Measurement of solar radiations: a current problem in radiometry

By D. Bolsee

Our social habits and the consequences

The Sun is indispensable to the growth and the development of every human being. Physically the Sun causes the production of vitamin D in our skin. Furthermore the Sun helps to strengthen our skeleton and it can cure certain skin diseases. Without the natural sunlight we wouldn't be able to live a normal live. Although the combined effect of an exaggerated exposure to sunrays and the global climate change clearly contribute to the rise of skin cancer in Europe. Indeed, an annual increase of 7% new cases (the number doubled in a period of 10 years) can't be fully explained by the expected increase (as a consequence of the ozone layer depletion) of the effective dose of UV-radiations reaching the Earth's surface (The quantification of the impact of UV-radiation). Mainly our post-war social habits of exposing us, from our youth onwards, far too much to the solar radiation ("sun bathing") and of spending our holidays more than once a year in sunny holiday resorts, help to explain why the number of skin cancers increased.

The necessity to change current habits

We point out the urgent necessity to change our social behavior patterns in order to change the current trend. Under the possible means we name:

- Recommendation of effective protection methods against UV-radiations (UV-filters delivered by the cosmetic industry, clothing, better spread periods of sun bathing…)

- The spread of adequate medical information (e.g. for attentive examination of the skin and possible beauty spots.

- The necessity to develop efficient dosimeters able to measure the effective UV-radiations and their biological consequences.

A control system for solar radiations and monitoring centres

Nowadays the following possibilities are at our disposal:

1. The accurate measurements of the UV-radiations with filter radiometers or grating spectroradiometers.
2. The efforts realised to quantify the intensity of radiations in a form accessible to a broad public (by introducing the concept UV-index) and to make a reliable prediction of that daily UV-index in the local weather forecasts.
3. An extensive research program for the finalisation of detectors sensitive to UV-radiations and easy in transport and usage: biological dosimeters

Pros and contras of the present measuring methods

Every measuring method has its own imperfections. The physical instruments measuring radiations offer very good results, but are expensive and complicated to use. Today it is impossible to develop a tight measurement network on a national level or to develop these instruments into very small, personal dosimeters. Moreover the UV-index forecasts deal with experimental errors, because of the difficulty in predicting changes in the thickness of the ozone layer and the cloudiness on a certain moment. On top of that a good knowledge of UV-radiations climatology is missing. The measuring data are seldom older that 10 years. Because of all that, real efforts are made in the field of biological dosimetry to develop small, personal dosimeters that permit to measure precisely the UV-radiations invisible to the human eye and sensed too late by the skin when exposed to the Sun (burning of the skin). Such dosimeters are still in a development state and show major variations in precision and reproducibility. The efforts are necessary because of better risk prevention and a better management of our precious "solar capital". These dosimeters should replace our intuition and our senses that are too easily mislead during the seasons.

Recurring risks: our watchfulness in not sufficient

In spring the increasing dose of UV-radiations easily cause "sunburn" because our alertness diminished during winter when we are not heavily exposed (more on Degree of latitude and local time). Even in the summer a strong wind can mask the baleful influence as a result of which we react too late. The presence of thin clouds that hide the Sun complete or partly, can mislead us as well because of the fact that the absence of direct solar rays doesn't mean that there are no UVB-radiations present. This is so because UVB radiations are diffused - but attenuated - by the clouds. Even the blue sky (without the solar disk) contributes to approximately 50% of the UVB radiations reaching the ground (more on factors with an influence on the amount of UV-radiations). Furthermore we too easily forget the increase of the UV-flux due to the reflection of the ground (85% for snow, 75% for stagnant water, but only 20% for sand). These reflections are important so that, for equal periods of exposure to the Sun, the consequences for the skin are clearly dependent on the location (beach, snowed areas in the mountains…)

When we evaluate the consequences of UV-radiations we need to take into account the substantial differences between human individuals concerning the resistance against UV-radiations. We speak of the genetic predestination and the photo type of the skin that play a role in the ultimate consequences of UV-radiations on the skin. The table underneath describes the 6 photo types of the skin as used by dermatologists:

Photo type	**Sensitivity for UV-radiations of the Sun**
Type1	The skin always turns red and does not tan
Type2	The skin always turns red and tans sometimes
Type3	The skin turns red sometimes and tans always
Type4	The skin never turns red and tans always
Type5	The skin is moderately pigmented
Type6	The skin is very pigmented