History
Ultraviolet-A, B, and C

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The terms ultraviolet-A, ultraviolet-B, and ultraviolet-C radiation (UV-A, UV-B, UV-C) were probably conceived during discussions at the Second International Congress on Light in Copenhagen 1932 (see historical account by Daphne Vince-Prue and David O. Hall (1975) available at http://iuphotobiology.com/history.html). The definitions of the UV bands adopted by the CIE (Comité International de l'Éclairage) are UV-A, 315–400 nm; UV-B, 280–315 nm; UV-C, 100–280 nm. Radiation of wavelength between x-rays and 200 nm is usually termed vacuum ultraviolet, but different terminology is still used in different branches of science, and no consensus exists regarding the delimitation between vacuum ultraviolet and x-rays. The terms UV-A, UV-B and UV-C are used mainly by biologists, and the reason for keeping them mainly relates to the spectral properties of DNA and of ozone, both of which have absorption peaks near 260 nm with tails extending through UV-B, but of minor importance in UV-A. The absorption of solar radiation by stratospheric ozone and oxygen is so strong throughout UV-C that none can be measured at the Earth surface. The UV-B component of sunlight reaching ground level, on the other hand, is strongly dependent on the (very variable) amount of ozone, while UV-A is not much affected. Of course, nothing changes abruptly at 280 or 315 nm, but it is important to consistently use these limits when discussing amounts of radiation.

Sometimes scientists, and in particular American scientists, have departed from the original definitions of the UV bands, which has caused (CIE 1999) to repeatedly emphasize the importance of sticking to the original definitions in order to avoid confusion. A discussion on photobiological terminology has been published by Sliney and CIE 2007. Urbach (N.D.) gives details on the original operational definition based on filters and type of sensor to be used for each of the UV bands.

It should be emphasized that extending the range of UV-B from 315 to 320 nm is no minor change. In fact this shift in the wavelength used as boundary can more than double the amount of ambient radiation included in UV-B, both whether expressed on an energy or on a photon basis (Figure 6.1). Using the same name for quantities differing this much, invites serious misunderstanding.

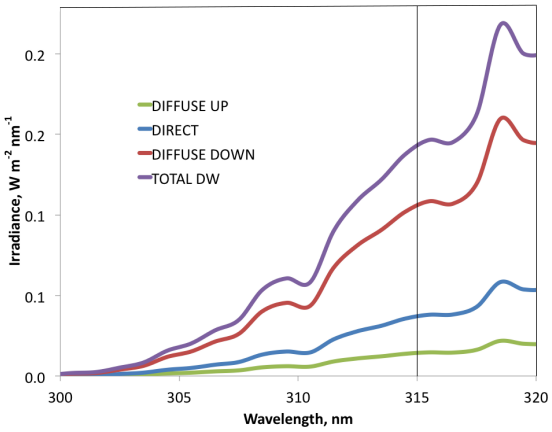

Figure 6.1: Spectra for the short-wavelength end of daylight calculated using the Quick TUV Calculator of the NCAR Earth System Laboratory (http://cprm.acd.ucar.edu/Models/TUV/Interactive_TUV/) with the following conditions: Sea level, 45° zenith angle (i.e. 45° solar elevation), 300 DU of ozone, ground albedo (reflectivity) 0.1 and cloudless sky (other conditions as calculator default). TOTAL DW stands for total downwelling radiation. The vertical line marks the upper limit of the UV-B band. Total UV-B irradiance in this case is 0.896 W m^{-2}. Between 315 and 320 there is 0.931 W m^{-2}. i.e. slightly more than true UV-B. Including this extra amount would thus more than double the value.

From Figure 6.1 it can also be seen that (under these conditions) diffuse radiation dominates the daylight UV radiation. Lindfors and Ylianttila (2015) give a visual demonstration through photographs of the relatively larger proportion of diffuse radiation in the UV region of the solar spectrum at ground level compared to that in the visible region. Thus in the shadow from direct sunlight UV-radiation may decrease much less than VIS-radiation.

References

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