

## The Decrease of the Ultra-violet Solar Radiation by City Smog Occurring in Winter

by

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The present authors reported previously on the decrease of the ultra-violet solar radiation by fog and cloud [1]. In that case, the extinction coefficient of the ultra-violet ray was the same as that of the total radiation measured by Robitsch's pyrhelimeter. Since the diameter of fog or cloud particles is of the order of  $10\mu$ , it may be natural that the extinction coefficient is independent of the wave-length. But, if the particle size is of the order of  $0.1\sim 1\mu$  as in dust or smoke particles, the extinction coefficient would be different according to the wave-length.

In winter, the central part of Tokyo is often covered with a dense smog when it is quite clear in the suburbs. Therefore, it is expected that in the central part, the solar radiation suffers a considerable attenuation by such a smog and it would surely give a bad effect upon the public health. We made an observation of the total and ultra-violet solar radiation at the Central Meteorological Observatory situated at the center and at the Institute situated in the western suburb of Tokyo from Dec. 11th, 1950, to Feb. 8th 1951. The observations were done when the

central part of the city was covered with a comparatively dense smog while it was clear in the suburbs. The total solar radiation was measured by Robitsch's pyrhelimeter and the ultra-violet solar radiation was observed with Miyake's ultra-violet actinometer [2]. The observation was made at every hour from 9 a.m. to 4 p.m.

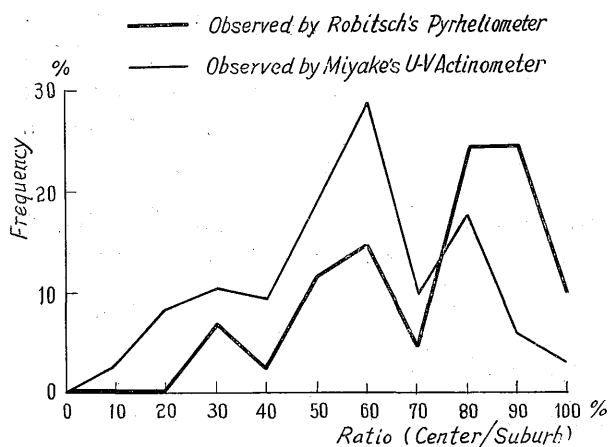


Fig. 1. Frequency in the ratio of transmittance of the solar radiation in winter at Tokyo.

Fig. 1 shows the frequency in the ratio of intensity at the center to that in the suburbs at the same hour. As to the total

radiation the maximum frequency lies near the ratio of 80~90%, and for the ultra-violet it is about 60%. The diurnal variation of the total and ultra-violet

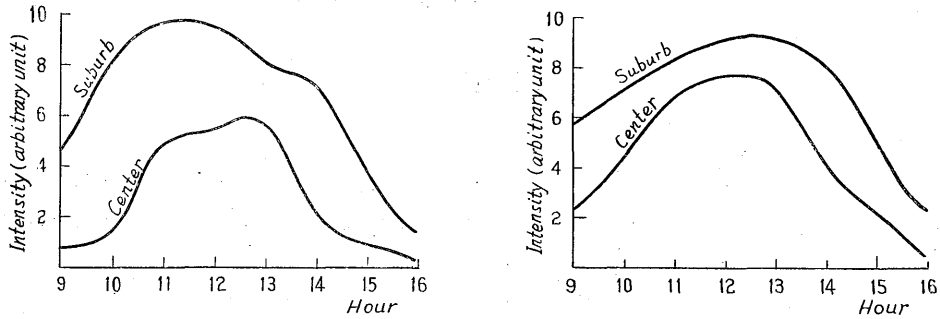


Fig. 2. Diurnal variation of the solar radiation at Tokyo (Jan. 23, 1951) in winter.

(a) U-V Radiation with Miyake's U-V actinometer.

(b) Total Radiation with Robitsch's pyr heliometer.

solar radiation are shown in Fig. 2. Regarding the ratio of the daily integrated amount of radiation, the total radiation in the center had the frequency maximum at about 70~80%, on the other hand, the ultra-violet ray was only from 40% to 60% of the amount in the suburbs.

It is interesting to note that the ratio increases in the daytime and decreases in the morning and the late afternoon. It is due to the increase of the rate of exchange of air on account of the temperature rise during the daytime and also the oblique path of the sunlight. Fig. 3 shows the mean diurnal variation of the ratio. In general, the correlation between the horizontal visibility near the ground and the intensity of ultra-violet ray was not great. It may be concluded that the effect of city smog occurring in winter upon the ultra-violet solar radiation is considerably larger than the total radiation measured by Robitsch's pyr heliograph especially in the morning and the later afternoon. The attenuation in the ultra-violet ray by smog is an important problem for city inhabitants and a reasonable control of smog is desirable.

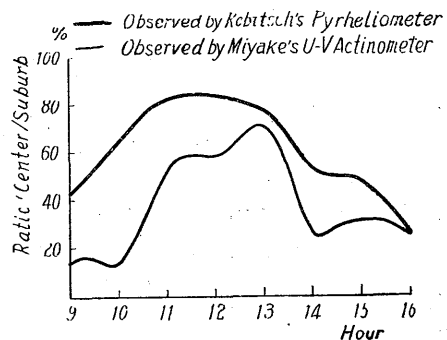


Fig. 3. Diurnal variation in the ratio of transmittance (Jan. 23rd, 1951).

### References

- [ 1 ] MIYAKE, Y. and SARUHASHI, K. 1950: The Estimation of the Height of Fog by Observing the Ultraviolet Solar Radiation. *Geophysical Magazine*, 21, p. 122.
- [ 2 ] MIYAKE, Y. 1949: A New Chemical Method for Measuring the Ultra-violet Ray. *Geophysical Magazine*, 20, p. 95.