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# The action spectrum of melanoma skin cancer derived from spatially resolved climatological spectral UV and epidemiological data

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During the past years the European initiative COST 726 (www.cost726.org) has recalculated global solar ultraviolet daily dose values over the past 50 years for 7 distinct wavelengths and also for the erythemally effective UV radiation. These daily dose values were calculated over Europe with a spatial resolution of approximately 5x5 km taking into account cloudiness, total ozone, aeorsol content and albedo.
On the other hand reliable annual incidence rates of melanoma are available for the Austrian territory for 102 districts since 1997. The melanoma incidence rates for Austria are comparable to those of other European countries. Austria is a relatively small country (294 km in latitude and 575 km in longitude) but has a very alternating topography. Capitals of districts are spread over a relatively wide range in altitude from 123 m to 1021 m above sea level.
From a first analysis we saw that the incidence rate increases strongly with altitude. The rates /100000 are around 9.6 at 172 m asl but are around 24.0 at 639 m asl. This increase can be described satisfactory with a simple power model.
In the next step correlation coefficients between incidence rates and erythemally weighted daily, non-melanoma skin cancer weighted and DNA-damage weighted daily doses were calculated. Analysis shows the DNA-damage weighted daily doses are higher correlated with the incidence rate than the other two (both get a higher contribution from UVA).
In the final step correlation analysis was done for the incidence rates in respect to daily doses at 295 nm, 300 nm, 305 nm, 310 nm, 315 nm, 330 nm and 360 nm. Correlation was highest for doses from 295 nm, 300 nm and 305 nm radiation and correlation decreases rapidly with increasing wavelength. This indicates that the action spectrum for melanoma peaks in the UVB and indicates a low efficiency of UVA radiation like in the case of DNA-damage. Wavelengths of 300 nm and 305 nm have a very similar or almost identical efficiency. Due to the low absolute amount of daily doses from 295 nm we can not exclude that the efficiency there is by a factor 3 higher or lower than at 300 nm and 305 nm. To ensure high correlation with incidence rate the efficiency of doses at all other wavelengths must be very low, at least similar as low as for DNA-damage.
To summarize, the proposed action spectrum, which we derived from epidemiological data, peaks around 295 nm and 305 nm and decreases steeply into the UVA by following the action spectrum of DNA-damage.