Contoured exposure assessment of biologically effective solar ultraviolet radiation

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A technique to represent biologically effective solar ultraviolet radiation incident on exposed surfaces of the human body has been developed from laser scans of manikin body part models. Variation in manikin topography has been modelled for three dimensional visualisation of the received biologically effective solar UV exposure to the face, neck, arms, hands and legs. Exposures to each of the modelled regions have been extensively measured at specific manikin sites using polysulphone dosimeters. The measurement sites allow the formation of a network of contours over the body to display biologically effective solar UV exposure relative to the incident horizontal plane biologically effective solar UV irradiance. Contour mesh functions have been developed for each body part that are consequently weighted to surface topography, providing a method for the estimation of biologically weighted incident solar UV irradiance across exposed body areas that minimises uncertainty due to exposure interpolation between widely spaced dosimeter sites. The developed body exposure contour functions are discussed in terms of the minimisation of the number of dosimeters for the estimation of biologically effective exposures over large exposed body surfaces. Exposure models for clear sky conditions and a solar zenith angle range of 30^{o}-50^{o} have been developed. The implications of the developed body contour mesh technique presented here, include use for investigating exposure at varying solar zenith angles, cloud conditions, body postures, and assessment of the protective effectiveness of environmental shade, hats and clothing. Some of these factors have been investigated and will also be presented.