Solar radiation pdf file

Solarradiation.m is used to calculate the solar radiation for a digital elevation model integrated over one year. Radiation is calculated depending on latitude, elevation, horizon shading, slope, aspect, time of year and hour of the day (day length/season) and ground reflectance. Temporal resolution of radiation calculation over sunshine hours can be set freely (1 hour default). The script follows the approach by Kumar et al (1997). Simple unweighed 4 nearest neighbour gradient calculation is used and relief shading is not accounted for. Reference: Kumar, L, Skidmore AK and Knowles E 1997: Modelling topographic variation in solar radiation in a GIS environment. Int.J.Geogr.Info.Sys. 11(5), 475-497 When you visit this site, it may store or retrieve information on your browser, mostly in the form of cookies. Cookies collect information about your preferences and your device and are used to make the site work as you expect it to, to understand how you interact with the site, and to show advertisements that are targeted to your interests. You can find out more and change our default settings with Cookies Settings. This tutorial helps you to get free set of meteorological data from NASA database through the POWER DATA ACCESS VIEWER online free tool. Particularly you will learn how to get radiation values on horizontal and tilted surface. STEP 1 : First you have to connect to the NASA Surface meteorology and Solar Energy database for a particular location, here : Power Data access Viewer : NASA solar radiation and meteorological data Select the "Power single point solar access" for data for a specific point on the map. STEP 2 : Keep the default "SSE-Renewable energy" selection. Choose a temporal average : - dayly - interranual (to get monthly average radiation for choosen years) - climatology (to get an average of monthly and annual data on a period of 22 years) Select "climatology" if you want data insolation for tilted solar panels. with the "point" button, select a location on the map. (example for London). Select Output File Formats (CSV for excel worksheet). Select meteorological parameters for which you want to get dayly or monthly values. To get irradiance on tilted solar panels select : tilted solar panels/Solar irradiance for equator facing tilted surfaces. See here : Then clic on the submit button. STEP 3 : RESULT : You will get a link to CSV files that can be opened with Excel. You can get an example of files here : example of meteorological file from NASA Power Data Access Viewer application In this file you get the monthly and annual average irradiance values for the following parameters in kwh/day.m² : SI_EF_TILTED_SURFACE_0 : irradiance on horizontal surface SI_EF_TILTED_SURFACE_36 : irradiance on tilted solar panels with slope 36° SI_EF_TILTED_SURFACE_51 : irradiance on tilted solar panels with slope 51° SI_EF_TILTED_SURFACE_66 : irradiance on tilted solar panels with slope 66° SI_EF_TILTED_SURFACE_90 : irradiance on tilted solar panels with vertical slope 90° SI_EF_OPTIMAL : irradiance on tilted solar panels with optimal angle for max annual production SI_EF_OPTIMAL_ANG : optimal angle according to month SI_EF_TILTED_ANG_ORT : orientation of solar panels (position of the equator according to solar panels) To get the annual sum of radiation you have to take the annual average (kwh/m2/day) and multiply it by 365 (days). For our example (London) the annual horizontal global solar radiation is 2.79*365=1018 kWh/m2 per year. Just follow the same methodology as above and select the relevant parameters : - Meteorology (Temperature) : Air temperature at 2 m - Meteorology (Other) : precipitation - Meteorology (Wind) : wind speed at 10 m You will get monthly and annual average values per day, just multiply per 365 to get the total amount per year. Note that one degree of latitude represents a distance about 110 km on earth, same thing for the longitude, as the meteo dataset is given for half a degree, the area covered is about a square of 4225 km2. This is not so big for a first assessment of energy production, specially for area without mountains. With the POWER DATA ACCESS VIEWER you can also get worlwide meteorological parameter interactive maps. An example with the insolation world map : To get a complete list of solar radiation, check the Solar radiation databases. Give In Honor & Memorial Sign Up For Email Cancer A-Z Risk, Prevention, & Screening Treatment & Survivorship Programs & Services Our Research Get Involved About Us Search Solar radiation datasets with high spatial and temporal resolution have been developed. This data helps simulate solar photovoltaic system operation and study the short-term impact (< 5 minutes) of irradiance fluctuations on the energy production of a power plant or a neighbourhood of solar houses. The measurement of solar radiation was performed at a high frequency (30-100 Hz or up to once every 10 milliseconds) to allow high ramp-rate events to be recorded. The datasets were retrieved from a network composed of 41 units that measure the solar irradiance, distributed among two systems at two Canadian sites. The first system is located in Varennes (Québec), and the second in Alderville (Ontario). The latter is co-located within a 1 MW sub-array of the 5 MW Alderville First Nations Solar Farm. These systems allow for the measurement of ground-level solar variability on a network of sensors distributed over a given surface. Instrumentation and Sampling The irradiance sensors are LI-COR LI-200S photodiode-type pyranometers installed on wirelessly communicating and autonomously powered remote units. Each unit has two irradiance sensors: the first for global horizontal irradiance, and the second for global tilted irradiance on an inclined plane. In Varennes, the inclined plane has a slope of 45° on the horizontal and faces south. In Alderville, the inclined plane has a slope of 30° on the horizontal (south-facing), which corresponds to the plane of irradiance for this array. Each unit takes measurements every millisecond (1 ms), averages them over a period of 10 milliseconds, and saves the data when it changes by more than 5 W/m² since the last saved value. In addition, data is saved at 1-minute intervals. The units are synchronized using a GPS system to ensure that the unit-to-unit skew is less than 1 millisecond. Data File Description Data files are saved in CSV format (comma separated values) and correspond to each unit of the network. The system located in Varennes has 17 units, and 24 units are in Alderville. Files are named by date and the identifier of the unit from which the data is collected. The location of each unit is saved in KML files, as described below. Data was taken on the date corresponding to the folder name containing the file (using the format yyyymmdd), from sunrise to sunset (civil twilight when the geometric centre of the sun is 6° below the horizon), for each unit of the corresponding site. Table 1 shows the content of each column in the files. Table 1 – Data files content and format Column Content Format 1 Day yyyy-mm-dd yyyy: year mm: month of the year (1-12) dd: day of the month (1-31) 2 Hour of the day, Eastern Standard Time (GMT-5:00) HH:mm:ss.nnn HH: hours (0-23) mm: minutes (0-59) ss: seconds (0-59) nnn: milliseconds (0-999) 3 Global horizontal irradiance, in W/m² Integer 4 Global tilted irradiance, in W/m² Integer The available data corresponds to four categories of days observed in Varennes and Alderville. Table 2 categorizes the days based on cloud cover. Click on the date to download data files for the desired day type and location. KML Location File Description Two KML files describe the location of each one of the 41 units in Varennes and Alderville. The file can be opened using Google Earth or the online tool Google Maps. The maps show the location of each unit on the two sites. Their coordinates are located at the bottom of this page. Varennes Site Because of the high sampling rate, the sensors are capable of measuring the effect of an obstruction passing over them, such as birds or insects. These events may cause a sudden drop in the measured irradiance on a unit. Some units are relatively close to obstructions (trees, power lines, etc.), which can also shade the sensors during certain times of the day and year. The identifier for the Varennes units begins with the letters VAR. The locations are shown in Figure 1. Alderville Site Similarly to Varennes, the sensors can be shaded, for instance, by birds or insects. However, the units are located in a more open area than in Varennes, and shading events caused by obstructions are less frequent. The identifier for the Alderville units begins with the letters AFN. The locations are shown in Figure 2 . Figure 1 – Map showing the unit locations in Varennes Figure 2 – Map showing the unit locations in Alderville, ON Unit Coordinates Tables 3 and 4 list the coordinates (latitude and longitude) of each unit. Units VAR01 to VAR17 are located in Varennes, and units AFN01 to AFN24 are located in Alderville. Table 3 – Coordinates of each unit located in Varennes Unit identifier Latitude (°) Longitude (°) VAR01 45.616084 -73.386362 VAR02 45.616760 -73.385428 VAR03 45.617659 -73.384157 VAR04 45.616777 -73.386646 VAR05 45.617206 -73.386011 VAR06 45.617509 -73.385312 VAR07 45.616783 -73.387937 VAR08 45.617202 -73.387311 VAR09 45.617689 -73.386657 VAR10 45.618096 -73.386048 VAR11 45.618569 -73.385269 VAR12 45.617297 -73.388603 VAR13 45.617682 -73.387882 VAR14 45.618080 -73.387298 VAR15 45.618513 -73.386500 VAR16 45.618561 -73.387829 VAR17 45.619610 -73.386530 Table 4 – Coordinates of each unit located in Alderville Unit identifier Latitude (°) Longitude (°) AFN01 44.190159 -78.096701 AFN02 44.190145 -78.096148 AFN03 44.190130 -78.095589 AFN04 44.190427 -78.096561 AFN05 44.190412 -78.096000 AFN06 44.190400 -78.095447 AFN07 44.190703 -78.096967 AFN08 44.190691 -78.096411 AFN09 44.190678 -78.095852 AFN10 44.190967 -78.096811 AFN11 44.190953 -78.096251 AFN12 44.190939 -78.095698 AFN13 44.191243 -78.097176 AFN14 44.191230 -78.096624 AFN15 44.191211 -78.095958 AFN16 44.191369 -78.096892 AFN17 44.191290 -78.096341 AFN18 44.191509 -78.097167 AFN19 44.191495 -78.096609 AFN20 44.191476 -78.095796 AFN21 44.191460 -78.095238 AFN22 44.191798 -78.097437 AFN23 44.191783 -78.096875 AFN24 44.191770 -78.096319 Acknowledgments The data was collected by the CanmetENERGY laboratory in Varennes, as part of the High-Resolution Solar Radiation Time Series Generation (RENI-506) project. The location for system installation in Varennes was provided by the Hydro-Québec Research Institute (IREQ). The field in Alderville was provided by the Ojibway Alderville First Nation. Funding for this project was provided by the Government of Canada through the ecoENERGY Innovation Initiative (ecoEII).

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