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Method of estimating cloud transmission in UV spectral range with the use of data of different satellite measurements and reanalysis.

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Cloudiness can significantly attenuate ultraviolet radiation (UVR) at the Earth's surface, however, in conditions with high surface albedo due to the effects of multiple reflection between cloud and surface the level of UVR can grow substantially.
The purpose of this work is the development of the method of evaluating the cloud UV transmission according to satellite data, which would provide more accurate retrievals of the UVR level at ground in conditions with high surface albedo. For the characteristic of cloud UV transmission we use CMF (Cloud modification factor), which is calculated as a ratio of global UVR in cloudy to global UVR in clear sky conditions and zero surface albedo.
There are different procedures for CMF evaluating which are based mainly on satellite data. However, there is a problem in the separation of situations between high surface albedo and thick clouds when the satellite data are used. Another problem is that the satellite measurements are not practically sensitive to the surface albedo under the presence of thick clouds. At the same time, due to the effects of multiple scattering there can be different UVR changes at the Earth's surface, which depend on the level of surface albedo. One of the methods of cloud UV transmission retrievals, based on the use of satellite data TOMS/OMI LER at the wavelength 380 nm, is presented in Eck et al [1995]. The task of this work is the improvement of cloud UV transmission estimates, using the TOMS/OMI data with additional account of surface albedo and cloud amount data. We propose the idea that TOMS LER at the wavelength 380 nm can be represented by the two parts: clear and cloud ones, taken with the weighted coefficients, which are evaluated from the cloud amount data. In this case clear part represents the reflectivity of surface, and cloud part - the reflectivity of clouds. Special attention was given to the selection of the data set for cloud amount. For this purpose we used the data of the reanalysis ECMWF ERA-Interim (1979-2002), satellite data - ISCCP, data of ground observations - EECRA. As the initial input parameters we used the TOMS LER at the wavelength 380 nm (1979-2002) and UV surface albedo (1979-1992) from the dataset proposed by Tanskanen [2004]. Employing this procedure we evaluated the monthly average cloud UV transmission for the territory of (40.5°N-79.5°N, 25.5°W-179.5°E) with the spatial resolution of $1^\circ \times 1^\circ$.
In order to test the obtained results, the comparisons were carried out with the experimental data of Meteorological Observatory of Moscow State University (MSU MO, 55.7°N, 37.5°E), which include measurements of erythemally active radiation, and the CMF's in the spectral range 300-380 nm. In addition, the comparisons were made with the results of the project COST Action 726, and with the CMF estimates, obtained by the standard approach [Eck et al., 1995]. We showed that the estimation of CMF using the proposed method gives a better agreement with the experimental data compared with the results obtained from the standard approach for winter conditions with high surface albedo. During warm period all CMF estimates from different methods are in a satisfactory agreement.