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Satellite estimate of UV clear-sky erythemal irradiance: Comparison of ground-based and satellite retrieved UV data in Poland

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Clear sky estimate of erythemal irradiance is frequently used to inform public of risk of UV overexposure. WHO prepared a guideline to avoid excessive UV radiation in dependence of UV index value. Measurements of UV radiation are carried out in limited number of sites thus a satellite alternative estimate is necessary. Ozone content in the vertical column of atmosphere and aerosol optical depth (AOD) in UVB range are basic atmospheric parameters to be used in radiative transfer (RT) simulations of the clear-sky erythemal irradiance. Ground based values of AOD at 340 nm from Cimel sunphotometer observations at Belsk (51.85N, 20.84E) and Racibórz (50.08N, 18.19E) are used as input value to RT model (TUV). Other option is to use satellite AOD values from OMI measurements or from MERRA-2 reanalyses. Column amount of ozone is taken from OMI retrieval and for Belsk also by the Dobson sunphotometer measurements. The ground–based and satellite ozone are in good agreement , i.e. bias (ground based minus satellite) is ∼3% with RMSE ∼3%. Satellite AOD at 340 nm is ∼1.5 higher than the measured values and correlation coefficient is 0.52 (Belsk) and 0.61 (Raciborz). Mean AOD from MERRA-2 reanalysis (derived from 550 nm value transformed to 340 nm wavelength by use of Angstrom coefficient of 1.3) is ∼1.3 larger than corresponding Cimel values but with smaller the correlation coefficient of ∼0.3. However, MERRA-2 values are much more frequent comparing to OMI retrieved AOD. The clear-sky UV index is reasonably reproduced by satellite retrievals, i.e. bias (ground-based minus satellite) is around zero with RMSE of 7% for both stations. It means the accuracy of UVI estimate less than 1 i.e. within the range recommended by WHO. Surprisingly a good correspondence is also found using satellite ozone and MERRA-2 AOD with bias -1% and RMSE of 8%. Thus, there is a perspective of use this approach to model the long-term variability of UV index since January 1980.
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