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ULTRAVIOLET RADIATION AT ASPENDALE, VICTORIA

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Solar ultraviolet radiation is a major cause of degradation in plastics, paints and other materials, and many inquiries are received as to its intensity in Australia. Records of ultraviolet irradiation (wavelength 290-385 nm), have been maintained at Aspendale, Victoria (38°02'S; 146°06'E) from the beginning of 1970, and this note summarises the first three years' results.

Standard meteorological radiation instruments (pyranometers and pyrheliometers) have been used with broad band glass filters following the technique described by Marchgraber and Armstrong (1962). The expected accuracy of individual measurements using this method is ±10%.

Global radiation (as received from sun and sky on a horizontal surface) in the ultraviolet wavelengths is monitored by pyranometers fitted with hemispherical filters, and the signal is integrated continuously with hourly print-out of radiation totals. The monthly averages of day totals for cloudless days and for all days are given in Table 1. The corresponding values for global short-wave radiation (wavelength 290-3,000 nm) are shown in Table 2. Cloudless days were selected from the autographic chart records as being days on which the radiation traces were substantially smooth throughout the day.

The relationship between global ultraviolet radiation and the noon solar altitude is shown in Fig 1, and Fig 2 gives the corresponding relationship for global short-wave radiation. The proportion of ultraviolet in short-wave radiation varies between 6% and 8%, decreasing with increasing solar altitude.

Measurements of direct beam ultraviolet were made when the sun was unobscured, using a pyrheliometer and flat filters. Individual readings were taken at times between 9 am and 3 pm. Means obtained by grouping the individual readings are plotted against solar altitude in Fig 3. The curve may be compared with that derived by Bener (1967) from theoretical considerations; the greatest discrepancy is not more than 0.4 mW cm^{-2}.

No measurements of diffuse ultraviolet radiation have been made, but for occasions when global and direct ultraviolet intensities were available this was calculated from the relationship $G = I \sin S + D$ where G, I and D are the global, direct and diffuse intensities respectively and S the solar altitude. The mean monthly values are given in Fig 4 as a function of solar altitude.

The increased scattering at the ultraviolet wavelengths causes the ratio of diffuse to global radiation to be considerably higher than for short-wave solar radiation, with an average of about 65%. With increasing solar altitude the ratio decreases as shown in Fig 5, in which monthly mean clear sky values are given as a function of solar altitude.

Recording of broad band ultraviolet radiation is continuing at Aspendale as part of the routine radiation observations, and it is expected that it will be supplemented by narrow band measurements in the erythemal range (295-320 nm).

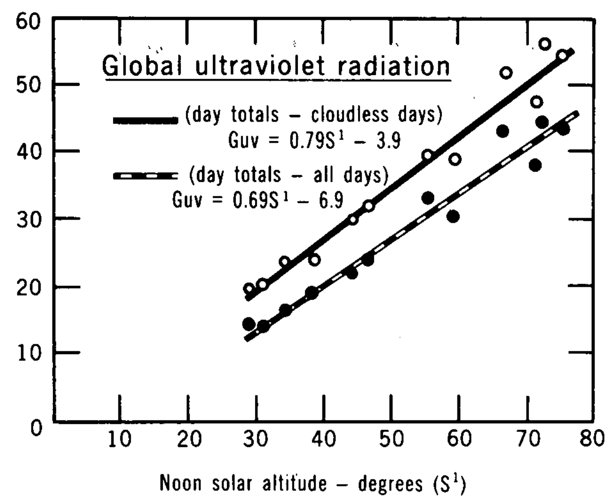

Fig 1 Day totals of global ultraviolet radiation as a function of noon solar altitude

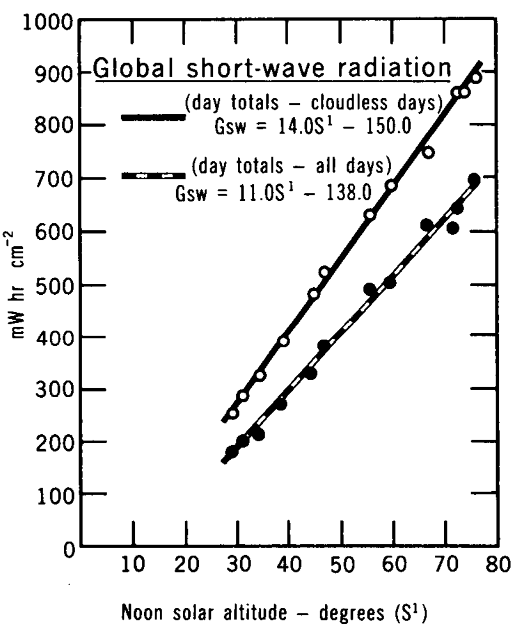

Fig 2 Day totals of global short-wave radiation as a function of noon solar altitude

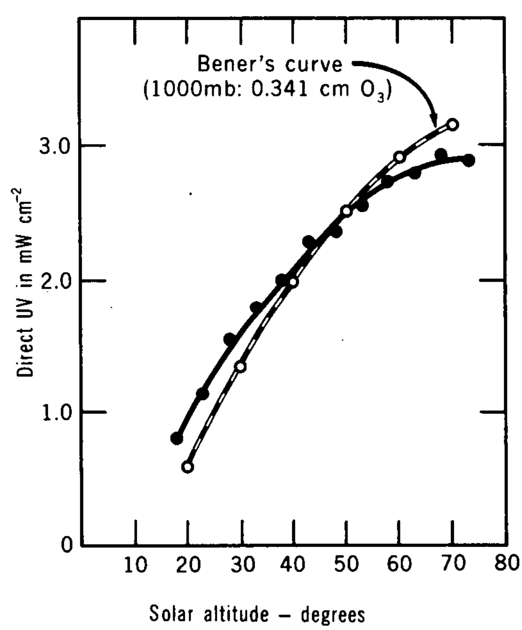

Fig 3 Direct beam ultraviolet radiation as a function of solar altitude

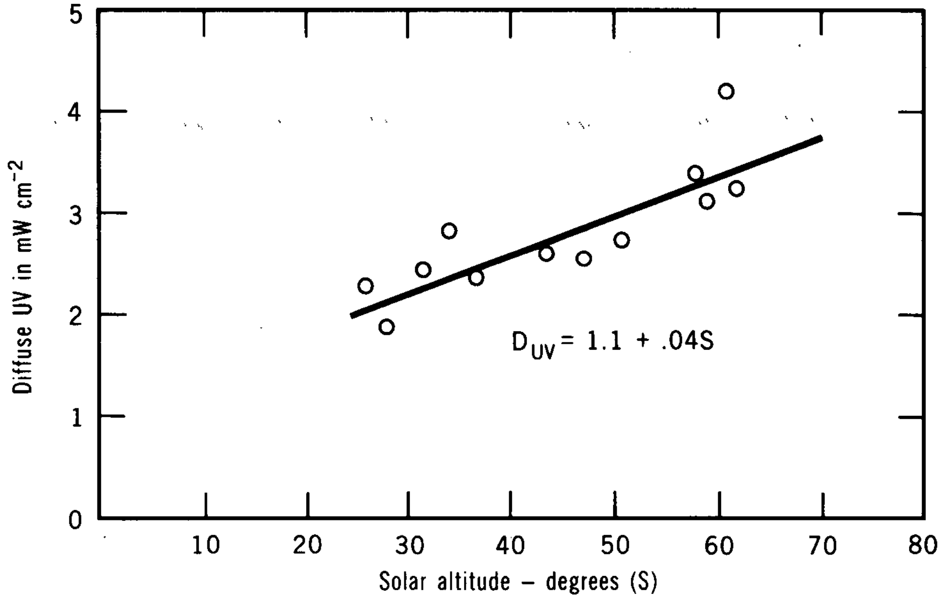

Fig 4 Diffuse ultraviolet radiation (clear skies) as a function of solar altitude

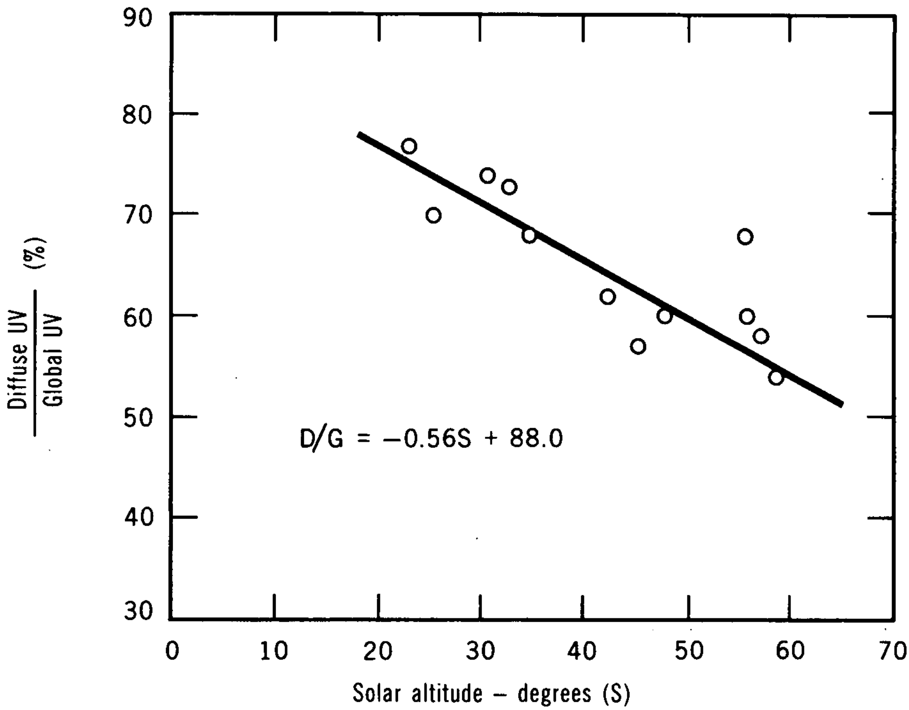

Fig 5 The ratio between diffuse and global ultraviolet radiation (clear skies) as a function of solar altitude

Table 1 Global ultraviolet radiation
$mW\ hr\ cm^{-2}$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
All days													
1970	47.4	46.6	31.4	21.1	16.5	13.8	13.0	19.8	26.9	33.9	43.0	46.9	30.0
1971	43.8	40.9	36.3	24.2	15.7	14.0	17.0	20.4	24.1	32.1	39.7	46.6	29.6
1972	43.8	42.9	32.7	20.5	17.7	15.3	12.4	16.8	21.8	25.7	32.5	38.3	26.7
Mean	45.0	43.5	33.5	21.9	16.6	14.4	14.1	19.0	24.3	30.6	38.4	43.9	28.8
Cloudless days													
1970	57.6	54.4	39.7	28.1	20.9	20.9	15.6	26.4	32.2	46.0	52.4	60.0	37.9
1971	56.5	47.8	41.2	33.1	26.1	-	28.0	-	37.7	37.2	48.4	58.8	38.2
1972	55.6	54.7	38.4	29.3	23.9	18.6	17.6	21.6	26.7	33.8	42.5	46.2	34.1
Mean	56.6	52.3	39.8	30.2	23.6	19.8	20.4	24.0	32.2	39.0	47.8	55.0	36.7

Table 2 Global short wave radiation
$mW\ hr\ cm^{-2}$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
All days													
1970	674	647	444	320	201	156	188	256	368	500	634	683	423
1971	649	612	525	351	198	169	197	277	350	477	556	668	419
1972	619	590	509	313	240	210	210	278	425	542	638	753	444
Mean	647	616	493	328	213	178	198	270	381	506	609	701	429
Cloudless days													
1970	850	687	669	454	339	233	281	365	533	720	861	881	573
1971	885	778	611	506	313	-	270	-	540	628	812	872	572
1972	859	789	623	478	325	272	303	420	498	715	911	920	593
Mean	865	751	634	479	326	253	285	393	524	688	861	891	579

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