

Solar Resource Parameter Definitions

1. **Averaged Insolation Incident On A Horizontal Surface.**

SRDB name: Insolation.

Definition: The average amount of the total solar radiation incident on a horizontal surface at the surface of the earth.

Period covered: 1999-01-01 to 2009-12-31.

Units: Wh/m²/Period, where Period is the period of averaging of Nhours.

Present data:

Data frequency	Period name	Nhours
Hourly	Hour	1
Daily	Day	24
Monthly	Month	(days-in-month)*24
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*24

How calculated:

Hourly – direct GSIP parameter.

Daily – sum hourly values and divide by 24.

Monthly – sum daily values and divide by the number of days in the month (28, 29, 30, or 31).

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

2. **3-hour Averaged Midday Insolation Incident On A Horizontal Surface.**

SRDB name: Midday_Insolation 3.

Definition: The sum of three hourly averages of the total solar radiation incident on a horizontal surface at the surface of the earth within 1.5 hours of local solar noon, divided by 3.

Period covered: 1999-01-01 to 2009-12-31.

Units: Wh/m²/Period, where Period is the period of averaging of Nhours.

Present data:

Data frequency	Period name	Nhours
Daily	Day	3
Monthly	Month	(days-in-month)*3
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*3

How calculated:

Daily – sum hourly values and divide by 3.

Monthly – sum daily values and divide by the number of days in the month (28, 29, 30, or 31).

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

3. **1-hour Averaged Midday Insolation Incident On A Horizontal Surface.**

SRDB name: Midday_Insolation 1.

Definition: The sum hourly average of the total solar radiation incident on a horizontal surface at the surface of the earth within 0.5 hours of local solar noon.

Period covered: 1999-01-01 to 2009-12-31.

Units: Wh/m²/Period, where Period is the period of averaging of Nhours.

Present data:

Data frequency	Period name	Nhours
Daily	Day	1
Monthly	Month	(days-in-month)*1
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*1

How calculated:

Daily – midday hourly flux.

Monthly – sum daily values and divide by the number of days in the month (28, 29, 30, or 31).

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

4. **Clear-Sky Days. SRDB name: Days_Clr.**

Definition: Number of days having an average cloud cover less than 10% during a given month.

Period covered: 1999-01-01 to 2009-12-31.

Units: Percents, 100*(clear days in Period)/(total days in Period), where Period is the period of averaging.

Present data:

Data frequency	Period name	Total Days
Monthly	Month	days-in-month (28, 30, 31)
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	341, 330, or 311

How calculated:

Monthly – 100*(clear days in the month)/(total days in the month).

Multiyear – for every month, sum of monthly values over 11 years divided by 11 (weighted sum for February).

5. **Averaged Clear-Sky Insolation Incident On A Horizontal Surface.**

SRDB name: Insolation_Clr.

Definition: Average amount of the total solar radiation incident on a horizontal surface at the surface of the earth when the cloud cover is less than 10%.

Period covered: 1999-01-01 to 2009-12-31.

Units: Wh/m²/Period, where Period is the period of averaging of Nhours.

Present data:

Data frequency	Period name	Nhours
Hourly	Hour	1
Daily	Day	24
Monthly	Month	(days-in-month)*24
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*24

How calculated:

Hourly – direct GSIP parameter. Present only for clear-sky days.

Daily – sum hourly values and divide by 24. Present only for clear-sky days.

Monthly – sum of the insolutions during the clear days of the month divided by the number of days in the month.

Multiyear – for every month, sum of monthly values over 11 years divided by 11 (weighted sum for February).

6. **Averaged Diffuse Radiation Incident On A Horizontal Surface.**

SRDB name: Diffuse_SWD.

Definition: The average amount of solar radiation incident on a horizontal surface at the surface of the earth under all-sky conditions with the direct radiation from the sun's beam blocked by a shadow band or tracking disk.

Period covered: 1999-01-01 to 2009-12-31.

Units: Wh/m²/Period, where Period is the period of averaging of Nhours.

Present data:

Data frequency	Period name	Nhours
Hourly	Hour	1
Daily	Day	24
Monthly	Month	(days-in-month)*24
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*24

How calculated:

Hourly – direct GSIP parameter.

Daily – sum hourly values and divide by 24.

Monthly – sum daily values and divide by the number of days in the month (28, 29, 30, or 31).

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

7. **Averaged Direct Radiation Incident On A Horizontal Surface.**

SRDB name: Direct_Normal_SWD.

Definition: The average amount of solar radiation incident on a surface oriented normal to the solar radiation.

Period covered: 1999-01-01 to 2009-12-31.

Units: Wh/m²/Period, where Period is the period of averaging of Nhours.

Present data:

Data frequency	Period name	Nhours
Hourly	Hour	1
Daily	Day	24
Monthly	Month	(days-in-month)*24
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*24

How calculated:

Hourly – (swdsfc – diffuse)/cos(SZA), where SZA is hourly average of the Solar Zenith Angle (GSIP parameter).

Daily – sum hourly values and divide by 24.

Monthly – sum daily values and divide by the number of days in the month (28, 29, 30, or 31).

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

8. **Averaged Insolation Clearness Index.**

SRDB name: Ins_Clearness_Index.

Definition: The average amount of the total solar radiation incident on a horizontal surface at the surface of the earth divided by the average of incoming top-of-atmosphere insolation.

Period covered: 1999-01-01 to 2009-12-31.

Units: Dimensionless with range from 0 to 1.

Present data:

Data frequency	Period name	Averaged over
Hourly	Hour	1 hour
Daily	Day	Daily hours
Monthly	Month	Days with data
Multiyear	11 years = 11 monthly data for every month	11 months

How calculated:

Hourly – $K = \text{swdsfc}/\text{swdtoa}$, where swdtoa is hourly average of incoming top-of-atmosphere insolation (solar constant times average cosine of the Solar Zenith Angle).

Daily – sum hourly values for the day and divide by their number.

Monthly – sum daily values and divide by the number of days with data.

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

9. **Averaged Clear-Sky Insolation Clearness Index.**

SRDB name: Ins_Clearness_Index_Clr.

Definition: Average amount of the total solar radiation incident on a horizontal surface at the surface of the earth when the cloud cover is less than 10% divided by the average of incoming top-of-atmosphere insolation.

Period covered: 1999-01-01 to 2009-12-31.

Units: Dimensionless with range from 0 to 1.

Present data:

Data frequency	Period name	Nhours
Hourly	Hour	1
Daily	Day	24
Monthly	Month	(days-in-month)*24
Multiyear	11 years = 341 days (11*31) or 11 years = 330 days (11*30) or 11 years = 311 days for February	(total days)*24

How calculated:

Hourly – ici parameter. Present only for clear-sky days. Others are missing values

Daily – sum hourly values for the day and divide by their number. Present only for clear-sky days.

Others are missing values.

Monthly – sum daily values during the clear days of the month divided by the number of clear days in the month. Missing value if there is no clear days in the month.

Multiyear – for every month, sum of monthly values over 11 years divided by 11 (weighted sum for February).

10. **Averaged Normalized Insolation Clearness Index.**

SRDB name: Norm_Insol_Clearness_Index.

Definition: The average zenith angle-independent expression of the insolation clearness index.

$$K' = K / (1.031 * \exp(-1.4 / (0.9 + 9.4 / m)) + 0.1)$$

where:

K' = normalized insolation clearness index

K = insolation clearness index

m = 1/cos(SZA) is air mass from Kasten's pyrheliometric formula

Period covered: 1999-01-01 to 2009-12-31.

Units: Dimensionless with range from 0 to 1.

Present data:

Data frequency	Period name	Averaged over
Hourly	Hour	1 hour
Daily	Day	Daily hours
Monthly	Month	Days with data
Multiyear	11 years = 11 monthly data for every month	11 months

How calculated:

Hourly – K' defined by the above formula with K equal to hourly value of the insolation clearness index (ici), $K = \text{swdsc}/\text{swdtoa}$, and m using hourly average of cosine of the Solar Zenith Angle.

Daily – sum hourly values for the day and divide by their number.

Monthly – sum daily values and divide by the number of days with data.

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

11. Daylight Cloud Amount.

SRDB name: Daylight_Cld_Frc.

Definition: The average percent of cloud amount during daylight within a GSIP cell.

Period covered: 1999-01-01 to 2009-12-31.

Units: Percent, with range from 0 to 100.

Present data:

Data frequency	Period name	Averaged over
Hourly	Hour	1 hour
Daily	Day	Daily hours
Monthly	Month	Days with data
Multiyear	11 years = 11 monthly data for every month	11 months

How calculated:

Hourly – $100 * \text{ncd} / (\text{ncl} + \text{ncd})$, where ncl and ncd are numbers of clear and cloudy pixels in a GSIP cell (both are GSIP parameters).

Daily – sum hourly values for the day and divide by their number.

Monthly – sum daily values and divide by the number of days with data.

Multiyear – for every month, sum of monthly averages over 11 years divided by 11 (weighted sum for February).

12. Cloud Fraction at Hourly Intervals.

SRDB name: YYYY_Average (yearly average), Multiyear_Average.

Definition: Monthly average of the hourly percent of cloud amount during daylight within a GSIP cell.

Presented on 24-hour scale of local time. Night hours are fill values.

Period covered: 1999-01-01 to 2009-12-31.

Units: Percent, with range from 0 to 100.

Present data:

Data frequency	Period name	Averaged over
Monthly	Month	Days with data
Multiyear	11 years = 11 monthly data for every month	11 months

How calculated:

Yearly – consider every month separately. In each month, for every daytime hour and every day of the month, calculate $100 * \text{ncd} / (\text{ncl} + \text{ncd})$, where ncl and ncd are numbers of clear and cloudy pixels in a GSIP cell (both are GSIP parameters). For every daytime hour, average data for all days in this month.

Yearly – use the above data for a given month during 11 years of observation to find the average for every daytime hour. Repeat for every month.

Multiyear – for every month, consider above-described averages during 11 years of observation. For every daytime hour, sum its averages over 11 years and divide by 11 (weighted sum for February).