From the examination of data from several stations, it has been repeatedly noted [19, 24] that, considering long-term averages of terrestrial radiation, the correspondence between the measured ratio of diffuse irradiance to diffuse daily irradiation, $r_D = D(0)/D_d(0)$, and this theoretical expression for extraterrestrial radiation (equation 20.22) is quite good, while the correspondence between the measured ratio of global irradiance to global daily irradiation, $r_G = G(0)/G_d(0)$, and this expression, although not perfect, is quite close, so that a slight modification is required to fit the observed data. The following expressions apply [21]:

$$r_D = \frac{D(0)}{D_d(0)} = \frac{B_0(0)}{B_{0d}(0)} \tag{20.23}$$

and

$$r_G = \frac{G(0)}{G_d(0)} = \frac{B_0(0)}{B_{0d}(0)}(a + b\cos\omega) \tag{20.24}$$

where a and b are obtained from the following empirical formulae:

$$a = 0.409 - 0.5016 \times \sin(\omega_S + 60) \tag{20.25}$$

and

$$b = 0.6609 + 0.4767 \times \sin(\omega_S + 60) \tag{20.26}$$

Note that r_D and r_G have units of T^{-1}, and that they can be extended to calculate irradiations during short periods centred on the considered instant, ω. For example, if we wish to evaluate the irradiation over one hour between 10:00 and 11:00 (in solar time), we set $\omega = -22.5^\circ$ (the centre time of the considered period is 10:30, i.e. one hour and half, or 22.5°, before noon) and $T = 24$ h. If we wish to evaluate the irradiation over one minute, we just have to express T in minutes, that is, we set it to 1440, the number of minutes in a day.

An example can help in the use of these equations: the calculation of the irradiance components at several moments along the 15 April in Portoalegre–Brasil ($\phi = -30^\circ$), knowing the global daily irradiation, $G_d(0) = 3861$ Wh/m^2. The results are as follows:

$$d_n = 105 \Rightarrow B_{0d}(0) = 7562 \text{ Wh/m}^2 \Rightarrow K_{Td} = 0.5106 \Rightarrow F_{Dd} = 0.423$$
$$\Rightarrow D_d(0) = 1633 \text{ Wh/m}^2$$

$$\omega_S = -84.51^\circ$$

$$\frac{\pi}{180}\omega_S \cos\omega_S - \sin\omega_S = 0.8542$$

$$a = 0.6172$$

$$b = 0.4672$$

$$r_D = 0.0922(\cos\omega + 0.0967) \text{ h}^{-1}$$

$$r_G = r_D(a + b\cos\omega)$$