV radiation time series are relatively short, in order to study its long-term changes, UV radiation reconstructions are essential. The 1964–2013 time series of erythemal UV radiation from Hradec Králové, Czech Republic, was reconstructed based on total ozone, global radiation, aerosols and surface albedo measurements using the libRadtran Radiative Transfer model and the empirical relationship of cloud modification factors for global and UV radiation and solar zenith angle. The analysis of the reconstructed time series documented that daily erythemal UV doses increased significantly especially in the period after 1980. The increase was most significant in spring and summer and could be attributed to the changes in total ozone and cloud cover. The relationship between UV radiation doses, total ozone and cloud cover was studied using multiple linear regression models which explained most of the UV radiation time series' variability in all seasons except winter. The relative amount of UV radiation change since the 1960s attributed to the change of total ozone and cloud modification factor for erythemal UV radiation was also considered. In the last part of the time series analysis, the days with a very high daily erythemal UV dose were studied. The yearly number of days with a very high daily erythemal dose significantly increased during the studied period and was dependent on the levels of total ozone and cloud cover, as well as on the surface albedo. The largest percentage of days with a very high daily erythemal dose was caused by the effect of both low total ozone and clear to partly cloudy skies, followed by the effect of low total ozone only. In winter months, most days with a very high daily erythemal dose occurred in the presence of snow cover, but the effect of increased surface albedo was often accompanied by the low amount of total ozone and clear or partly cloudy skies.