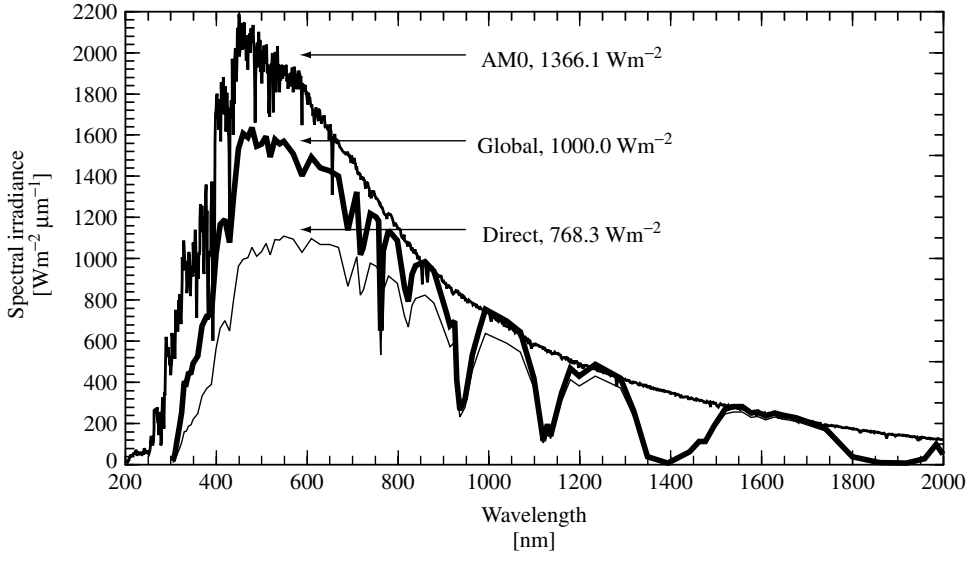

Figure 16.1 Global, Direct, and AM0 reference spectra listed in Tables 16.2 and 16.3. Adapted with permission from the Annual Book of ASTM Standards, Copyright ASTM [10, 12, 13]

integrates to approximately 768 Wm^{-2}. Different numerical integration methods give differences in the integrated or total irradiance of the reference spectra at the 0.1% level because of the relatively small number of data points (120) and the large variations in the spectral irradiance with wavelength. The structure in the spectral irradiance is a function of bandwidth. The bandwidth in the spectral irradiance at any given wavelength is approximately the difference in wavelength between adjacent points. The PV community has arbitrarily taken the term "one sun" to mean a total irradiance of 1000 Wm^{-2} [17]. In fact, the spectral irradiance of the global reference spectrum normalized to 1000 Wm^{-2} in Table 16.2 and Figure 16.1 exceeds the AM0 spectral irradiance in the infrared, which is not physically possible without concentration. The term *global* in Tables 16.1 and 16.2 refers to the spectral irradiance distribution on a 37° tilted south-facing surface with a solar zenith angle of 48.19° (AM1.5). The term *direct* in Tables 16.1 and 16.2 refers to the direct-normal component (5° field of view) of the global spectral irradiance distribution [18]. The term AM1 or AM1.5 is often used to refer to standard spectra, but the relative optical air mass (AM) is a geometrical quantity and can be obtained by taking the secant of the zenith angle (See Section 20.3 for a more complete explanation of AM.). For AM1, the zenith angle is 0°. The relative optical air mass can be pressure-corrected to an absolute air mass by multiplying by the barometric pressure and dividing by the sea level pressure. In outer space the pressure is zero so the absolute air mass is always zero. The internationally accepted global reference spectrum is based upon the 1962 US standard atmosphere with a rural aerosol distribution as input to a sophisticated Monte Carlo ray-tracing model for wavelengths up to 2500 nm and an undocumented simple direct-normal spectral model for the irradiances from 2500 nm to 4050 nm [12, 13, 18]. The fact that the reference spectrum only approximates the "real-world" spectra at solar noon is unimportant as long as the differences between the photocurrents are the same for various PV