1977, the IPS-1956 reference was substituted by the WRP); and inconsistencies between global, direct and diffuse irradiation values due to mistakes in graphic record evaluation. All these difficulties must be overcome when computing statistical representative values. Different researchers use different procedures (for example, when considering a set of data of doubtful quality, one can opt to use it directly, or to estimate a best value, or simply to neglect it), arriving at different results. Furthermore, different researches use different data recording periods for computing representative values (because solar radiation data are being constantly and routinely recorded, this is usually the case). The astonishing result is that a large disparity in representative values is found for the same location, when different publications are consulted. Table 20.2 presents the $G_{dm}(0)$ values for Madrid according to different publications. Large disparities are evident and deserve further comment, because they translate into serious practical consequences. For example, for sizing the PV generator of a stand-alone PV system, it is customary to select the so-called worst month, that is, the month with the lowest value of $G_{dm}(0)$. It is clear that irrespective of the selected sizing methodology, the choice of the particular solar radiation database for Madrid involves PV array size differences up to 12% [(1.58−1.77)/1.58], far beyond the claimed accuracy of most presently available PV sizing methods.

It is important to note that, despite the above-mentioned difficulties, concerning rough solar radiation data, the uncertainty does not derive primarily from a lack of perfect precision in the measuring instruments, but rather from the random nature of the solar radiation, that is, from the overall statistical fluctuations in the collection of finite number of counts over finite intervals of time. This leads us to the question of the real representativeness of the data, or, in more strict terms, to the "confidence" we have that average values, based on past observations of solar radiation, are a correct prediction of the future solar radiation. A close look at the rough recorded data can help to elucidate this question. Figure 20.10 shows the January $G_{dm}(0)$ values corresponding to the years 1979 to 1986, for which very accurate data – let us say, 3% of accuracy – are available, according to Reference [16]. The average value is $\overline{G_{dm}}(0) = 1.99$ kWh/m^2. We could then give this value as our estimate for the future. However, if someone now asked the question, "What is the probability that the future $G_{dm}(0)$ will be exactly 1.99 kWh/m^2?", we would have to answer – somewhat uncomfortably – that the probability is no doubt close to zero. However, we would have to hasten to add that if we relax the prediction rigour, just saying that the future $G_{dm}(0)$ values will be within the range of 1.55 to 2.58 kWh/m^2, as in Figure 20.10, then the probability is high. Note that this range represents ±26% of the

Table 20.2 Values of the mean global daily irradiations $G_{dm}(0)$, in kWh/m^2, in Madrid according to different publications

Ref	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
[7]	1.86	2.94	3.78	5.22	5.80	6.53	7.22	6.42	4.69	3.17	2.08	1.64	4.29
[16]	1.99	2.64	4.32	5.32	6.28	7.29	7.47	6.62	5.11	3.40	2.16	1.72	4.53
[94]	2.29	2.81	4.48	5.25	6.60	7.24	7.55	6.33	5.22	3.62	2.10	1.64	4.60
[10]	2.0	2.8	4.4	5.4	6.6	7.4	7.8	7.0	5.4	3.6	2.6	1.8	4.7
[9]	1.73	2.63	4.15	5.45	6.17	6.69	7.22	6.49	4.80	3.16	1.99	1.77	4.36
[95]	2.0	2.91	3.92	5.34	6.31	6.95	7.09	6.31	4.73	3.30	2.18	1.74	4.41
[96]	2.13	2.75	4.55	5.10	6.58	7.43	7.42	6.48	5.00	3.39	2.13	1.58	4.55
[14]	1.94	2.76	4.05	4.84	5.79	6.47	7.05	6.24	4.87	3.07	1.98	1.61	4.23