2.26 Typical Meteorological Year Data (TMY)

典型气象年数据

The most common data for describing the local solar climate is through what is called Typical Meteorological Year data (TMY). To determine TMY data, various meteorological measurements are made at hourly intervals over a number of years to build up a picture of the local climate. A simple average of the yearly data underestimates the amount of variability, so the month that is most representative of the location is selected. For each month, the average radiation over the whole measurement period is determined, together with the average radiation in each month during the measurement period. The data for the month that has the average radiation most closely equal to the monthly average over the whole measurement period is then chosen as the TMY data for that month. This process is then repeated for each month in the year. The months are added together to give a full year of hourly samples.

最常用的描述局部区域太阳气候的数据称为典型气象年数据。人们各种各样间隔时间为 1 小时并持续多年的气象测量以建立局部区域的气候数据以决定典型气象年数据。简单的年均数据会低估气候变化的程度，因此月数据更能代表选定地点的气候。对于每一个月来说，它在整个测量周期的平均辐射和测量周期中每个月的平均辐射的值被计算出来。如果一个月的数据最接近整个测量周期中每一年的那个月的平均值，那个月的数据就被定为典型气象年数据。对于每一个月重复上述步骤，而后把这些月份的数据整合起来得到一年的小时取样样本。

There is no strict standard for TMY data so the user must adjust the data to suit the application. Considerable care must be taken with sample periods. An example of a raw TMY data file is given below for January 1st in Melbourne, Australia. The comments on the right hand side of the file describe the measurements taken and the data format.

对于典型气象年数据没有严格的标准，因此用户需要调整数据以适应应用的需要。处理样本周期时必须非常小心。下给出了澳大利亚墨尔本 1 月 1 日的原始典型气象年数据。文件右侧的备注描述了测量方法和数据格式。

TMY2 and TMY3

典型气象年数据 2 和典型气象年数据 3。

Due to the inconsistencies in TMY data, the data sets were updated for the US in 1994 (http://rredc.nrel.gov/solar/old_data/nsrdb/1961-1990/tmy2/) and again in 2008 (http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/)

由于典型气象年数据的不连续性，1994 年（http://rredc.nrel.gov/solar/old_data/nsrdb/1961-1990/tmy2/）和 2008 年（http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/），美国更新了这些数据集。

1 1 1 0 0130 0 99007 MELBOURNE TMY: 75 71 75 73 76 78	墨尔本 典型气象年
1 1 2 0 0127 10 98040 78 72 78 70 69 68	
1 1 3 0 0118 7 94040	
1 1 4 0 0109 3 90041 ----------	
1 1 5 0 0100 0 86001 PARAMETERS:	参数
1 1 6 33106117 3 96141 ----------	
1 1 7110260133 7106140 MONTH	月份
1 1 8186311150 10115140 DAY	天
1 1 9257342183 7133140 HOUR	小时
1 110317351217 3151140 HORIZONTAL GLOBAL IRRADIATION, MJ*100/HOUR	水平面接收的总辐射
1 111356353250 0167000 SUN TRACKING BEAM IRRADIATION, MJ*100/HOUR	太阳跟踪光束辐射
1 112381357272 14166120 AMBIENT TEMPERATURE, DEG.C*10	环境温度
1 113387362293 27165120 WIND SPEED, M/S*10	风速
1 114365359315 41164120 WET BULB TEMPERATURE, DEG.C*10	湿球温度
1 115324355314 43164130 WIND DIRECTION, COMPASS POINTS	风向，方位点
1 116267348314 45163130 CLOUD COVER, OCTAS	云层覆盖，计量标准从0到8
1 117198336313 46162140 --------	
1 118120277307 38162140 FORMAT :	格式
1 119 44147300 29160150 --------	
1 120 2 12294 21159150 1X,3I2,5I3,I2,I1	
1 121 0 0274 26154150	
1 122 0 0253 31148160	
1 123 0 0233 36143160	
1 124 0 0235 36142160	

The description at the side of the above data is formatted into a more readable format, and is shown below:

上述数据一侧的描述被整合为一个更易读的形式，如下所示：

月份	天数	小时	总辐射强度	跟踪光束辐射强度	温度	风速	湿球温度	风向	云层覆盖
Month	Day	Hour	Global Irradiation x100MJ/h/m^2	Tracking Beam Irradiation x100MJ/h/m^2	Temp (x10°C)	Wind Speed (x10 m/s)	Wet Bulb Temp (x10°C)	Wind Direction	Cloud Cover
1	1	1	0	0	130	0	99	00	7
1	1	2	0	0	127	10	98	04	0
1	1	3	0	0	118	7	94	04	0
1	1	4	0	0	109	3	90	04	1
1	1	5	0	0	100	0	86	00	1
1	1	6	33	106	117	3	96	14	1
1	1	7	110	260	133	7	106	14	0
1	1	8	186	311	150	10	115	14	0
1	1	9	257	342	183	7	133	14	0
1	1	10	317	351	217	3	151	14	0
1	1	11	356	353	250	0	167	00	0
1	1	12	381	357	272	14	166	12	0
1	1	13	387	362	293	27	165	12	0
1	1	14	365	359	315	41	164	12	0
1	1	15	324	355	314	43	164	13	0
1	1	16	267	348	314	45	163	13	0
1	1	17	198	336	313	46	162	14	0
1	1	18	120	277	307	38	162	14	0
1	1	19	44	147	300	29	160	15	0
1	1	20	2	12	294	21	159	15	0
1	1	21	0	0	274	26	154	15	0
1	1	22	0	0	253	31	148	16	0
1	1	23	0	0	233	36	143	16	0
1	1	24	0	0	235	36	142	16	0

TMY data is used for a wide variety of meteorological applications and therefore a large amount of data is usually irrelevant for photovoltaic applications. Of the parameters given,

usually only the time and irradiation figures are used. However, more advanced models also use the temperature and wind speed.

典型气象年数据在气象学中有非常广泛的运用，因此其中很大一部分数据与光伏应用是无关的。在给出的参数中，常用的只有时间和太阳辐射图。然而，更高级的模型需要用到温度和风速。

Month is the month of the year with January = 1 and December = 12.

月份指的是一年中的每一个月，1 月份对应 1，12 月份对应 12。

Day is the number of days within a month. Not all months are of equal value.

天数指的是某一天在一个月中的序数。并不是所有的月份的值都是相同的。

Hour is the hour of the day in 24 hour time, so the table above covers one full day. The data is usually an average for the hour and covers ½ an hour before the sample to ½ an hour after the sample. Thus the first row on the table is for 1st January and covers 12:30am to 1:30am.

小时指的是一天中的时刻，采用 24 小时制，因此上面的表格中包含了一整天的数据。数据通常为一小时的平均数据，对应时间为采样前半个小时和后半个小时。因此，表格第一行为 1 月 1 日凌晨 12 点 30 分到 1 点 30 分的数据。

The Global Irradiation is the amount of energy striking a horizontal surface during the hour. To convert from the above units of x100MJ/hr/m2 to the typical photovoltaic units of kW/m2, divide by 360. The greatest irradiance is at midday and falls to 0 at night.

总辐射强度为一小时内水平面接收到的能量。从上述的 100 兆焦耳每小时每平方米转化为常用的千瓦每平方米，数值要除以 360。最强的辐射出现在正午时，夜间辐射为 0。

The Direct Beam Irradiation gives the irradiation striking a plate perpendicular to the sun's rays but does not include diffuse radiation. A tracking concentrator only sees the direct beam irradiation.

直射光束辐射给出了与光线传播方向垂直的平面接收到的辐射量，不包含漫射的辐射量。跟踪聚光型太阳能板只能接收直射光束辐射。

The Temperature and Wind Speed are averaged over the hour. Note the x10 multiplication factor.

温度和风速为对应的 1 小时的平均值。注意它们的值乘以了 10。

The Wet Bulb Temperature is the temperature shown by a thermometer bulb surrounded by a damp wick. The WBT varies from the dry bulb temperature according to the amount of evaporation and thus the humidity. This detail is generally not used for PV applications.

湿球温度指的是从包裹含水棉芯的温度计水银球读取的温度。湿球温度与干球温度的区别受蒸发和空气湿度的影响。光伏应用通常不使用这一参数。

The Wind Direction shows the compass points from which the wind is coming. North is 00, East is 04 etc. Again, this detail is generally not used for PV applications.

风向表示为风吹来的方向在罗盘上的方位点。北对应 00，东对应 04 等等。光伏应用通常也不使用这一参数。

The Cloud Cover is a visual estimate of the proportion of cloud covering the sky. In this case it is in eights so 0 is no cloud and 8 is full cloud cover. And, once again this detail is generally not use for PV applications.

云层覆盖是云覆盖天空的比例的视觉估测。在这个例子里，它以 8 来计量，没有云的时候为 0，完全被云层覆盖的时候为 8。光伏应用通常也不使用这一参数。

One additional unit often required in PV applications is the amount of diffuse radiation. The diffuse irradiation (D_h) falling on a horizontal surface can be calculated from the global irradiation (G_h), the direct beam tracking radiation (I_t) and the elevation (el) from:

$$D_h = G_h - I_t \sin(el)$$

另一个光伏应用中常用的参数为散射辐射的量。水平面接收的散射辐射（D_h）可以通过总辐射（G_h）、直射光伏跟踪辐射（I_t）以及太阳仰角（el）来计算。

$$D_h = G_h - I_t \sin(el)$$

The diffuse radiation is not uniformly spread across the sky. For instance, the area just around the sun (circumsolar) is considerably brighter than the rest of the sky. A commonly used model is the Perez model[1] which divides the sky into a circumsolar component, horizon component, and the rest of the sky. The size of each of these regions and the relative intensities of the regions are adjusted to closely model the measured radiation.

散射辐射在天空中的分布是不均匀的。例如，临近太阳的区域相比于天空中的其他区域更亮。通常的采用法勒斯模型将天空分为太阳周边区域，地平线区域和天空中的其他区域。这些区域的大小和相对强度需要经过调整以模拟测量到的辐射值。

参考文献

1. Perez R, Ineichen P, Seals R, Michalsky J, Stewart R. Modeling daylight availability and irradiance components from direct and global irradiance. Solar Energy [Internet]. 1990;44:271 - 289. Available from: http://www.sciencedirect.com/science/article/B6V50-497T9KG-S0/2/034fdf1417cea3a44d8509fe805f679e