instituto português do mar e da atmosfera

ULTRAVIOLET RADIATION

Ultraviolet radiation | FAQ | Caution

Solar radiation is an important natural factor of Earth's climate, which significantly influences the environment. The ultraviolet portion of the solar spectrum (UV) plays a leading role in many processes in the biosphere, having many beneficial effects; however, it can cause severe damage to health if the UV levels exceed the "safety" limits.

In fact, if the amount of ultraviolet radiation exceeds the limits beyond which the protection mechanisms inherent to each species become inefficient, severe damage at biological level can be caused, this happening also to human body, particularly to skin and sight organs. In order to avoid acute and chronic lesions as result of exposure to high UV levels, exposure to solar radiation should be reduced by adopting protective measures. These may vary in accordance with each one's sensitiveness to a given solar radiation level.

The diurnal and annual variation of solar radiation reaching surface is governed by astronomical factors and geographic parameters, as well as by atmospheric conditions. Actions resulting from human activity reaching the atmosphere, polluting air and influencing the ozone layer, also affect the UV radiation that reaches surface. So, UV radiation is an environmental parameter that is highly variable with space and time.

The ultraviolet radiation (UV) is part of the spectrum of solar radiation in the wavelengths from 290 nm to 400 nm. The so-called UV-B radiation corresponds to the spectrum interval between 280 nm and 320 nm, being the major factor responsible for skin burning, skin cancer, cataracts and other impacts on human health. The UV-B solar radiation that reaches the atmosphere of the Earth is absorbed mainly by the stratospheric ozone, which is found at altitudes between 10 km and 50 km. However, other atmospheric components, such as clouds, atmospheric aerosol and even the air, can also contribute to an attenuation (by absorption and/or diffusion) of the UV-B in atmosphere. Other factors, such as reflections on the clouds, snow, sand, etc., can contribute to the enhancement of UV-B radiation

Ultraviolet radiation and the ozone layer

Nearly 90 % of the atmospheric ozone is in stratosphere (10-50 km). Assuming that the other factors (Sun height, site, cloudiness, aerosol, etc.) are constant, the variations in UV-B radiation are a result of variations in the thickness of stratospheric ozone due to the various mechanisms of transport, development and destruction of ozone in the atmosphere. In the last 20 years a gradual depletion of the ozone layer has been recorded, especially at medium and high latitudes, ascribed to ozone destruction by chemical compounds as a result of human activity. This depletion usually increases towards the poles and more intensely in the so-called Ozone Hole of Antarctica. In Portugal, the conditions of the ozone layer are not significantly different from the other regions at the same latitude, a depletion of 3% per decade having been observed for the last 30 years.

The concerns resulting from the increase in UV-B radiation due to the global depletion of the ozone layer led to a greater interest in the measurement and prediction of UV-B radiation, taking into account the great ozone variability with space and time.

Definition of UV Index

The need to provide the general public with information on UV radiation and its possible adverse effects led the scientific community to define a parameter that might be used as an index for exposures to this radiation. Such parameter is called UV Index (UVI). Thus, UVI is a measure of the levels of ultraviolet solar radiation effectively contributing to the development of human skin burning (erythema). This development depends on the types of skin (I, II, III, IV) and on the maximum time of exposure to the sun with unprotected skin.

Types of skin	Tanning	Burning	Hair	Eye Colour
I	Never	Queima	Red	Blue
II	Sometimes	Sometimes	Blond	Blue/Green
III	Always	Seldom	Brown	Grey/Brown
IV	Always	Seldom	Black	Brown

The UV is numerically expressed as the result of the multiplication by 40 of time mean value of actual irradiance (W/m2). Example: Na actual irradiance of 0.2 W/m2 corresponds to an UVI of 8.0.The UV Index ranges between less than 2, in which UV is Low, 3 to 5 (Moderate), 6 to 7 (High), 8 to 9 (Very High) and more than 11 (Extreme).

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Average UV values for the latitude of Portugal range from 3 to 6 in the period between October and April, which means Moderate, possibly High in some moments, and from 9 to 10 in the period between May and September, which corresponds to Very High.

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