Converting Solar Radiation to Hours of Bright Sunshine

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Hours of bright sunshine (n) are often used in biological models. In the past, a measurement of the bright sunshine hours was accomplished using a sunshine recorder. Then the ratio (n/N) of actual bright sunshine to potential bright sunshine (N) was used to estimate the ratio of surface to extraterrestrial solar radiation ($\underline{R_s/R_a}$). However, now it is more common to measure irradiance (total global solar radiation) with a pyranometer (e.g., see the photo below) than to measure hours of bright sunshine.

In some cases, it is desirable to convert back from irradiance to sunshine hours. This involves first estimating extraterrestrial radiation and the potential (maximum) sunshine hours, which both depend on the astronomical calculations. The ratio n/N is calculated as a function of R_s/R_a as:

$$\frac{n}{N} = 2\left(\frac{R_s}{R_a} - 0.25\right)$$

Then the actual bright sunshine hours is determined by multiplying the n/N by the N estimated from astronomical calculations. Click on Wton to upload the Excel program Wton.XLS that makes these calculations. To use the program, input the site information in the open boxes near the top and then enter the solar radiation data (R_s) in the units MJ $m^{-2}d^{-1}$.

To convert from the mean power over the 24-hour day in W $m^{-2}d^{-1}$ to MJ $m^{-2}d^{-1}$, multiply by 0.0864.