



MEAN DAILY GLOBAL SOLAR RADIATION

Notes and Definitions

Solar Radiation: Energy transmitted from the sun in the form of electromagnetic waves. Global solar radiation includes radiation received at the earth's surface by direct incidence and radiation received after scattering or diffuse reflection by atmospheric gas molecules, water vapor, and dust particles. In addition to direct and diffuse radiation, global solar radiation on inclined surfaces includes the component of radiation reflected from ground surfaces.

Monthly Mean Daily Global Solar Radiation: The average of the daily global solar radiation values for the month. The months of June and December have been selected as the months with highest and lowest averages for daily values of global solar radiation incident on a horizontal surface.

The seasonal variation of solar radiation received at the earth's surface is influenced significantly by four factors: the declination of the sun, the length of day, cloudiness, and ground cover. In the northern hemisphere, the sun reaches its maximum declination of 23°26'30"N (Tropic of Cancer) at the summer solstice (June 20-22) and minimum declination of 23°26'30"S (Tropic of Capricorn) at the winter solstice (December 20-22). Solar radiation received on a horizontal surface varies accordingly, with values ranging from highest at the time of maximum declination to lowest at the time of minimum declination.

The changing declination of the sun in its annual apparent path between the tropics of Cancer and Capricorn is also responsible for the variation of day length throughout the year. The length of day in turn governs the amount of time available for the receipt of incoming radiation. Considerable seasonal variation in day length occurs throughout Canada, particularly in arctic regions. Extremes are reached on the months of June and December when up to 24 hours of daylight or darkness occur. The mean limits of these extremes are indicated on the maps of June and December respectively.

As clouds above and reflect back to space a substantial proportion of incoming solar radiation, cloud cover and thickness are additional controls on the amount of radiation that reaches the earth's surface. Solar radiation on inclined surfaces is further modified by the reflectivity of the ground surface. Snow, for example, reflects more solar radiation than a dark ground surface. Global radiation on inclined surfaces is therefore augmented by its reflected component, and it is possible to convert surface to receive more global solar radiation in winter and in spring than in summer.

Monthly Mean Daily Global Solar Radiation Method: The standard deviation of the monthly mean daily global solar radiation—a measure of the inter-annual variation of monthly mean daily global solar radiation values.

Inclined Surfaces: Data for solar radiation incident on inclined surfaces have been derived from measured and simulated horizontal radiation data using a numerical model. Inclined surfaces of 60° and 90° with a south orientation were assumed because of their relevance to solar energy applications. 60° was the applicable to active solar energy systems. Inclined radiation on solar energy systems, 60° and 90° are relevant to passive energy systems that use solar radiation directly.

MEGAJOULES PER SQUARE METRE ($\text{MJ}\cdot\text{m}^{-2}$)

CLIMATE STATION

- Measured Data
- Simulated Data

Magnitude Per Square Metre ($\text{MJ}\cdot\text{m}^{-2}$) The standard metric unit of radiation measurement. One joule (J) is the amount of energy equivalent to the work done by a force of one newton ($\text{N}=\text{kg}\cdot\text{m}\cdot\text{s}^{-2}$) when the point at which the force is applied is displaced one metre in the direction of the force.

Polar Night: This period of continuous darkness during which the sun does not appear above the horizon within a 24-hour period. The darkness of polar night is reduced by light and by moonlight reflected by ice and snow.

Polar Day: For the purposes of these maps polar day is defined as the period of continuous daylight during which the sun does not sink below the horizon within a 24-hour period.

Observing Network: The solar radiation observing network operated by the Atmospheric Environment Service of Environment Canada included 24 climate stations in 1980-1981 with more than 10 years of record. In order to increase the information base, solar radiation data were simulated for 89 additional sites from a numerical model.

Period of Record: Measured data are based on the recording period of 1950 to 1975; simulated data are based on the recording period of 1950 to 1980.

Radiation Availability: Adapt changes occur in the amount of solar radiation received on surfaces in mountainous regions as a result of significant variations of elevation, aspect and slope, over short distances. In areas of more regular terrain, however, of continuous bathymetric irregularities imposed by the uneven and often sparse distribution of observations, the density of the station network can be used as an index of radiation availability. A discontinuous line symbol is used over water bodies to indicate approximate values.

This map sheet was prepared in association with the Canadian Climate Centre, Atmospheric Environment Service, Environment Canada, Canadian Climate Centre. Additional research by S.A. Kelly and D.M. Chapman, Geographical Research, Geographical Services Division, Survey and Mapping Branch, Energy, Mines and Resources Canada.

Cartography by Cartography and Topography, Geographical Services Division, Survey and Mapping Branch, Energy, Mines and Resources Canada.

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