Fig. 1. Comparison between measured and computed total solar intensities on S-, E- and W-facing vertical surfaces with cloudless skies

This model gives the following interpretation of the constants which appear in the equation for Heywood's radiation characteristic lines:

$$C = \frac{0.5 \tan \alpha (1 - \cos \theta_H)}{\sin \theta_H} \left[\left(\frac{D_{bh}}{E_h} \right)_{av} + \rho_0 \right]$$

$$M = 1 - \left(\frac{D_{bh}}{E_h} \right)_{av}$$

where α is solar altitude; ρ_0 is ground reflectance at measuring site; $\left(\frac{D_{bh}}{E_h} \right)_{av}$ is average value of $\frac{D_{bh}}{E_h}$ for cloudless skies.

The method discussed here, therefore, embraces Heywood's system of characteristic lines within a single equation the terms of which can be evaluated. It has the further advantages that allowance can be made for the ground reflectance at the site for which predictions are to be made, and that it relates the estimate of E_t to

the value of $\frac{D_{bh}}{E_h}$ pertaining at the time.

A. G. LOUDON
P. PETHERBRIDGE

Building Research Station,
Garston, Watford,
Herts.

¹ Heywood, H., *Nature*, **204**, 669 (1964).

² Loudon, A. G., and Danter, E., *Build. Sci.*, **1**, 89 (1965).

³ Petherbridge, P., *Building Res. Sta. Current Paper, Research Ser. No. 39* (1965).

⁴ Parmelee, G. V., *A.S.H.V.E. Trans.*, **60**, 341 (1954).

THE equations developed by A. G. Loudon and P. Petherbridge constitute a mathematical expression of the graphical procedure described in my first communication¹. Both procedures have the same fundamental basis, and in fact I have myself derived equations similar to those in the preceding communication in a more detailed paper which was presented at the Solar Energy Society Conference at Phoenix, Arizona, March.

Though synthesis of the individual factors involved is an ideal procedure, this can only be accomplished if numerical evaluation of each of these factors is possible. This involves the experimental difficulty of defining precisely how much of the circumsolar diffuse radiation should be included in the direct radiation and how much forms part of the uniform background diffuse radiation. The ratio of diffuse radiation flux on inclined and hori-

zontal surfaces respectively is shown by the curves in Fig. 1. These measurements were made with clear sky conditions at Woolwich and the disk obscuring the Sun subtended an angle of one-tenth of a radian at the thermopile. It is evident that the diffuse radiation flux on an inclined surface is affected considerably by the azimuth angle between the Sun and the facing direction of the surface, even though some of the circumsolar diffuse radiation must have been screened from the thermopile. Total radiation flux on a horizontal surface is the only datum available for many parts of the world, and for this and the foregoing reason I proposed a method of evaluating the total flux on inclined surfaces in terms of this factor.

Fig. 1. Ratio of diffuse radiation flux on inclined and horizontal surfaces respectively. $\cos A_r = 1$ for surface facing towards Sun; $\cos A_r$, 0 for surface facing at right angles to direction of Sun; $\cos A_r$, -1 for surface facing away from Sun

Whether or not it is more simple to perform the computation by estimating the individual factors and calculating the total radiation therefrom, or to derive functions in terms of total radiation from suitable experiments, is a question I leave to be determined when more experience has been gained. The construction of the radiation characteristic line is, however, a potent method of correlating a series of experimental determinations in order to eliminate individual errors of observation or the effect of fluctuations in conditions, and has been so used to analyse certain published data.

H. HEYWOOD

Woolwich Polytechnic,
London, S.E.18.

¹ Heywood, H., *Nature*, **204**, 669 (1964).

GEOPHYSICS

Solar Plasma Wind, Earth Currents and Diurnal Magnetic-field Variations

MEAD¹ calculated the diurnal magnetic-field variations caused by the impingement of the solar plasma wind on the terrestrial magnetosphere. The current sheet produced at the magnetospheric boundary leads to a perturbation of the dipole field throughout the magnetosphere and on the ground. A surprising result is that the