Relationship between the UV index and selected parameters

Abstract

Ultraviolet radiation (UV radiation) is a shortwave radiation with wavelengths from 100 to 400 nm. This radiation has both positive and negative effects on living organisms and human health. Therefor the so-called UV index (UVI), characterizing the biological effect of UV radiation on human health was defined in 1994. This thesis aims to evaluate the link between selected factors (total ozone column, solar elevation angel, cloudiness and altitude) and the UVI values. Observed data at four stations in Czechia (Hradec Králové, Košetice, Kuchařovice, Labská bouda) and SYNOP reports from the four nearest stations during the period 2010−2017 were used. The Sun elevation (angle of Sun ray) has the strongest effect on the UVI values. The highest UVI values are generally reached at high angels when the Sun rays go the shortest path through the atmosphere. The increase of the UVI is exponential, from an angle of 30° the increase is approximately linear. The UVI values increase on average by 0.8 at the Hradec Králové station and by 0.9 at the Labská bouda station for angle increasing by 5°. The effect of clouds is significant and depends on the height and the clouds amount. High level clouds reduce UVI negligible, overcast sky by only 15 %. Medium and low level clouds reduce UVI by 15−64 %, depending on the total cloud cover. The reduction between 21−64 % was detected for cumulus and cumulonimbus. However, the same clouds slightly increase the UVI values if the sun disk is not covered. Because UVI depends explicitly on the intensity of UV-B radiation, its values are affected by the total ozone column (TOC) in stratosphere. At the same time, the values are strongly influenced by the Sun elevation. At the angles of 26°−46°, the decrease in TOC by 100 DU under otherwise the same conditions increase the UVI by 1.14, at an angle of 41°−55° by 0.47. The effect of altitude was confirmed of the UVI is by 28.5 % and 12.5 % per 1,000 altitude meters in winter and summer, respectively. The results of this diploma thesis significantly contributed to the accuracy improvement of the influence of individual parameters on the UVI values and to the possible improvement of the UVI prediction.