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Effect of selected parameters on clear-sky solar UV radiation determined from Brewer spectrophotometer measurements in Poprad-Ganovce (Slovakia)

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Total column ozone has been measured by the Brewer ozone spectrophotometer MKIV 097 at Poprad - Ganovce (49.03 N, 20.32 E, 706 m a.s.l.) since 1993. Measurements show descending tendencies in total column ozone not only in spring months (probably as consequence of stratospheric ozone depletion caused by anthropogenic pollution) but also in summer and these changes possibly relate to altering atmospheric circulation patterns (Misaga, 2015). Along with these observations, there were detected ascending trends in global solar radiation since the 80-ty years in the investigated area and these trends can be explained by changes in aerosols and cloudiness (IPCC, 2013). The aim of the study was to compare influence of total column ozone and aerosol on clear-sky UV irradiance variability. Besides integral DUV irradiance (spectral global UV irradiance weighted by action spectrum for human erythema), UV irradiances with wavelengths of 306 nm and 320 nm were investigated. Measurements of the Brewer ozone spectrophotometer in period 1994-2015 were used for determination of all parameters – UV irradiance, total column ozone and aerosol optical depth (AOD) in the UV range of spectrum. AOD for radiation with wavelength of 320 nm was used as indicator of aerosol influence on the UV irradiance. Radiative transfer model calculations were compared with measured data. Influence of total ozone and aerosols was expressed by radiation amplification factor. Analysis of the data shows that inter-diurnal variability in clear-sky DUV irradiances by particular solar elevations caused by total column ozone is of comparable range with changes caused by AOD. Effect of both phenomena is more significant by smaller solar elevations. Though variability of total ozone is the biggest in spring months, joint influence of day-to day changes in total ozone and AOD is the biggest in summer, and in July it causes of ± 25 % variability in DUV irradiance against the DUV irradiance corresponding to mean total column ozone and AOD. Significantly bigger sensitivity to total ozone variability was detected for irradiance with wavelength of 306 nm in comparison to AOD or to ozone influence on irradiance with wavelength of 320 nm. The radiation amplification factor for the AOD was comparable for both wavelengths but it was calculated with bigger error due to higher variability in the irradiance with the wavelength of 306 nm.