
The influence of UV-radiation

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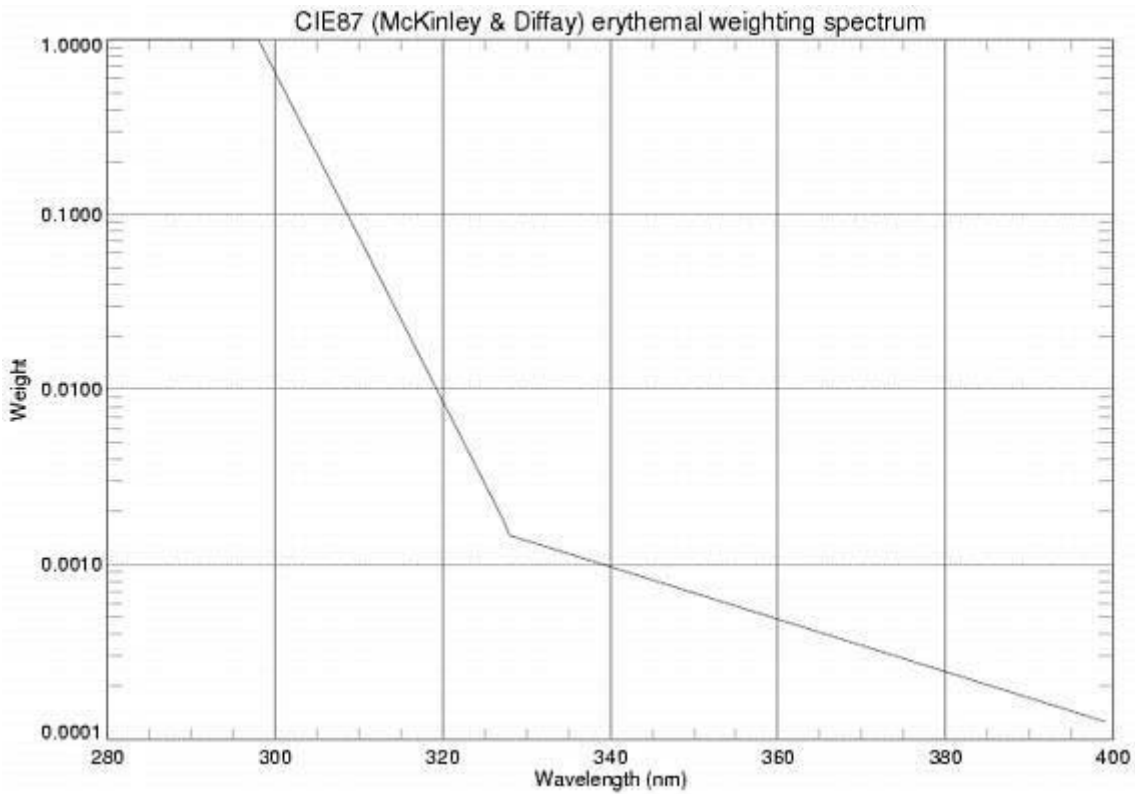
The long-lasting exposure to Ultraviolet radiation lies undoubtedly at the base of important damages to a large amount of living organisms. For example painful sunburns are a clear confirmation of the reaction of the skin to an overdose ultraviolet radiations. Moreover, the UV-radiation, and especially the very aggressive UVB- and UVC-radiations, can cause substantial damage to certain molecules like our DNA, the key molecule to all life. Even though natural mechanisms for the recovery of damage to the molecules that form our genetic patrimony exist, nevertheless mankind develops certain diseases like skin cancer, cataract, photo allergies and an accelerated aging of the skin. In addition it has to be noted that, paradoxically, a number of recovering mechanisms benefit from an adapted exposure to UV-radiations. To conclude, the risks for an UV-exposed population (voluntary or not) are closely linked to the type of UV-radiation, but especially the intensity, the duration and the frequency of exposure.

Of course human beings are not the only living organisms sensitive to UV-radiation. Vegetation can be also affected by an abnormal exposure to UV-radiation with consequences like, for example, smaller leaves. However determination of the exact effect of exposure to UV-radiation of the Sun is difficult because of the fact that plants are very sensitive to other negative factors like a shortage to water and minerals, changes in the concentration of carbon dioxide in the atmosphere...

The quantification of the impact of UV-radiation

In order to quantify the biological effects due to exposure to UV-radiation, physicians and biologists study the way in which living cells and complex organic molecules react to UV-radiations. In particular they try to determine the spectral response or wavelength dependence of the reaction of each specimen. This spectral response or "action spectrum" will differ considerably according to the kind of living cell or the considered effect. Despite of the complexity of this mission, a great number of "action spectra" were collected. The sensitivity of human skin for sunburns as a result of UV-radiations is characterised by a "standard erythemal weighting spectrum" (CIE 87). This spectrum is illustrated in the next figure.





One notices that the sensitivity reaches a maximum for the UVB-radiations and decreases for the UVA-radiations. This action spectrum CIE is commonly used for quantification of the amount of UV-doses.

When we know the amount of UV-radiations that reach the surface, their possible impacts and their effects can be quantified by weighing the incident total spectrum with the action spectrum corresponding to the considered effect.

This is represented schematically in the following figure, where the incident solar spectrum is weighted by an arbitrary action spectrum (bold line). The total dose causing the studied effect is represented by the total surface beneath the curve (the orange part).



